



Kent Academic Repository

Grilo, Clara, Neves, Tomé, Bates, Jennifer, le Roux, Aliza, Medrano-Vizcaíno, Pablo, Quaranta, Mattia, Silva, Inês, Soanes, Kylie, Wang, Yun, Abate, Sergio Damián and others (2025) *Global Roadkill Data: a dataset on terrestrial vertebrate mortality caused by collision with vehicles*. Scientific Data, 12 . ISSN 2052-4463.

Downloaded from

<https://kar.kent.ac.uk/109789/> The University of Kent's Academic Repository KAR

The version of record is available from

<https://doi.org/10.1038/s41597-024-04207-x>

This document version

Publisher pdf

DOI for this version

Licence for this version

CC BY-NC-ND (Attribution-NonCommercial-NoDerivatives)

Additional information

Versions of research works

Versions of Record

If this version is the version of record, it is the same as the published version available on the publisher's web site. Cite as the published version.

Author Accepted Manuscripts

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding. Cite as Surname, Initial. (Year) 'Title of article'. To be published in **Title of Journal** , Volume and issue numbers [peer-reviewed accepted version]. Available at: DOI or URL (Accessed: date).

Enquiries

If you have questions about this document contact ResearchSupport@kent.ac.uk. Please include the URL of the record in KAR. If you believe that your, or a third party's rights have been compromised through this document please see our [Take Down policy](https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies) (available from <https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies>).



OPEN

DATA DESCRIPTOR

Global Roadkill Data: a dataset on terrestrial vertebrate mortality caused by collision with vehicles

Clara Grilo^{1,2,3,4,319}✉, Tomé Neves^{1,2,3,319}, Jennifer Bates⁵, Aliza le Roux^{6,7}, Pablo Medrano-Vizcaino^{8,9}, Mattia Quaranta¹⁰, Inês Silva¹⁰, Kylie Soanes¹¹, Yun Wang¹² & Data Collection Consortium*

Roadkill is widely recognized as one of the primary negative effects of roads on many wildlife species and also has socioeconomic impacts when they result in accidents. A comprehensive dataset of roadkill locations is essential to evaluate the factors contributing to roadkill risk and to enhance our comprehension of its impact on wildlife populations and socioeconomic dimensions. We undertook a compilation of roadkill records, encompassing both published and unpublished data gathered from road surveys or opportunistic sources. GLOBAL ROADKILL DATA includes 208,570 roadkill records of terrestrial vertebrates from 54 countries across six continents, encompassing data collected between 1971 and 2024. This dataset serves to minimise the collection of redundant data and acts as a valuable resource for local and macro scale analysis regarding rates of roadkill, road- and landscape-related features associated with risk of roadkill, vulnerability of species to road traffic, and populations at risk of local extinction. The objective of this dataset is to promote scientific progress in infrastructure ecology and terrestrial vertebrate conservation while limiting the socio-economic costs.

Background & Summary

The mortality of wildlife resulting from collisions with vehicles is considered one of the main negative effects of roads on numerous species¹. Roadkill can increase the risk of local extinction by reducing effective population size and genetic diversity, while also limiting demographic and genetic rescue mechanisms^{2,3}. Such effects have the potential to disrupt species distribution, spatial population dynamics, and genetic structure, thereby compromising long-term conservation efforts^{4,5}.

Estimates can reach to 340 million of birds killed on the roads in USA⁶, 194 million birds, 29 million mammals in Europe⁷ and 17 million of birds and mammals in Latin America⁸. While numbers of roadkill are high, populations may be able to persist into the future if they are common and abundant^{9,10}. Conversely, species already threatened by other factors, with slow reproductive rates may find it challenging to recover from the loss of individuals, even when roadkill rates are low, thus increasing the risk of local extinctions^{11–13}. Several studies that assessed the current and future impacts on mammal populations highlighted that populations of maned wolf (*Chrysocyon brachyurus*), tiger (*Panthera tigris*), leopard (*Panthera pardus*) and brown hyena (*Hyaena brunnea*) are particularly exposed to road traffic with associated increase of risk of extinction^{13–16}.

¹CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, InBIO Laboratório Associado, Campus de Vairão, Universidade do Porto, Porto, Portugal. ²CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, InBIO Laboratório Associado, Instituto Superior de Agronomia, Universidade de Lisboa, Lisboa, Portugal. ³BIOPOLIS Program in Genomics, Biodiversity and Land Planning, CIBIO, Porto, Portugal. ⁴Departamento de Ecologia e Conservação, Universidade Federal de Lavras, Lavras, Brazil. ⁵Department of Geography & Earth Sciences, University of North Carolina at Charlotte, Charlotte, USA. ⁶Department of Zoology and Entomology, University of the Free State-Qwaqwa, Phuthaditjhaba, Free State, South Africa. ⁷Afromontane Research Unit, University of the Free State-Qwaqwa, Kestell Road, Phuthaditjhaba, 9866, Free State, South Africa. ⁸Red Ecuatoriana para el Monitoreo de Fauna Atropellada-REMFA, Quito, Ecuador. ⁹Instituto de Investigación en Recursos Cinegéticos (IREC-CSIC, UCLM-JCCM), Ciudad Real, Spain. ¹⁰Center for Advanced Systems Understanding (CASUS), Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Görlitz, Germany. ¹¹School of Agriculture, Food and Ecosystem Sciences, The University of Melbourne, Victoria, Australia. ¹²China Academy of Transportation Sciences, Beijing, China. ³¹⁹These authors contributed equally: Clara Grilo, Tomé Neves. *A list of authors and their affiliations appears at the end of the paper. ✉e-mail: clara.grilo@cibio.up.pt

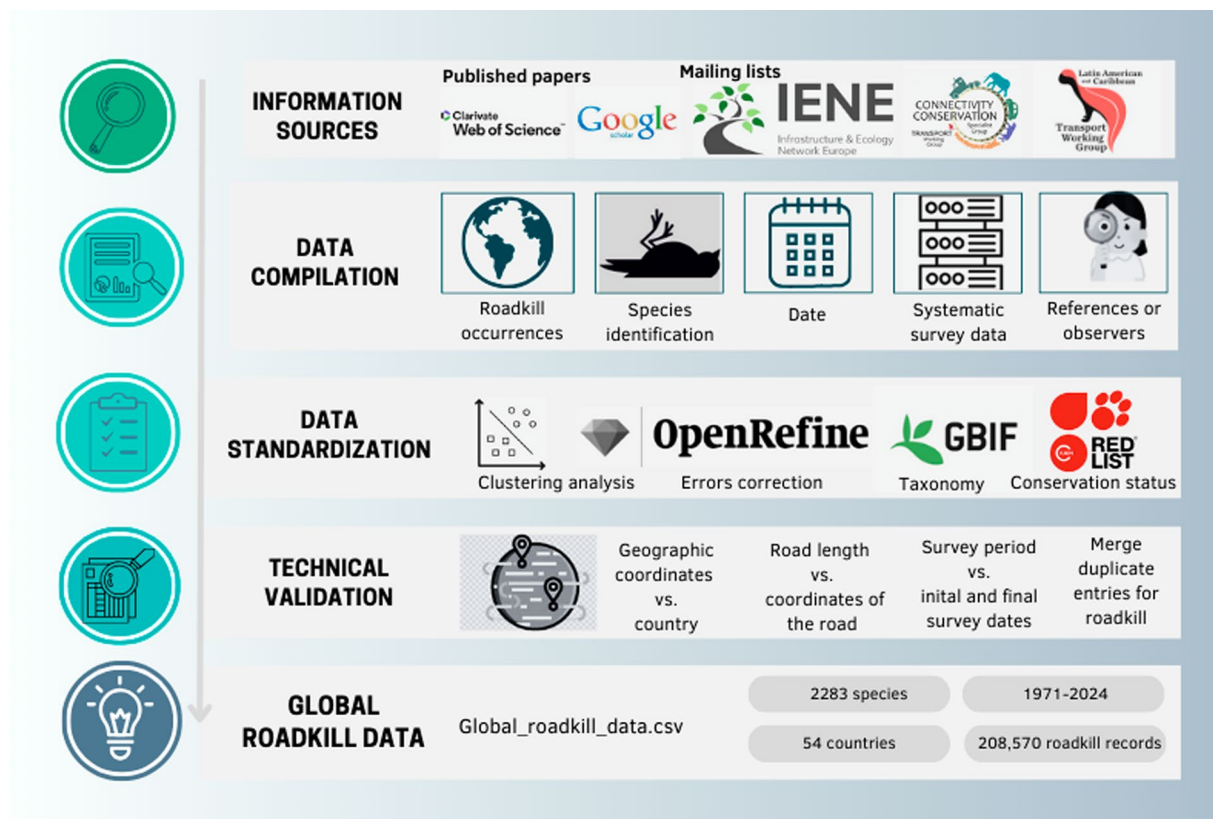


Fig. 1 The workflow to compile roadkill data of terrestrial vertebrates.

In addition to conservation concerns, the socio-economic impacts of roadkill have been extensively documented, particularly in North America and North and Central Europe^{17–19}. In the United States, collisions have been estimated to cause over 200 human fatalities and 29,000 injuries annually, with associated costs ranging from US\$ 6 to 12 billion¹⁸. Similarly, in Europe, collisions with ungulates resulted in approximately 300 human fatalities and 30,000 injuries per year, with associated costs surpassing one billion dollars¹⁷.

Over the next few decades, the “Belt and Road” and “Global Gateway” initiatives represent strategies aimed at investing in transportation and energy infrastructure projects worldwide, involving the expansion of millions of kilometres of the road network^{20–22}. These initiatives try to meet global infrastructure development needs mainly in emerging economic countries with well conserved areas, threatening more than 250 species of conservation concern²³.

A comprehensive dataset of roadkill locations is essential to evaluate the factors contributing to roadkill risk and enhance our comprehension of its impact on wildlife populations and associated socio-economic costs. Scientists and consultants have conducted road surveys, compiled opportunistic roadkill locations, and developed citizen science applications to comprehend the mechanisms underlying roadkill risk and provide guidance for mitigation. However, a significant portion of the literature produced on this topic, including research papers, dissertations, reports, and other forms of grey literature, is either highly localized or lacks the display of geographic coordinates for roadkill locations. Efforts have been made to compile roadkill data and make it accessible. For instance, the Brazil roadkill data²⁴, databases collected via citizen science²⁵ and the Global Primate Roadkill Database²⁶. However, they are often confined to specific regions or groups of species.

We present the GLOBAL ROADKILL DATA, the largest worldwide compilation of roadkill data on terrestrial vertebrates. We outline the workflow (Fig. 1) to illustrate the sequential steps of the study, in which we merged local-scale survey datasets and opportunistic records into a unified roadkill large dataset comprising 208,570 roadkill records. These records include 2283 species and subspecies from 54 countries across six continents, ranging from 1971 to 2024.

Large roadkill datasets offer the advantage of preventing the collection of redundant data and are valuable resources for both local and macro-scale analyses regarding roadkill rates, road and landscape features associated with roadkill risk, species more vulnerable to road traffic, and populations at risk due to additional mortality. The standardization of data - such as scientific names, projection coordinates, and units - in a user-friendly format, makes them readily accessible to a broader scientific and non-scientific community, including NGOs, consultants, public administration officials, and road managers. The open-access approach promotes collaboration among researchers and road practitioners, facilitating the replication of studies, validation of findings, and expansion of previous work. Moreover, researchers can utilize such datasets to develop new hypotheses, conduct meta-analyses, address pressing challenges more efficiently and strengthen the robustness of road ecology

research. Ensuring widespread access to roadkill data fosters a more diverse and inclusive research community. This not only grants researchers in emerging economies with more data for analysis, but also cultivates a diverse array of perspectives and insights promoting the advance of infrastructure ecology.

Methods

Information sources. A core team from different continents performed a systematic literature search in Web of Science and Google Scholar for published peer-reviewed papers and dissertations. It was searched for the following terms: “roadkill* OR “road-kill” OR “road mortality” AND (country) in English, Portuguese, Spanish, French and/or Mandarin. This initiative was also disseminated to the mailing lists associated with transport infrastructure: The CCSG Transport Working Group (WTG), Infrastructure & Ecology Network Europe (IENE) and Latin American & Caribbean Transport Working Group (LACTWG) (Fig. 1). The core team identified 750 scientific papers and dissertations which made use of roadkill information, but did not make it available. The first authors of these publications were contacted to request georeferenced roadkill locations and to offer co-authorship on this data article. Of the 824 authors contacted, 145 agreed to share georeferenced roadkill locations, often involving additional colleagues who contributed to data collection. Since our main goal was to provide open access to data that had never been shared in this format before, available data from citizen science projects (e.g., globalroadkill.net), or data already available in published papers, were not included.

Data compilation. A total of 423 co-authors compiled the following information: continent, country, latitude and longitude in WGS 84 decimal degrees of the roadkill, coordinates uncertainty, class, order, family, scientific name of the roadkill, vernacular name, IUCN status, number of roadkill, year, month, and day of the record, identification of the road, type of road, survey type, observers that recorded the roadkill and the reference containing analyses that included roadkill occurrences (Supplementary Information Table S1 - description of the fields and Table S2 - reference list). When roadkill data were derived from systematic surveys, the dataset included additional information on road length that was surveyed, latitude and longitude of the road (initial and final part of the road segment), survey period, start year of the survey, final year of the survey, 1st month of the year surveyed, last month of the year surveyed, and frequency of the survey. We consolidated 142 valid datasets into a single dataset. We complemented this data with OccurrenceID (a UUID generated using Java code), basisOfRecord, countryCode, locality using OpenStreetMap’s API (<https://www.openstreetmap.org>), geodeticDatum, verbatimScientificName, Kingdom, phylum, genus, specificEpithet, infraspecificEpithet, acceptedNameUsage, scientific name authorship, matchType, taxonRank using Darwin Core Reference Guide (<https://dwc.tdwg.org/terms/#dwc:coordinateUncertaintyInMeters>), AssociatedReferenceID and link of the associatedReference (URL).

Data collection. This dataset includes two types of data, opportunistic and systematic, clearly labelled in the surveyType column. Opportunistic data has no set methodology, representing data points that the authors collected by mere chance. Systematic data is a result of surveys, with a clearly defined duration, location and frequency of sampling. All systematic data points thus possess information on: the latitude and longitude of the start (initialRoadLatitude and initialRoadLongitude) and the end (finalRoadLatitude and finalRoadLongitude) of the sampled road segment; the km of the sampled road segment (roadLength); the starting year (startYear) and month (firstMonthOfTheYear) of the survey, as well as its final year (finalYear) and month (lastMonthOfTheYear); the duration of the survey in months (surveyPeriod); and, finally, the frequency of sampling effort (surveyFrequency). All of the roadkill data that was collected during each of the surveys is fully represented in the dataset.

Data standardization. We conducted a clustering analysis on all text fields to identify similar entries with minor variations, such as typos, and corrected them using OpenRefine (<http://openrefine.org>). We also standardized all date values using OpenRefine. Coordinate uncertainties listed as 0 m were adjusted to either 30 m or 100 m, depending on whether they were recorded after or before 2000, respectively, following the recommendation in the Darwin Core Reference Guide (<https://dwc.tdwg.org/terms/#dwc:coordinateUncertaintyInMeters>).

Taxonomy. We cross-referenced all species names with the Global Biodiversity Information Facility (GBIF) Backbone Taxonomy using Java and GBIF’s API (<https://doi.org/10.15468/39omei>). This process aimed to rectify classification errors, include additional fields such as Kingdom, Phylum, and scientific authorship, and gather comprehensive taxonomic information to address any gap within the datasets. For species not automatically matched (matchType - Table S1), we manually searched for correct synonyms when available.

Species conservation status. Using the species names, we retrieved their conservation status and also vernacular names by cross-referencing with the database downloaded from the IUCN Red List of Threatened Species (<https://www.iucnredlist.org>). Species without a match were categorized as “Not Evaluated”.

Data Records

GLOBAL ROADKILL DATA is available at Figshare²⁷ <https://doi.org/10.6084/m9.figshare.25714233>. The dataset incorporates opportunistic (collected incidentally without data collection efforts) and systematic data (collected through planned, structured, and controlled methods designed to ensure consistency and reliability). In total, it comprises 208,570 roadkill records across 177,428 different locations (Fig. 2). Data were collected from the road network of 54 countries from 6 continents: Europe (n = 19), Asia (n = 16), South America (n = 7), North America (n = 4), Africa (n = 6) and Oceania (n = 2).

All data are georeferenced in WGS84 decimals with maximum uncertainty of 5000 m. Approximately 92% of records have a location uncertainty of 30 m or less, with only 1138 records having location uncertainties ranging from 1000 to 5000 m. Mammals have the highest number of roadkill records (61%), followed by amphibians (21%), reptiles (10%) and birds (8%). The species with the highest number of records were roe deer (*Capreolus*

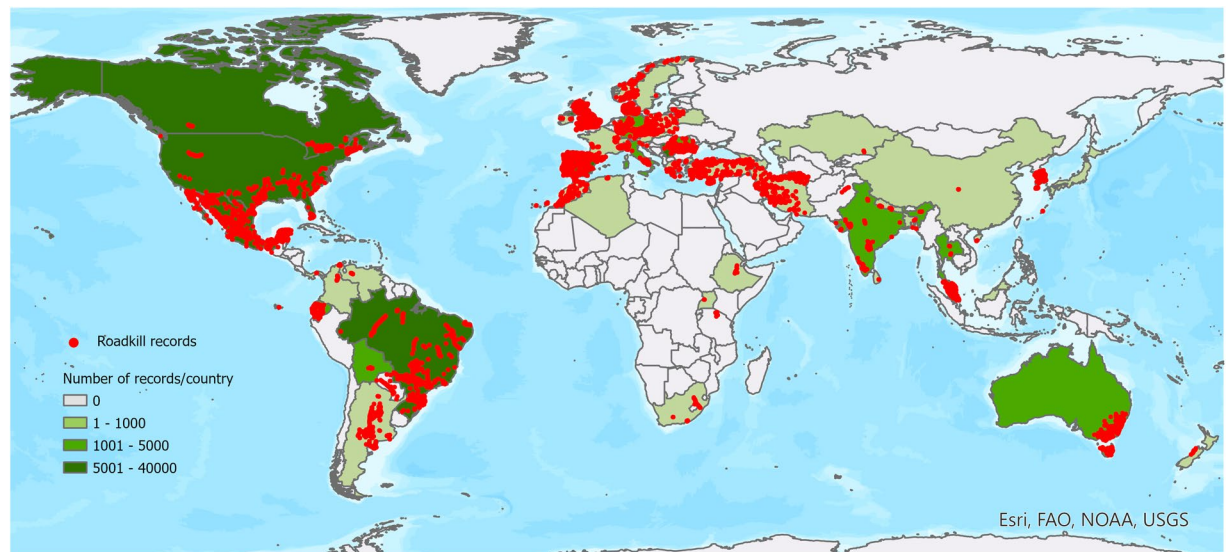


Fig. 2 Distribution and number of roadkill records per country.

capreolus, $n = 44,268$), pool frog (*Pelophylax lessonae*, $n = 11,999$) and European fallow deer (*Dama dama*, $n = 7,426$).

We collected information on 126 threatened species with a total of 4570 records. Among the threatened species, the giant anteater (*Myrmecophaga tridactyla*, VULNERABLE) has the highest number of records $n = 1199$, followed by the common fire salamander (*Salamanca salamandra*, VULNERABLE, $n = 1043$), and European rabbit (*Oryctolagus cuniculus*, ENDANGERED, $n = 440$). Records ranged from 1971 and 2024, comprising 72% of the roadkill recorded since 2013. Over 46% of the records were obtained from systematic surveys, with road length and survey period averaging, respectively, 66 km (min-max: 0.09–855 km) and 780 days (1–25,720 days).

Technical Validation

We employed the OpenStreetMap API through Java to detect location inaccuracies, and validate whether the geographic coordinates aligned with the specified country. We calculated the distance of each occurrence to the nearest road using the GRIP global roads database²⁸, ensuring that all records were within the defined coordinate uncertainty. We verified if the survey duration matched the provided initial and final survey dates. We calculated the distance between the provided initial and final road coordinates and cross-checked it with the given road length. We identified and merged duplicate entries within the same dataset (same location, species, and date), aggregating the number of roadkills for each occurrence.

Usage Notes

The GLOBAL ROADKILL DATA is a compilation of roadkill records and was designed to serve as a valuable resource for a wide range of analyses. Nevertheless, to prevent the generation of meaningless results, users should be aware of the following limitations:

- **Geographic representation** - There is an evident bias in the distribution of records. Data originated predominantly from Europe (60% of records), South America (22%), and North America (12%). Conversely, there is a notable lack of records from Asia (5%), Oceania (1%) and Africa (0.3%). This dataset represents 36% of the initial contacts that provided geo-referenced records, which may not necessarily correspond to locations where high-impact roads are present.
- **Location accuracy** - Insufficient location accuracy was observed for 1% of the data (ranging from 1000 to 5000 m), that was associated with various factors, such as survey methods, recording practices, or timing of the survey.
- **Sampling effort** - This dataset comprised both opportunistic data and records from systematic surveys, with a high variability in survey duration and frequency. As a result, the use of both opportunistic and systematic surveys may affect the relative abundance of roadkill making it hard to make sound comparisons among species or areas.
- **Detectability and carcass removal bias** - Although several studies had a high frequency of road surveys, the duration of carcass persistence on roads may vary with species size and environmental conditions, affecting detectability. Accordingly, several approaches account for survey frequency and target species to estimate more realistic roadkill rates^{29,30}.

Acknowledging these limitations, it is important to highlight that this dataset is the largest available roadkill compilation on terrestrial vertebrate species worldwide. Records obtained from systematic surveys enable the estimation of roadkill rates, exploration of spatial and temporal patterns of roadkill, modelling of factors potentially explaining roadkill risk across diverse species, and analysis of the potential population impacts.

Opportunistic data have the potential to generate extensive datasets across large areas, providing an overview of which species and regions are most exposed to and at risk from traffic. By integrating both systematic and opportunistic data, we can compile lists of species affected by collisions with vehicles, identify threatened species at risk, and assess local and landscape-level factors influencing mortality probabilities using presence-only approaches. Furthermore, this dataset facilitates the identification of geographic gaps in roadkill surveys, focusing scientists and road agencies' efforts in data-deficient areas. Finally, beyond its applications in road ecology, this dataset contributes with species occurrences for distribution modelling and broader macroecological and conservation studies.

Code availability

The Java code used to process and validate the dataset is available at https://github.com/PORBIOTA/PORBIOTA-ICNF/tree/main/DwC_Creation_Helpers.

Received: 30 April 2024; Accepted: 2 December 2024;

Published online: 31 March 2025

References

- van der Ree, R., Jaeger, J. A. G., van der Grift, E. A. & Clevenger A. P. Effects of Roads and Traffic on Wildlife Populations and Landscape Function: Road Ecology is Moving toward Larger Scales. *Ecol. Soc.* **16**(1), <http://www.ecologyandsociety.org/vol16/iss1/art48/> (2011).
- Benítez-López, A., Alkemade, R. & Verweij, P. A. The impacts of roads and other infrastructure on mammal and bird populations: A meta-analysis. *Biol. Conserv.* **143**, 1307–1316, <https://doi.org/10.1016/j.biocon.2010.02.009> (2010).
- Jackson, N. D. & Fahrig, L. Relative effects of road mortality and decreased connectivity on population genetic diversity. *Biol. Conserv.* **144**, 3143–3148, <https://doi.org/10.1016/j.biocon.2011.09.010> (2011).
- Fahrig, L., & Rytwinski, T. Effects of Roads on Animal Abundance: An Empirical Review and Synthesis. *Ecol. Soc.* **14** (1), <http://www.ecologyandsociety.org/vol14/iss1/art21/> (2009).
- Bennett, V. J. Effects of Road Density and Pattern on the Conservation of Species and Biodiversity. *Curr Landscape Ecol Rep* **2**, 1–11, <https://doi.org/10.1007/s40823-017-0020-6> (2017).
- Loss, S. R., Will, T. & Marra, P. P. Estimation of bird-vehicle collision mortality on U.S. roads. *J. Wild. Mgmt.* **78**, 763–771, <https://doi.org/10.1002/jwmg.721> (2014).
- Grilo, C., Koroleva, E., Andrášik, R., Bíl, M. & González-Suárez, M. Roadkill risk and population vulnerability in European birds and mammals. *Front. Ecol. Environ.* **18**, 323–328, <https://doi.org/10.1002/fee.2216> (2020).
- Medrano-Vizcaíno, P. *et al.* Roadkill patterns in Latin American birds and mammals. *Glob. Ecol. Biogeogr.* **31**, 1756–1783, <https://doi.org/10.1111/geb.13557> (2022).
- Borda-de-Água, L., Grilo, C. & Pereira, H. M. Modeling the impact of road mortality on barn owl (*Tyto alba*) populations using age-structured models. *Ecol. Model.* **276**, 29–37, <https://doi.org/10.1016/j.ecolmodel.2013.12.022> (2014).
- Cardillo, M. *et al.* Human Population Density and Extinction Risk in the World's Carnivores. *PLoS Biol* **2**(7), e197, <https://doi.org/10.1371/journal.pbio.0020197> (2004).
- Ceia-Hasse, A., Borda-de-Água, L., Grilo, C. & Pereira, H. M. Global exposure of carnivores to roads. *Global Ecol. Biogeogr.* **26**, 592–600, <https://doi.org/10.1111/geb.12564> (2017).
- Pinto, F. A. S., Clevenger, A. P. & Grilo, C. Effects of roads on terrestrial vertebrate species in Latin America. *Environ. Impact Assess. Rev.* **81**, 106337, <https://doi.org/10.1016/j.eiar.2019.106337> (2020).
- Grilo, C. *et al.* Conservation threats from roadkill in the global road network. *Glob. Ecol. Biogeogr.* **30**, 2200–2210, <https://doi.org/10.1111/geb.13375> (2021).
- Ceia-Hasse, A., Navarro, L. M., Borda-de-Água, L. & Pereira, H. M. Population persistence in landscapes fragmented by roads: Disentangling isolation, mortality, and the effect of dispersal. *Ecol. Model.* **375**, 45–53, <https://doi.org/10.1016/j.ecolmodel.2018.01.021> (2018).
- Carter, N. H. *et al.* Forecasting effects of transport infrastructure on endangered tigers: a tool for conservation planning. *PeerJ* **10**, e13472, <https://doi.org/10.7717/peerj.13472> (2022).
- Quintana, I. *et al.* Severe conservation risks of roads on apex predators. *Sci Rep* **12**, 2902, <https://doi.org/10.1038/s41598-022-05294-9> (2022).
- Groot Bruinderink, G. W. T. A. & Hazebroek, E. Ungulate traffic collisions in Europe. *Conserv. Biol.* **10**(4), 1059–1067, <http://www.jstor.org/stable/2387142> (1996).
- Huijser, M. P. *et al.* Cost–Benefit Analyses of Mitigation Measures Aimed at Reducing Collisions with Large Ungulates in the United States and Canada: a Decision Support Tool. *Ecol. Soc.* **14**(2), <https://www.jstor.org/stable/26268301> (2009).
- Langbein J., Putman R., Pokorny B. in *Ungulate management in Europe: problems and practices*, Ch 8 (2010).
- Laurance, W. *et al.* A global strategy for road building. *Nature* **513**, 229–232, <https://doi.org/10.1038/nature13717> (2014).
- Ascensão, F. *et al.* Environmental challenges for the Belt and Road Initiative. *Nat. Sustain.* **1**, 206–209, <https://doi.org/10.1038/s41893-018-0059-3> (2018).
- Tagliapietra, S. The European Union's Global Gateway: An institutional and economic overview. *The World Econ.* **47**, 1326–1335, <https://doi.org/10.1111/twec.13551> (2024).
- Li, N. & Shvarts, E. The Belt and Road Initiative: WWF Recommendations and Spatial Analysis Briefing Paper (2017).
- Grilo, C. *et al.* BRAZIL ROAD-KILL: a data set of wildlife terrestrial vertebrate road-kills. *Ecology* **99**, 2625–2625, <https://doi.org/10.1002/ecy.2464> (2018).
- Heigl, F. *et al.* A dataset of road-killed vertebrates collected via citizen science from 2014–2020. *Sci. Data* **9**, 504, <https://doi.org/10.1038/s41597-022-01599-6> (2022).
- Praill, L. C. *et al.* Road Infrastructure and Primate Conservation: Introducing the Global Primate Roadkill Database. *Animals* **13**, 1692, <https://doi.org/10.3390/ani13101692> (2023).
- Grilo, C. *et al.* Global Roadkill Data: a data set on terrestrial vertebrate mortality caused by collision with vehicles. *Figshare* <https://doi.org/10.6084/m9.figshare.25714233> (2024).
- Meijer, J. R. *et al.* Global patterns of current and future road infrastructure. *Environ. Res. Lett.* **13**, 064006, <https://doi.org/10.1088/1748-9326/aabd42> (2018).
- Santos, S. M., Carvalho, F. & Mira, A. How Long Do the Dead Survive on the Road? Carcass Persistence Probability and Implications for Road-Kill Monitoring Surveys. *PLoS ONE* **6**(9), e25383, <https://doi.org/10.1371/journal.pone.0025383> (2011).
- Santos, R. A. L. *et al.* Carcass Persistence and Detectability: Reducing the Uncertainty Surrounding Wildlife–Vehicle Collision Surveys. *PLoS ONE* **11**(11), e0165608, <https://doi.org/10.1371/journal.pone.0165608> (2016).

Acknowledgements

This dataset was developed as part of the **RISKY** project—Wildlife Mortality from Energy and Transport Infrastructure—funded by **OSCARS (Open Science Clusters' Action for Research and Society)** under the European Commission's **Horizon Europe Research and Innovation Programme** (Grant Agreement No. 101129751). Additionally, the development of this dataset was supported by the European Union's **Horizon 2020 Research and Innovation Programme** (Grant Agreement No. 857251). Further support was provided by **Fundação para a Ciência e Tecnologia (FCT, Portugal)** (Grant CG - 2022.00579.CEECIND) and a grant awarded to TN from **National Funds** (UIDP/50027/2020) within the BIOPOLIS Association. **Roadkill recording** was supported by Asian Development Bank, Asociación Colombia Endémica, Andalusian Ministry of Environment, Andalusian Regional Government), British Herpetological Society, CEI de Carbone (DIR Sud-Ouest), Center of Advanced Systems Understanding (CASUS) - Germany's Federal Ministry of Education and Research (BMBF), Chico Mendes Institute for Biodiversity Conservation and the conservation units of Santarém, Pará and PIBIC/ICMBio, Consejería Medio Ambiente (Junta de Andalucía), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq - PCI/DA MPEG/MCTI 2019–2023), CAPES (Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior), Charles Darwin Foundation, Departament de Medi Ambient, Territori i Sostenibilitat of the Generalitat de Catalunya (FBG301492), Deutsche Bundesstiftung Umwelt (DBU), Doñana Natural Park and Doñana Natural Space, Doñana Biological Station EBD-CSIC - "Evaluation of the effects of motorized traffic on species and communities of interest in Doñana Protected Area" (2008 × 0963), Department of Primary Industries FeralScan, DSI-NRF South African Research Chairs Initiative (SARCHI; SARC-87311) and the University of Venda (SMNS/17/Zoo/01), Emirates Airlines, Environment and Climate Change Canada (ECCC), Environment Research and Technology Development Fund (JPMEERF20184004) of the Environmental Restoration and Conservation Agency of Japan, Ethiopian Biodiversity Institute, FAPESC (Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina), FAPEG (Fundação de Amparo a Pesquisa do Estado de Goiás), FCT (Fundação para a Ciência e Tecnologia (Portugal) - CEECIND/03265/2017, CEECIND/02213/2017, SFRH/BD/66393/2009, SFRH/BPD/115228/2016, DL57/2016/CP1440/CT0010, NORTE-01-0246-FEDER-000063, Fondation Segré (YGGR and ENS), French Ministry of Ecology, Friends of Laguna Atascosa, FUNDECT-PPP 2014, German Federal Ministry of Transport and Digital Infrastructure, (Modernitätsfonds/mFUND" - nr. 100319244), Germany's Federal Ministry of Education and Research (BMBF) and by the Saxon Ministry for Science, Culture and Tourism (SMWK), RTCF-USFWS, Grant Service of Forests of the Czech Republic, s.e.; project no. TA02031259 of the Technology Agency of the Czech Republic and from the research arm of the Czech Academy of Sciences (RVO 68081766), Greengrants Fund, Guyra Paraguay, Hainan Provincial Natural Science Foundation of China (#320MS057) and National Key R&D Program of China (Grant No. 2021YFB2600104), Houston Zoo, Idaho Department of Fish and Game, Idaho Transportation Department, Boise State University Raptor Research Center, Instituto de Ecología A.C. (INECOL) and CONACYT, IDEA WILD (KARUSRI-0921/0522), Institute of Parasitology, BC CAS (RVO 60077344), Jane Goodall Institute–Switzerland, Keith Du Cross, Global, Laurentian University (Canada), LHS - National Research Foundation of South Africa (Grant Nr: 107099, 115040), Mekelle University (Ethiopia), Mexican Council of Science and Technology (COMECYT-Mexico), Mineração Rio do Norte S/A, Ministère des transports, de la mobilité durable et de l'électrification des transports du Québec (MTMDET), Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant No. 451-03-9/2021-14/200007), N3 Toll Concession (N3TC), Nashville Zoo (DRY), National Science Centre, Norwegian Environment Agency, NSERC Discovery Grant, National Geographic's Young Explorer Grant (NG Asia 48–16), Panthera's Small Cat Action Fund (SCAF)-2020, National Science Centre, Poland (2020/39/B/NZ9/01829), Petchra Pra Jom Klao Doctoral Scholarship from King Mongkut's University of Technology Thonburi (KMUTT), Programa de Pós-graduação em Biodiversidade for the grants #02/2020 and #02/2021, Program of long-term conceptual development of research organizations (Ministry of Transport, Czechia), Project Consulting S.A., Project MontObEO - Montesinho biodiversity observatory: an Earth Observation tool for biodiversity conservation (MTS/BRB/0091/2020)), PID2022-141763NA-I00, funded by MCIN/AEI/10.13039/501100011033), Protocol between BRISA Auto-Estradas de Portugal S.A and Centro de Biologia Ambiental (BRISA-CBA 2007–2010 - 'Eficácia de medidas de minimização dos efeitos negativos das auto-estradas'), Project LIFE LINES - LIFE14-NAT-PT001081, funded by the European Commission, OUC's Small Research Grants, Ontario Parks, Ontario Ministry of Natural Resources, Ontario Ministry of Transportation (MTO) HIIFF Grant, Research Council of Lithuania under the Programme "University Excellence Initiatives" of the Ministry of Education, Science and Sports of the Republic of Lithuania (Measure No. 12-001-01-01-01 "Improving the Research and Study Environment") (Project No.: S-A-UEI-23-11), Romanian Academy (RO1567-IBB09/2024), Romanian Ministry of Research, Innovation, and Digitization, CNCS - UEFISCDI, PNCDI III (grant numbers PN-III-P1-1.1-PD-2021-0591 and PN-III-P1-1.1-TE-2021-1452), Rufford Small Grant number 26640-1, RZSS (ALJD), the Rufford Foundation (23951-1, 39927-2), Rufford Small Grant number 18847-1, São Paulo Research Foundation-FAPESP: 2020/12588-0, Saxon Ministry for Science, Culture and Tourism (SMWK)/Saxon State Parliament, Scientific Initiation Scholarship Program (PIC) from Centro Universitário de Brasília, Sistema Nacional de Investigación (SNI - Mexico), Spanish Ministry of Science and Innovation (MICINN) through the Juan de la Cierva Incorporación Program (IJC2019-039662-I), Tanzania Wildlife Research Institute (TAWIRI), Talent Attraction fellowship from the Autonomous Community of Madrid (CAM), Spain (2022-T1-AMB-24025), The Lake Simcoe Conservation Foundation and its donors, The McLean Foundation, The Dufferin Simcoe Land Stewardship Network, and the Lake Simcoe Region Conservation Authority and its municipal/regional partners, Third Xinjiang Scientific Expedition Program (YW Grant No. 2022xjkk0804), the Second Tibetan Plateau Scientific Expedition and Research Program (STEP) (Grant no.2021QZKK0203), Tigray-Afar Eco-region project (VPRS/25/2012, CNCS/MU-UMB/02/2011, and VPRCS/RB/20/2012), University of Venda, National Research Foundation of South Africa: 107099, 115040. University of Venda: SMNS/17/Zoo/01, USDA

Forest Service, USFWS (surveys in the Florida Keys - Grants F20AC11116 & F21A0C406-00), UiTM Negeri Sembilan Kuala Pilah Campus, Vinci Autooutes “réseau ASF”, UFG (Universidade Federal de Goiás), UNEMAT (Universidade do Estado de Mato Grosso), University of Venda - Department of Lands, Resources and the Environment at Magnetawan First Nation, US Fish and Wildlife Service, Western Ghats Nature Foundation, Whitley Fund for Nature, Wildland Networks, and Wolgan Valley One & Only. This work was partially funded by the Center of Advanced Systems Understanding (CASUS), which is financed by Germany’s Federal Ministry of Education and Research (BMBF) and by the Saxon Ministry for Science, Culture and Tourism (SMWK) with tax funds on the basis of the budget approved by the Saxon State Parliament. **We thankful the field assistance in recording roadkill** and identifying species to: Abeje Kassie, A. Langer, Abhishek Srivastava, Abuzar Yaran, Adam Otomar, Adrián Lamosa, Alberto Muñoz Costa, Aldo Crisci, Alejandro Arteaga, Alessio Becucci, Alex Richter-Boix, Alexandre Flesch, Allyson Armendariz, Ana Cristina Sacramento, André L. Reglin, Andrea Senese, Aníbal Rodríguez, Animekh Hazarika, Ankur Nahok, Anselm de Silva, Antigoni Kaliontzopoulou, Antonio Croce, Arjun Shandilya and Dr. Anil Khaple, Arnaldo Iudici, Arup Kumar Das (Aaranyak), Atteneri Rojas, Author’s classmates of Universiti Teknologi MARA, Barry Chalmers, Beatriz Martín, Bertrand Charry, Bibhuti P Lahkar (Aaranyak), Birgit Fessl, Bryan Zurita and Anne Dixon, Buller Vet Service, Brisa Autoestradas de Portugal SA, Bund für Umwelt und Naturschutz Deutschland (BUND), C. Trowbridge, C. Watt, Camillo Campolongo, Carling Dewar, Carlos H. Salvador, Carolina Eberhardt, Carolina Diegues, Cassiano do Reis Oliveira, César Ayres, Charlie Teasedale, Chennai, Cheryl Frederick, Chief Conservator of Forests & Field Director, Chippy Wood, citizen science platform iNaturalist, citizen scientists contributing data to CyROS (www.cyroadkills.org), citizen scientists who contributed sightings to WomSAT (WomSAT.org.au), Clara Silva, Claudio D’Esposito, collaborators of the Proyecto de Registro de Fauna atropellada en carreteras Mexicana, colleagues from Secretaria do Meio Ambiente e Infraestrutura do Estado do Rio Grande do Sul, Cristina Venezia, Colin Lawton (NUIG), colleagues from fauna and parcs (Québec), Daniele Scinti Roger, Dante Francomano, David Anchundia, David Dopereiro, Davide De Rosa, Deputy Director of Mudumalai Tiger Reserve, Diana Cardona, Diego Gurvich, and Eimear O’Keefe (Infomar), D. Jones, Dylan Robinson, Ede Municipality, Edison C. M. da Rosa, Eduardo C. do Amaral, Elnaz Najafi-Majd, ENM, Elsimar S. da Silva, Enrico Tammariello, Enza Notorio, Esteban Sanchez, Evan Hovington, Everson Fleck, Ezequiel Vivas, Fabiana Pinto Bertuol, Faegh Mandami, Felipe Camurugi, Felipe Siverio, forest guardians, Founder, Francesca Buoninconti, Forest brigade members from the Perobas Biological Reserve (Júlio Cesar dos Santos, Sidnei do Carmo Bequer, Wilians Batista de Oliveira, Vitor Emanuel Silva Machado, Maykon Junior Moraes Danguí, Clodoaldo Araújo dos Reis and João Henrique Secco), Francisco Álvares, Francisco Jiménez Cazalla, Francisco Pérez, Federico Corga, Gabriel and Grazi, Gabrielle Blanchette, Gabriele Del Gaizo, Gaspare Adinolfi, Gerson Miguel Casagrande Trentim, Getachew Mulualem, Giancarlo Rassati, Gilson Rivas, Giovanni Capobianco, Gisele Steinmetz Magro, Gregor Pachmann, Griselda Millot, Guarda Nacional Republicana (Portugal), Guilherme Souza Oliveira, Gustavo Jiménez-Uzcátegui, G. Hughes, Hannah Bottomley, Hugo B. Mozerle, Haileselasie, Hugo Giraudo, Ignazio Avella, Ilaria Cammarata, Inês Freitas, Ing. Oliver (General Directorate of Cadastre), Ing. Gustavo Hilal (Cordoba Provincial Department of Roads), Ion Garin, Isidro Rodríguez, Ismael Espasandín, Ivo R. Ghizoni-Jr., J. Dixon, Jack O’Connor, Jan M. Kaczmarek, Jan Riegert, Javier Álvarez, Jaynina Deku, Jeju Wildlife Rescue Center, J.E. Baxter-Gilbert, Jeju-si City hall, Jess Reedy, Jessica Papa, Jiří Sedoník, João F. Martins, Jody Mays, Joey O’Connor, Jon Buldain, John Morrison, José Carlos Brito, Josephine Cheng, Juan Conrado Rosacher, Juleysi Reyes, Jyotish Ranjan Deka (Aaranyak), Kathy Gilbert, Kenzie Azmi, Landesverband Rheinland-Pfalz e.V., Lake Simcoe Region Conservation Authority staff and volunteers, Lars Hugaard, Lasoi Ketere, Linda Laack, Lisa Bidinosti, Lizandro Gusen de Oliveira, L. Monck-Whipp, Luís O. M. Giasson, Luis Sánchez, Luiz G. Marins de Sá, K. Tabobondung, C. Neufeld, the Magnetawan First Nation community, Maine Big Night volunteers, Manuel Meijide, Manuel Ramos, Manuela de Lucas, Marc Frank Quintana, Marcela Orozco, Marcello Giannotti, Marco Marotti, Marcos A. G. Azevedo, María José Doiñy, Marilena Izzo, Martino Cabana, Mary-Helen Paspaliaris, Megan Chan, Megan Deslauriers, Melanie Down, Members of NPO Conservation & Animal Welfare Trust, Michał Figura, Michele Innangi, Michele Soprano, Miguel A. Sanza, Miguel Fernando Zapata, Miss Jidapha Thongbanthum, Miss Wipavee Hoonheang, Mitch Sternberg, Moisés Asensi, Monia Nakamura, Mr J. Murphy, Mr. Chanchai Ploysri, Mr. Chattakan Ngamchaluy, Mr. K.V.R.K. Thirunaranan, Mr. Manigandan Mr. Warut Chaleekarn, Ms K. Papastergiou, Ontario Ministry of Natural Resources and Forestry Stewardship Rangers, N. Noble, N3TC staff, Nahla Lucchini, Natalia Kolenda, Norwegian Nature Inspectorate staff, Nicola Campomorto, Óscar Zuazo, Ottavio Janni, Pablo Michelutti, Pablo Sierra, Panduka Silva, Parque Estadual do Tainhas team, Paula Gonzalez Ciccía, Pedro Carrillo Seijas, Pedro Teófilo, Philipp Schiefenhövel of Will und Liselott Masgeik-Stiftung für Natur- und Landschaftsschutz, Pietro Balestrieri, Piotr P. Kazimirski, Professor Estela Bonfiglio, Pronatura Peninsula de Yucatan Team, Prue Grant, Qasem Salimi, Rainer Karsch, R. Bomma, R. Dillon, R. Maleau, Rebecca Blaesing, Renato A. M. Monteiro, Ricardo Soria, Ricardo Zaldivar, Richard Nicole, Ritesh Joshi, Robin Reid, Rochelle Methot, Rodrigo Castro Silva, Roque Santos, Rosenei Olicheski, Ryan Collins, Salvatore Ferraro, Samantha Klein, Sandra Anastasio, Sandro P. Faria, Santiago Reyes, Sarah Courtemanche, Sarayo Guña, Seogwipo-si City hall, Shashi Mishra, Silvia Romano, Simon Tapper, Stanislav Grill, Stefano Erbaggio, Stephen Macfarlane, Sue Findlay, Sujan Henkanaththegedara, Syxto Ferraira, Tamil Nadu Principal Chief Conservator of Forests and Chief Wildlife Warden of Tamil Nadu state, Tanya Barr, Tania Paradiso, Tiran Abeywardene, Thasun Amarasinghe, the Danish Nature Agency, Tito Barros, Thomas deMaar, Tobias Kunz, U.S. Fish and Wildlife biologists and affiliates, Valeria Balestrieri, Valérie Hayot-Sasson, Victor Esqueda, Víctor León, Victor Merlino, Vitor Zimmermann, Volunteer hunters of the Danish Schweiss-Register, Volunteers of database at <http://cyroadkills.org>, Wanessa, William, Wendy Collinson-Jonker, and Xosé Pardavila. **We acknowledge the following persons, projects, institutions and organizations that were associated to roadkill data collections:** Agencia Andaluza de Cooperación Internacional (Junta de Andalucía), Center for Wildlife Studies, company Eixo-SP and company Arteris Entrevias, Comunidad de Madrid (2018-T1/AMB-10374 and 2022-5 A/AMB-24242 to RB), Consejería Medio Ambiente (Junta de Andalucía), Consórcio

Concremat-Hollus, Consórcio DT PR-445, Consórcio PROSUL-MAC III, COVINSE, CRAS and Environmental Police, Crocodile Lake National Wildlife Refuge, DACBIOL-UJAT, Department of Wildlife Conservation, Sri Lanka; Department of Forest Conservation, Sri Lanka, Department of National Museum Sri Lanka, Departamento de Estradas de Rodagem do Paraná (DER/PR), Departamento Nacional de Infraestrutura de Transportes - Superintendência Regional do Amazonas (DNIT/AM), Departamento Nacional de Infraestrutura de transportes (DNIT), Director of the Serengeti Wildlife Research Centre (SWRC), the Chief Park warden for the Serengeti National Park, Direction interdépartementale des routes de l'Est de la France (DIR EST), Direction Régionale de l'Environnement de l'Aménagement et du Logement de Franche-Comté (DREAL FC), ESSA in the scope of the project "Smart Infrastructure Planning and Design to Protect Natural Habitats and Biodiversity: Ecological Assessment of the NHP Road Upgrading", Marianne Cheveau, Endangered Wildlife Trust, Éric Alain, Faculty of Graduate Studies of the University of Colombo, Sri Lanka, Federal University of Lavras – UFPA, Federal University of Mato Grosso do Sul and the Post-Graduate Program in Ecology and Conservation, Forest Ecology Laboratory, Forêt Montmorency, Friends of Presqu'île Provincial Park, Fundação de Pesquisas Florestais do Paraná (FUPF), Fundação de Amparo à Pesquisa do Estado do Acre (FAPAC), Galapagos Conservancy, General Directorate for National Roads and Motorways (Poland), Gladys Porter Zoo, Géraldine Conruyt-Rogeeon Service du Patrimoine Naturel du Museum National d'Histoire Naturelle, Provincia di Cuneo, Città Metropolitana di Torino, GIT Impacto de Infraestructuras Humanas a la Vida Silvestre (SMBC), Héloïse Bastien, Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), Instituto Tecnológico de Transportes e Infraestrutura (ITTI), Jean-Emmanuel Arsenault, Jean-François Dumont, Julie Boucher, Laboratory of Studies and Projects in Forest Management – LEMAF, Mathieu Brunet, Michel Michaud, Ministère des transports, Museum of Natural Sciences 'Anibal Montes', Parc National de la Jacques Cartier, Park rangers at Nam Nao National Park, Patrouille secours, Presqu'île Provincial Park, Projectree Engenharia Ltda, Public Ministry of Campo Grande, Raleigh Road Mortality Project in North Carolina, Project "Distribución Conservación y Ecología del Turón en la Península Ibérica", the Department of National Parks, Wildlife and Plant Conservation, Project UG/FCI 046-2021: Mortalidad de Vertebrados silvestres por colisiones vehiculares en las principales carreteras entre las provincias de Guayas y Santa Elena (Ecuador), Pierre Blanchette, Quebec Center for Biodiversity Science (QCBS), Ministère des Forêts (Canada), Ministère des transports, de la mobilité durable et de l'électrification des transports du Québec (MTMDT), Réserve Faunique des Laurentides, Science Forest Department, Sistema Nacional de Investigación, Société des établissements de plein air du Québec (Sépaq), SOLURB, Sûreté du Québec, Sylvain Boucher, The Department of National Parks, Universidade do Extremo Sul Catarinense (UNESC), Universidade Federal do Acre (UFAC), Universidade Federal do Paraná (UFPR), University of Malaga (Spain), University of Venda, volunteers of NGO Hora ést, Wildlife Management at the National University of Cordoba, Yves Bédard, Yves Leblanc, Zetta UFPA Agency for Innovation in Geotechnologies and Intelligent Systems in Agribusiness - Zetta UFPA, This paper was written and prepared in part by U.S. Government employees on official time, and therefore it is in the public domain and not subject to copyright. The findings and conclusions in this publication are those of the authors and should not be construed to represent an official USDA, Forest Service, or United States Government determination or policy.

Author contributions

C.G. conceived and coordinated the dataset and was the primary writer. T.N. performed the standardization and technical validation and contributed to the writing. C.G., J.B., I.S., M.Q., A.L.R., P.M.-V., K.S. and Y.W. performed the compilation of literature with information on roadkill. All the remaining co-authors collected the roadkill data into a dataset. A.B., G.T. and A.P.C. provided writing edits.

Competing interests

The authors declare no competing interests.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1038/s41597-024-04207-x>.

Correspondence and requests for materials should be addressed to C.G.

Reprints and permissions information is available at www.nature.com/reprints.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Open Access This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

© The Author(s) 2025

Data Collection Consortium

Sergio Damián Abate¹³, Fernanda D' Abra^{14,15}, Stuart Aldaz Cedeño¹⁶, Pedro Rodrigues de Alencar¹⁷, Mariana Fernanda Peres de Almeida¹⁸, Mario Henrique Alves^{19,20}, Paloma Alves²¹, André Ambrozio de Assis²², Rob Ament²³, Richard Andrášik²⁴, Edison Araguillin²⁵, Danielle Rodrigues de Araújo²⁶, Alexis Araujo-Quintero²⁷, Jesús Arca-Rubio²⁸, Morteza Arianejad²⁹, Carlos Armas³⁰, Erin Arnold^{31,32}, Fernando Ascensão³³, Badrul Azhar³⁴, Seung-Yun Baek³⁵, Hemant Bajpai³⁶, Dimitrios Bakaloudis³⁷, Ana Carolina França Balbino-Silva Balbino-Silva^{38,39}, Alessandro Balestrieri⁴⁰, Rosario Balestrieri^{41,42}, Udit Bansal^{43,44}, Christophe Barbraud⁴⁵, Allison Barg^{46,47}, Rafael Barrientos⁴⁸, Priscila Cortêz Barth⁴⁹, Tomáš Bartonička⁵⁰, Marco Basile⁵¹, Matteo Luca Bastianelli^{52,53}, Gabriela Batista⁵⁴, James Baxter-Gilbert⁵⁵, Júlia Beduschi^{56,57}, Satyaranjan Behera⁵⁸, Katrina Bélanger-Smith⁵⁹, Mohamed Belkacem⁶⁰, Yanina Benedetti⁶¹, Griselda Benítez-Badillo⁶², Jim Bethhoff⁶³, Beulah bah Jesudass⁶⁴, Alexandra Maria Ramos Bezerra⁶⁵, Michal Bíl⁶⁶, Daniel Blamires⁶⁷, Juliano André Bogoni⁶⁸, Vasileios Bontzorlos⁶⁹, Amael Borzee⁷⁰, Than Boves^{71,72}, Alex Augusto Abreu Bovo⁷³, Sean P. Boyle⁷⁴, Cecília Bueno⁷⁵, John K. Bukombe⁷⁶, Ufuk Bülbül⁷⁷, María Eugenia Cabrera-García⁷⁸, Pier Cacciali⁷⁹, Carlos Camacho⁸⁰, Amanda de Campos⁸¹, João Campos⁸², David Canal⁸³, Luca Canova⁸⁴, Patricio Canul Chuc⁸⁵, Anthony Caravaggi⁸⁶, Bradley E. Carlson⁸⁷, Guillermo Carmona⁸⁸, Jose Luis Cartes⁸⁹, Filipe Carvalho^{90,91}, Victor Castelazo-Calva⁹², Hugo del Castillo⁹³, Karoline Ceron^{94,95}, Rodolfo Cervantes-Huerta⁹⁶, Jaroslav Červinka⁹⁷, Desalegn Chala⁹⁸, Noah Charney^{99,100}, Matthew W. H. Chatfield^{101,102}, Jorge José Cherem¹⁰³, Bryan Chruszcz¹⁰⁴, Kerim Çiçek^{105,106}, Vojtech Cicha¹⁰⁷, Alfred-Ştefan Cicort-Lucaci¹⁰⁸, Anthony P. Clevenger¹⁰⁹, Victor J. Colino-Rabanal¹¹⁰, Wendy Collinson¹¹¹, Patrick Colombo¹¹², Andréa C. G. L. Costa¹¹³, Gabriel Carvalho Costa¹¹⁴, José Roberto Nascimento da Costa¹¹⁵, Ana Luiza Costa-Silva¹¹⁶, Severus-Daniel Covaciu-Marcov¹¹⁷, Michael V. Cove¹¹⁸, Kelly A. Crandall¹¹⁹, Matthew Crane¹²⁰, Lucas Batista Crivellari¹²¹, Adriano Souza da Cunha¹²², Héli da Ferreira da Cunha¹²³, Maria Eduarda Bernardino Cunha^{124,125}, Diana Cupşa¹²⁶, Marcello D'Amico¹²⁷, Jyoti Das^{128,129}, Katia M. P. M. B. Ferraz¹³⁰, Leonidas de los Reyes Lara¹³¹, Juan Domingo Delgado¹³², Shailesh Desai¹³³, Arnaud Desbiez^{134,135}, André Desrochers¹³⁶, Raphael Igor Dias¹³⁷, Thiago da Costa Dias¹³⁸, Prateep Duengkae¹³⁹, Martin DuĽa¹⁴⁰, Jessica Durán-Antonio¹⁴¹, Thomas Engleder¹⁴², Martin Ernst¹⁴³, Mauricio Failla¹⁴⁴, Abul Hassan Faiz¹⁴⁵, Mattia Falaschi¹⁴⁶, Felipe Moreli Fantacini^{147,148}, Sára Ferentí¹⁴⁹, Marcela Ferreira¹⁵⁰, Miguel Ferrer¹⁵¹, Rafael G. Cabral Filho¹⁵², Jonathan Filius¹⁵³, Pedro Santana Fischer^{154,155}, Jean-Christophe Foltête¹⁵⁶, Marco Aurélio Leite Fontes¹⁵⁷, Marc Franch Quintana^{158,159}, Marcelo Duarte Freire¹⁶⁰, Robert D. Fyumagwa¹⁶¹, Diego Gallego-garcía^{162,163}, Dumas Gálvez¹⁶⁴, Lilia María Gama Campillo¹⁶⁵, Nuno Garcia¹⁶⁶, José-María García-Carrasco¹⁶⁷, Núria Garriga-Rovira¹⁶⁸, Viorel Dumitru Gavril¹⁶⁹, Iago Vinicios Geller¹⁷⁰, Iulian Gherghel^{171,172}, Xavier Girardet¹⁷³, Samuel Ferreira Gohlke¹⁷⁴, Samuel C. Gomides¹⁷⁵, Alvaro González-Calderón¹⁷⁶, Alberto González-Gallina¹⁷⁷, Elías José Gordillo-Chávez¹⁷⁸, Jai Green-Barber¹⁷⁹, Kari Gunson¹⁸⁰, Tsegazeabe Hadush Haileselasie^{181,182}, Farah Hamici¹⁸³, Wellington Hannibal¹⁸⁴, Kwaslema M. Hariohay¹⁸⁵, Mandana Hazrati¹⁸⁶, Sol Heber¹⁸⁷, Dener Heiermann^{188,189}, Anuar Hernández-Saint Martin¹⁹⁰, Mathias Herrmann¹⁹¹, Marco Heurich^{192,193}, Mircea G. Hidalgo-Mihart¹⁹⁴, Pim van Hooft¹⁹⁵, Stefanie Huck¹⁹⁶, Marcel Pieter Huijser^{197,198}, Magne Husby¹⁹⁹, Jochen A. G. Jaeger^{200,201}, Dariusz Jakubas²⁰², Tomáš Janík^{203,204}, Pablo Jarrín-V²⁰⁵, Miloslav Jirků²⁰⁶, Nitin Joshi^{207,208}, Ritesh Joshi²⁰⁹, Romain Juilliard²¹⁰, Márcio Vieira de Carvalho Junior²¹¹, Willi Bruschi Junior²¹², Mikotaj Kaczmariski²¹³, Wanmo Kang²¹⁴, Pandi Karthik²¹⁵, Sivaraj Karthick²¹⁶, Suranjan Karunarathna²¹⁷, Subbiah Karuppusamy²¹⁸, Abeje Kassie²¹⁹, Zdenek Keken²²⁰, Alexis Grote Kellermann²²¹, Eoghan Kelly²²², Naim Khandakar²²³, Andreas Kindel^{224,225}, Daniel Knitter²²⁶, Halime Koç-Gür²²⁷, Krzysztof Kolenda²²⁸, Evangelos Kotsonas²²⁹, Jan Kubeček²³⁰, Wuttisak Kummoo²³¹, Tomáš Kušta²³², Bibhuti Lahkar²³³, Jochen Langbein²³⁴, Stefano Lapadula²³⁵, Michael Daniel Larreátegui Palma²³⁶, Dimitra Lazaridou²³⁷, Magdalena Lazarus²³⁸, Camila Rabelo Oliveira Leal²³⁹, Gregory LeClair^{240,241}, Seong-Min Lee²⁴², Carlos Rodrigo Lehn²⁴³, Luiz Carlos de Lima Leite²⁴⁴, Jabamalainathan Leona Princy²⁴⁵, Stalo Leontiou^{246,247}, Isabel Salgueiro Lermen^{248,249}, David Lesbarrères^{250,251}, Qilin Li²⁵², Vassilis Litskas^{253,254}, Jacqueline D. Litzgus²⁵⁵, Yan Liu²⁵⁶, Gustavo A. Llorente²⁵⁷, Victor J. T. Loehr²⁵⁸, Edson Varga Lopes^{259,260}, Isaac Lord²⁶¹, Robert Ludgate²⁶², Ruth Del Carmen Luna Ruiz²⁶³, Richard D. Lyamuya²⁶⁴, Felipe Santana Machado^{265,266}, Reginaldo Assencio Machado²⁶⁷,

Marlon Macías González¹⁶, Jenny MacPherson²⁰⁸, Marcelo Magioli^{159,209,210}, Raoul Manenti⁴⁰, Amit Manhas^{211,212}, Luis Renato Bernardo²¹³, Marko Anđelković²¹⁴, David G. Marneweck^{215,216}, Juan Ignacio Zanón-Martínez^{217,218}, Fernando Martínez-Freiría^{1,3}, Luiza Barros Martins²¹⁹, Emmanuel H. Masenga⁷³, Ena Edith Mata Zayas¹³⁸, Denise Lidório Mattia²¹, Jenny Mattisson²²⁰, Sujatha Mayadunnage¹⁴⁷, Martin Mayer^{221,222}, Matthew R. McLennan^{223,224}, Maulid L. Mdaki⁷³, Raluca Melenciuc¹⁴⁴, Fabiana Cristina Silveira Alves Melo²²⁵, Fabiano Rodrigues de Melo²²⁶, Pier Giuseppe Meneguz²²⁷, Jorge Fernando Saraiva Menezes^{228,229}, Talita Menger^{56,57}, Mebrahtom Mesfin²³⁰, Fabio Leonardo Meza-Joya²³¹, Jefferson Eduardo Silveira Miranda^{232,233}, Asako Miyamoto²³⁴, Eduardo Javier Moguel Ordóñez¹³⁸, Alireza Mohammadi²³⁵, Albert Montori²³⁶, Federico Morelli⁶¹, Marcia Moreno-Baez²³⁷, Gregorio Moreno-Rueda²³⁸, Roberta Moriano²²⁷, Aloysio Souza Moura²³⁹, Getachew Mulualem^{230,240,241}, Claire Mundy²⁰⁴, Grayson G. Mwakalebe⁷³, Robert W. Mysłajek^{242,243}, Elnaz Najafi-Majd⁹³, Allisya Nasir²⁴⁴, Sara Navarro²⁴⁵, Neda Bogdanović²⁴⁶, Luca Nelli²⁴⁷, Jiří Neudert²⁴⁸, Maarten Nieuwenhuis²⁴⁹, Ally K. Nkwabi⁷³, Sabina Nowak^{242,243}, Julie Old¹⁴⁷, Luiz Gustavo Rodrigues Oliveira Santos³⁸, Diogo Reis Oliveira^{109,110}, Gabriela Schuck de Oliveira^{180,181}, José Everaldo de Oliveira¹³², Seixas Rezende Oliveira²⁵⁰, Paula Maiten Orozco-Valor^{75,136}, Mário Luís Orsi¹⁴², Zaida Ortega^{238,251}, Fabrice G. W. A. Ottburg¹²⁹, Ali Uğur Özcan²⁵², Hatice Özkan⁷⁴, Paanwaris Paansri²⁵³, Coral J. Pacheco-Figueroa¹³⁸, Jeffrey Parmelee²⁵⁴, Claire Patterson-Abolat⁹⁸, Brent S. Pease¹⁰⁴, Alan Deivid Pereira²⁵⁵, Deivid Pereira⁴⁹, Josani Carbonera Pereira¹⁹¹, Jori Ramos Pereira²¹, Kleber Fernando Pereira²⁵⁶, Mariluci Pereira²¹, Milton Perelló²⁵⁷, Wibke Peters²⁵⁸, Oscar Piguave Anchundia¹⁶, Richard Pither²⁵⁹, Judith Plante¹⁶¹, Geisy Kelen Plodowski^{260,261}, Daniel-Răzvan Pop⁹⁵, Laxmanan Prakash²⁶², Ali Turk Qashqaei²⁶³, Pablo Quiles²⁶⁴, Abdelwahab Rai¹⁵¹, Eliana Ramos²³¹, Nilton Rascon¹¹⁹, Gianluca Rassati²⁶⁴, Kaitlyn Read²⁶⁵, Joseph Redinger²⁰⁴, Eloy Revilla⁷⁷, Paulo Ribeiro²⁶⁶, Yuri Geraldo Gomes Ribeiro¹⁹, Julia L. Riley⁵⁵, Daniel Borba Rocha¹⁰⁷, Lício Mota da Rocha^{119,267}, Vlamir José Rocha²¹⁹, Rodrigo Becker Rodrigues¹⁸⁰, Airam Rodríguez⁸⁰, Beneharo Rodríguez³⁰, Octavio Rojas-Soto²⁶⁸, Michael J. Rolheiser¹⁶¹, Jacinto Román⁷⁷, Dušan Romportl^{164,165}, Clarissa Rosa²⁶⁹, Eivin Røskoft²⁷⁰, Marcin Ryś²⁷¹, Guilherme Augusto Munhoz de Sá¹⁰¹, João Vinícius Sachet²⁶⁰, Enrique Sacramento³⁰, Joel C. Saenz²⁷², Tiberiu Constantin Sahlean¹⁴¹, Erica Naomi Saito^{19,22,273}, Jaime A. Salas^{16,274}, Martin Šálek^{61,240,275}, Arockianathan Samson³⁶, Arya Sanjar¹⁰⁴, Mariela Santacruz²⁷⁶, Palanisamy Santhoshkumar⁶³, Manuel Santiago-Plata²⁷⁷, Adryhano dos Santos²⁷⁸, Xavier Santos^{1,3}, José Hernán Sarasola^{75,136}, Sema Sarikurt⁷⁴, Tommaso Savini¹⁰⁵, Shauna Sayers¹⁰⁴, Christopher M. Schalk²⁷⁹, Greta Schmidt^{280,281}, David Seburn²⁸², Jiří Sedoník^{24,184}, Andrés E. Seijas²⁷, Margaret Lumy Sekiama²¹⁹, Lorena Sforza⁷⁶, Bhuvan Keshar Sharma²⁸³, Bibek Raj Shrestha^{284,285}, Rodrigo Sidooski²², Neftalí Sillero⁷⁹, Antonio Guilherme Cândido da Silva¹¹⁹, André Luiz Ferreira da Silva^{22,286}, Daniel Silva⁷⁹, Eduardo Araujo da Silva²², Daniel Vilasboas Slomp²⁸⁷, Mahmood Soofi^{288,289,290}, Ronald Sosa²⁹¹, Marina de Souza¹⁰⁶, Wellington Fernandes de Souza²⁷⁸, Ariel G. Spanowicz¹⁶¹, Cătălin Răzvan Stanciu²⁹², Hayley Stannard²⁹³, Mitch Sternberg^{281,294}, Grace Stonecipher²⁹⁵, Alexandru Strugariu¹⁴³, Warong Suksavate¹²⁰, Thilina D. Surasinghe²⁹⁶, Lourens H. Swanepoel²⁹⁷, Hilary Swarts²⁸¹, Syoko Tamanaha²⁹⁸, Jiraporn Teampanpong²⁹⁹, Mekonen Teferi¹⁴⁹, Fernanda Zimmermann Teixeira^{180,181}, Gustavo Tejera³⁰, Leonardo Teófilo Teles²⁶, Weldemariam Tesfahunegn²³⁰, Bill Thompson²⁶⁵, Paolo Tizzani²²⁷, Giedrius Trakimas^{300,301}, Ricardo Keichi Umetsu²³², Pantiya Utsa³⁰², Viral Vadodariya³⁰³, Juan de Dios Valdez Leal¹³⁸, Francesco Valerio^{1,3,304}, Edgar A. van der Grift¹²⁹, Yntze van der Hoek³⁰⁵, Aayush Vasava³⁰⁶, Nadines Velázquez²⁷, Guillermo Velo-Antón^{1,307}, Vinícius Rozendo Vianna¹⁷, Ana Paula Vidotto-Magnoni³⁰⁸, Ioannis Vogiatzakis^{192,309}, Mengistu Wale¹⁷⁷, Yuya Watari²³⁴, Samuel T. Williams^{310,311,312}, Marina Winter¹³, Donggul Woo³¹³, Marcelo Hideki Shigaki Yabu¹⁴², Pochamoni Bharath Simha Yadav¹⁷⁶, Muhammad Syafiq Yahya³⁴, Débora Regina Yogui^{19,314}, Răzvan Zaharia³¹⁵, Sarah Shazwani Zakaria²⁴⁴, Caroline Zank^{107,316}, Antonio Carlos da Silva Zanzini¹³², Glaucio Zeferino²¹³, Juli Luft Zenere²¹, Jairo José Zocche²¹, Ludmila Zoel³¹⁷, Savvas Zotos¹⁹² and Eric Guinard³¹⁸

¹³Universidad Nacional de Río Negro, Sede Atlántica. Centro de Investigaciones y Transferencia de Río Negro (UNRN-CONICET), Viedma, Río Negro, Argentina. ¹⁴Center for Conservation and Sustainability, Smithsonian Conservation Biology Institute, National Zoological Park, Washington, USA. ¹⁵ViaFauna Estudos Ambientais, São Paulo, Brazil. ¹⁶Universidad de Guayaquil, Facultad de Ciencias Naturales, Carrera de Biología, Guayaquil, Ecuador. ¹⁷Faculdade de

Ciências da Educação e Saúde, Centro Universitário de Brasília, Brasília, Brazil. ¹⁸BioStatera, Brasília, Brazil. ¹⁹Wild Animal Conservation Institute (ICAS), Campo Grande, Mato Grosso do Sul, Brazil. ²⁰Department of Veterinary Medicine, University of Bari, Bari, Italy. ²¹Laboratório de Ecologia de Paisagem e de Vertebrados (LABECO), Universidade do Extremo Sul Catarinense (UNESC), Santa, Catarina, Brazil. ²²Rede Brasileira de Especialistas em Ecologia de Transportes (REET Brasil), São Paulo, Brazil. ²³Center for Large Landscape Conservation, Bozeman, USA. ²⁴Transport Research Centre (CDV), Brno, Czechia. ²⁵Metropolitan District of Quito, Environment Unit of the Calderón Zonal Administration, Guayaquil, Ecuador. ²⁶UnUCET, Universidade Estadual de Goiás, Goiânia, Brazil. ²⁷Universidad Nacional Experimental de los Llanos Occidentales Ezequiel Zamora (UNELLEZ), Guanare, Venezuela. ²⁸University of Pablo de Olavide, Sevilla, Spain. ²⁹Hormuz Wildlife Guardians Foundation, Tehran, Iran. ³⁰Canary Islands' Ornithology and Natural History Group, Sevilla, Spain. ³¹Raptor Research Center and Department of Biological Sciences, Boise State University, Boise, Idaho, USA. ³²U.S. Fish & Wildlife Service, Vancouver, WA, USA. ³³CE3c - Centre for Ecology, Evolution and Environmental Changes, Faculdade de Ciências da Universidade de Lisboa, Lisboa, Portugal. ³⁴Faculty of Forestry and Environment, Universiti Putra Malaysia, Serdang, Selangor, Malaysia. ³⁵United Graduate School of Agricultural Science, Tokyo University of Agriculture and Technology, Fuchu, Tokyo, Japan. ³⁶Bombay Natural History Society, Mumbai, Maharashtra, India. ³⁷School of Forestry and Natural Environment, Aristotle University of Thessaloniki, University campus, Thessaloniki, Greece. ³⁸Federal University of Mato Grosso do Sul, Campo Grande, Brazil. ³⁹Mamirauá Sustainable Development Institute, Amazonas, Brazil. ⁴⁰Department of Environmental Science and Policy, Università degli Studi di Milano, Milan, Italy. ⁴¹Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, CRIMAC, C.da Torre Spaccata, Amendolara, Italy. ⁴²ARDEA APS - Via Ventilabro 6, 80126, Napoli, Italy. ⁴³Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY, USA. ⁴⁴Western Ghats Nature Foundation, Ponnampet, India. ⁴⁵CEBC ULR 7372 – CNRS, Villiers-En-Bois, France. ⁴⁶School of Applied Sciences, University of South Wales, South Wales, UK. ⁴⁷School of Natural Resources, University of Nebraska—Lincoln, Lincoln, USA. ⁴⁸Road Ecology Lab, Department of Biodiversity, Ecology and Evolution, Faculty of Biological Sciences, Complutense University of Madrid, Madrid, Spain. ⁴⁹Museu de Ciências Naturais da Secretaria do Meio Ambiente e Infraestrutura do Rio Grande do Sul, Santarém, Brazil. ⁵⁰Masaryk University, Faculty of Science, Dept. of Botany and Zoology, Brno, Czechia. ⁵¹Swiss Federal Research Institute WSL, Birmensdorf, Switzerland. ⁵²Chair of Wildlife Ecology and Management, University of Freiburg, Freiburg, Germany. ⁵³Department of National Park Monitoring and Animal Management, Bavarian Forest National Park, Grafenau, Germany. ⁵⁴Universidade Federal do Oeste do Pará, Instituto de Ciências e Tecnologia das Águas, Santarém, Brazil. ⁵⁵Department of Biology, Mount Allison University, Sackville, NB, Canada. ⁵⁶PRECISA Consultoria Ambiental, Santarém, Brazil. ⁵⁷Programa de Pós-Graduação em Ecologia, Universidade Federal do Rio Grande do Sul (UFRGS); Núcleo de Ecologia de Rodovias e Ferrovias, Centro de Ecologia, Universidade Federal do Rio Grande do Sul, Santarém, Brazil. ⁵⁸Odisha Biodiversity Board, Regional Plant Resource Centre Campus, Nayapali, Odisha, India. ⁵⁹Concordia University Montreal, Department of Biology, Montréal, Canada. ⁶⁰Biotechnologies and Protection of Agricultural and Natural Ecosystems Laboratory, SNVST Faculty, University of Bouira, Bouira, Algeria. ⁶¹Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Prague, Czechia. ⁶²Red de Ambiente y Sustentabilidad, Instituto de Ecología A.C. (INECOL), Xalapa, Veracruz, Mexico. ⁶³Department of Zoology and Wildlife Biology, Government Arts College, Udthagamandalam, The Nilgiris, Tamil Nadu, India. ⁶⁴Museu Paraense Emílio Goeldi, Belém, Brazil. ⁶⁵Universidade Estadual de Goiás, Departamento de Ciências Biológicas, UnU Iporá, Goiás, Brazil. ⁶⁶Programa de Pós-Graduação em Ciências Ambientais, Laboratório de Mastozoologia, Universidade do Estado de Mato Grosso, Cáceres, Brazil. ⁶⁷CSO TYTO - Association for the Management and Conservation of Biodiversity in Agricultural Ecosystems, Larisa, Greece. ⁶⁸Laboratory of Animal Behaviour and Conservation, College of Life Sciences, Nanjing Forestry University, Nanjing, China. ⁶⁹Department of Biological Sciences, Arkansas State University, Jonesboro, Arkansas, USA. ⁷⁰National Center for Bird Research and Conservation – CEMAVE, Chico Mendes Institute for Biodiversity Conservation – ICMBio, Floresta Nacional da Restinga de Cabedelo, Brasília, Brazil. ⁷¹School of Science and the Environment, Memorial University of Newfoundland and Labrador, Corner Brook, Canada. ⁷²Universidade Veiga de Almeida/NEVS/Concer, Rio de Janeiro, Brazil. ⁷³Tanzania Wildlife Research Institute, Arusha, Tanzania. ⁷⁴Karadeniz Technical University Faculty of Science Department of Biology Trabzon, Trabzon, Türkiye. ⁷⁵Centro para el Estudio y Conservación de las Aves Rapaces en Argentina (CECARA), Universidad Nacional de La Pampa, La Pampa, Argentina. ⁷⁶Guyra Paraguay, Paraguay. ⁷⁷Estación Biológica de Doñana-CSIC, Seville, Spain. ⁷⁸Secretaria de Meio Ambiente, Cianorte, Paraná, Brazil. ⁷⁹CICGE - Centro de Investigação em Ciências GeoEspaciais, Faculdade de Ciências da Universidade do Porto, Porto, Portugal. ⁸⁰Departamento de Ecología Evolutiva, Museo Nacional de Ciencias Naturales (MNCN), CSIC, Madrid, Spain. ⁸¹Department of Chemistry, University of Pavia, Via Taramelli 24, I-27100, Pavia, Italy. ⁸²Pronatura Península de Yucatán A.C., Mérida, Mexico. ⁸³Wabash College, Crawfordsville, Indiana, USA. ⁸⁴Department of Zoology and Entomology, School of Biological and Environmental Sciences, University of Fort Hare, Fort Hare, South Africa. ⁸⁵Laboratório de Estrutura e Dinâmica da Diversidade (LEDDiv), Departamento de Biologia Animal, Instituto de Biologia, Universidade Estadual de Campinas (UNICAMP), São Paulo, Brazil. ⁸⁶Laboratório de Interações Ecológicas e Biodiversidade (LIEB), Departamento de Biologia, Universidade Federal do Ceará, Ceará, Brazil. ⁸⁷Biology Centre CAS, Academy of Sciences of the Czech Republic, Ceske Budejovice, Czechia. ⁸⁸University of Oslo, Natural History Museum, Blindern, Oslo, Norway. ⁸⁹University of Maine, Maine, USA. ⁹⁰Maine Big Night: Amphibian Migration Monitoring, Maine, USA. ⁹¹Instituto Tabuleiro, Florianópolis, Brazil. ⁹²Parks Canada, Revelstoke, Canada. ⁹³Ege University, Faculty of Science, Department of Biology, Bornova, İzmir, Türkiye. ⁹⁴Natural History Application and Research Centre, Ege University, Bornova, İzmir, Türkiye. ⁹⁵Faculty of Informatics and Sciences, Department of Biology, University of Oradea, Oradea, Romania. ⁹⁶Western Transportation Institute, Montana State University, Bozeman, USA. ⁹⁷Department of Animal Biology. Anthroponatura, Faculty of Environmental Science, University of Salamanca, Salamanca, Spain. ⁹⁸Endangered Wildlife Trust, Johannesburg, South Africa. ⁹⁹Museu de Ciências Naturais da Secretaria do Meio Ambiente e Infraestrutura do Rio Grande do Sul, Imbé, Brazil. ¹⁰⁰Programa de Pós-graduação em Biodiversidade, Universidade Federal do Oeste do Pará, Pará, Brazil. ¹⁰¹Hollus Serviços Técnicos Especializados Ltda, Brasília, Brazil. ¹⁰²Universidade Federal do Acre, Programa de Pós-

Graduação em Ciências Ambientais, Campus Floresta, Cruzeiro do Sul/Acre, Brazil. ¹⁰³North Carolina Museum of Natural Sciences, Raleigh, NC, USA. ¹⁰⁴School of Forestry and Horticulture, Southern Illinois University, Carbondale, USA. ¹⁰⁵School of Bioresources and Technology, King Mongkut's University of Technology Thonburi (KMUTT), Bangkok, Thailand. ¹⁰⁶Programa de Pós-graduação em Zoologia, Universidade Federal do Paraná (UFPR), Curitiba, Brazil. ¹⁰⁷Biowall Consultoria Ambiental Ltda, Porto Alegre, Brazil. ¹⁰⁸Universidade Estadual de Goiás, Goiânia, Brazil. ¹⁰⁹Programa de Pós-Graduação em Biologia Animal, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. ¹¹⁰Museu de Ciências Naturais da Secretaria do Meio Ambiente e Infraestrutura do Rio Grande do Sul, Brasília, Brazil. ¹¹¹Aaranyak, Bishnu Rabha Path, Beltola, Guwahati, India. ¹¹²Zoological Society of London, Regents Park, London, NW1 4RY, UK. ¹¹³Departamento de Ciências Florestais, Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo, São Paulo, Brazil. ¹¹⁴TRAGSATEC, Madrid, Spain. ¹¹⁵Area de Ecología, Dept. Sistemas Físicos, Químicos y Naturales, Univ. Pablo de Olavide, Sevilla, Spain. ¹¹⁶Banaras Hindu University, Banaras, India. ¹¹⁷Royal Zoological Society of Scotland (RZSS), Murrayfield, Edinburgh, UK. ¹¹⁸Université Laval, Faculté de foresterie, de géographie et de géomatique, Québec, Canada. ¹¹⁹Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio, Brasília, Brazil. ¹²⁰Department of Forest Biology, Faculty of Forestry, Kasetsart University, Bangkok, Thailand. ¹²¹Department of Forest Ecology, Faculty of Forestry and Wood Technology, Mendel University, Brno, Czechia. ¹²²Red de Biología y Conservación de Vertebrados, Instituto de Ecología, Veracruz, Mexico. ¹²³Green Heart of Europe, Haslach, AT, Austria. ¹²⁴Faculty of Forestry and Wood Technology, Department of Forest Protection and Wildlife Management, Mendel University in Brno, Brno, Czechia. ¹²⁵Proyecto Patagonia Noreste, Balneario El Condor, Rio Negro, Argentina. ¹²⁶Women University of Azad Jammu & Kashmir, Bagh, Pakistan. ¹²⁷Instituto Ambiental Bröderthal (IAB), Rua Carlos Cervi, 300, Centro, 88353-190, Brusque, Santa Catarina, Brazil. ¹²⁸Programa de Pós-Graduação em Ambiente e Sociedade, Universidade Estadual de Goiás, Quirinópolis, Brazil. ¹²⁹Wageningen University & Research, Wildlife Ecology and Conservation Group, Wageningen, Netherlands. ¹³⁰Instituto de Biociências, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil. ¹³¹Université de Franche-Comté, CNRS, Théma, Besançon, France. ¹³²Department of Forest Sciences, Federal University of Lavras, Lavras, Brazil. ¹³³BioLAND Research Group, Departament de Ciències Ambientals, Universitat de Girona, Girona, Spain. ¹³⁴CICGE - Centro de Investigação em Ciências Geo-Espaciais, Universidade de Porto, Porto, Portugal. ¹³⁵Laboratório de Herpetologia, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil. ¹³⁶Instituto de Ciencias de la Tierra y Ambientales de La Pampa (INCITAP), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), La Pampa, Argentina. ¹³⁷Coiba Scientific Station, Programa Centroamericano de Maestría en Entomología, Smithsonian Tropical Research Institute, Panama City, Panamá. ¹³⁸DACBIOL-UJAT, Villahermosa, Tabasco, Mexico. ¹³⁹University of Málaga, Málaga, Spain. ¹⁴⁰Pg. Congost, 20, 08530, La Garriga, Barcelona, Spain. ¹⁴¹Institute of Biology Bucharest, Romanian Academy, Bucharest, Romania. ¹⁴²Universidade Estadual de Londrina, Programa de Pós-Graduação em Ciências Biológicas, Londrina, PR, Brazil. ¹⁴³Alexandru Ioan Cuza University of Iași, Institute of Interdisciplinary Research, Department of Exact and Natural Sciences, Iași, Romania. ¹⁴⁴Ovidius University Constanța, Faculty of Natural and Agricultural Sciences, Constanța, Romania. ¹⁴⁵Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Instituto de Ecología, Genética y Evolución de Buenos Aires (UBA-CONICET), Buenos Aires, Argentina. ¹⁴⁶Unidad de Servicios Profesionales Altamente Especializados (USPAE), Instituto de Ecología A.C. (INECOL), Xalapa, Veracruz, Mexico. ¹⁴⁷School of Science, Western Sydney University, Hawkesbury, Australia. ¹⁴⁸Eco-Kare Consulting, Peterborough, Ontario, Canada. ¹⁴⁹Mekelle University, College of Natural and Computational, Sciences, Department of Biology, Arid Main Campus, Mekelle, Tigray, Ethiopia. ¹⁵⁰Tigray Biological and Biodiversity Association (TB2A), Mekelle, Tigray National Regional State, Ethiopia. ¹⁵¹Laboratoire de Gestion et Valorisation des Ressources Naturelles et Assurance Qualité, Faculté SNVST, Université de Bouira, 10000, Bouira, Algeria. ¹⁵²Laboratório de Ecologia e Biogeografia de Mamíferos, Universidade Estadual de Goiás, Quirinópolis, Brazil. ¹⁵³College of African Wildlife Management, Moshi, Tanzania. ¹⁵⁴Iran's Birds and Power Lines Committee, Arak, Iran. ¹⁵⁵Secretaria Regional do Ambiente e Alterações Climáticas on Faial Island, Porto, Portugal. ¹⁵⁶Oeko-log field research, Parlow, Germany. ¹⁵⁷University of Inland Norway, Koppang, Norway. ¹⁵⁸Retscheider Hof e.V. Wildtierstation & Wildtierforschung, Bad Honnef, Germany. ¹⁵⁹Centro Nacional de Pesquisa e Conservação de Mamíferos Carnívoros (CENAP), Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Atibaia, São Paulo, Brazil. ¹⁶⁰Section of Science, Nord University, Levanger, Norway. ¹⁶¹Concordia University Montréal, Department of Geography, Planning and Environment, Montréal, Canada. ¹⁶²Loyola Sustainability Research Centre, Concordia University Montréal, Québec, Canada. ¹⁶³University of Gdańsk, Faculty of Biology, Dept. of Vertebrate Ecology and Zoology Gdańsk, Gdańsk, Poland. ¹⁶⁴Faculty of Science, Department of Physical Geography and Geoecology, Charles University, Praha, Czechia. ¹⁶⁵Department of Spatial Ecology, Landscape Research Institute, Průhonice, Czechia. ¹⁶⁶Laboratorio de Secuenciamiento de Ácidos Nucleicos, Instituto Nacional de Biodiversidad, Quito, Ecuador. ¹⁶⁷Biology Centre of the Czech Academy of Sciences, Institute of Parasitology, České Budějovice, Czechia. ¹⁶⁸Department of Botany, University of Delhi, Delhi, India. ¹⁶⁹Department of Environmental Sciences, Hemvati Nandan Bahuguna Garhwal University, Srinagar, Uttarakhand, India. ¹⁷⁰Ministry of Environment, Forest & Climate change, Government of India, New Delhi, India. ¹⁷¹UMR 7204 CESCO MNHN CNRS, Paris, France. ¹⁷²Department of Zoology, Poznan University of Life Sciences, Poznan, Poland. ¹⁷³Department of Forest Environment and Systems, College of Science and Technology, Kookmin University, Seoul, Korea. ¹⁷⁴Wildland Division, Wildlife Trust of India, Uttar Pradesh, India. ¹⁷⁵Nature Exploration and Education Team, Moratuwa, Sri Lanka. ¹⁷⁶The Madura College, Madurai, Tamil Nadu, India. ¹⁷⁷Ethiopian Biodiversity Institute, Addis Ababa, Ethiopia. ¹⁷⁸Marine Institute, Rinville, Oranmore, Co, Galway, Ireland. ¹⁷⁹Department of Zoology, Jagannath University, Dhaka, Bangladesh. ¹⁸⁰Programa de Pós-Graduação em Ecologia, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil. ¹⁸¹Núcleo de Ecologia de Rodovias e Ferrovias, Centro de Ecologia, Universidade Federal do Rio Grande do Sul, Brasil, Porto Alegre, Brazil. ¹⁸²Department of Evolutionary Biology and Conservation of Vertebrates, University of Wrocław, Wrocław, Poland. ¹⁸³Department of National Parks, Wildlife, and Plant Conservation of Thailand, Bangkok, Thailand. ¹⁸⁴Faculty of Forestry and Wood Sciences of the Czech University of Life Sciences Prague, Prague, Czechia. ¹⁸⁵Langbein Wildlife Associates, Greenleas, Chapel Cleeve, Somerset, UK. ¹⁸⁶Dipartimento di Scienze e Politiche Ambientali, Università degli Studi di Milano, Milano, Italy. ¹⁸⁷Department of

Forestry and Natural Environment Management, Agricultural University of Athens, Karpenisi, Greece.¹⁸⁸University of Gdańsk, Faculty of Biology, Dept. of Plant Taxonomy and Nature Conservation, Gdańsk, Poland.¹⁸⁹Research Institute of Agriculture and Life Sciences, Seoul National University, Seoul, Republic of Korea.¹⁹⁰Instituto Federal de Educação, Ciência e Tecnologia Farroupilha, campus Panambi, Brazil.¹⁹¹DAER RS - Departamento Autônomo de Estradas de Rodagem, Pelotas, Brazil.¹⁹²Faculty of Pure and Applied Sciences, Open University of Cyprus, Nicosia, Cyprus.¹⁹³BirdLife Cyprus, Nicosia, Cyprus.¹⁹⁴Biology Department, Laurentian University, Sudbury, ON, Canada.¹⁹⁵National Wildlife Research Centre, Environment and Climate Change Canada, Ottawa, Canada.¹⁹⁶Hainan Tropical Ocean University, Hainan, China.¹⁹⁷VL Sustainability Metrics Ltd, Nicosia, Cyprus.¹⁹⁸School of Natural Sciences, Laurentian University, Sudbury, Canada.¹⁹⁹Deputy Director in Forests, Wetlands and Nature Reserves of Yuhang District, Hangzhou City, Zhejiang Province, China.²⁰⁰Dept Biologia Evolutiva, Ecologia i Ciències Ambientals. Universitat de Barcelona, Barcelona, Spain.²⁰¹Dwarf Tortoise Conservation, IJsselstein, Netherlands.²⁰²Laboratório de Ecologia e Conservação da Universidade Federal do Oeste do Pará, Santarém, Brazil.²⁰³Programa de Pós-Graduação em Recursos Naturais da Amazônia (PGRNA) da Universidade Federal do Oeste do Pará, Santarém, Brazil.²⁰⁴Crocodile Lake National Wildlife Refuge, Key Largo, FL, USA.²⁰⁵Government of the State of Minas Gerais, E. E. Profa. Celina de Rezende Vilela, Cordislândia, Brazil.²⁰⁶São Gonçalo do Sapucaí City Hall, E. M. Bento Gonçalves Filho and Maria Olimpia Borges, Minas Gerais, Brazil.²⁰⁷Universidade Federal do Acre, Laboratório de Herpetologia, Campus Floresta, Cruzeiro do Sul Acre, Brazil.²⁰⁸Vincent Wildlife Trust, Ledbury, Herefordshire, UK.²⁰⁹Instituto Pró-Carnívoros, Atibaia, São Paulo, Brazil.²¹⁰Laboratório de Ecologia e Conservação (LAEC), Departamento de Biologia, Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto (FFCLRP), Universidade de São Paulo, São Paulo, Ribeirão Preto, Brazil.²¹¹Governement College Suthaliya, Rajgarh, Madhya Pradesh, India.²¹²PerSonaLife, Bhopal, India.²¹³Companhia de Concessão Rodoviária Juiz de Fora-Rio de Janeiro (CONCER), Duque de Caxias, Brazil.²¹⁴Institute for Biological Research “Siniša Stanković” - National Institute of Republic of Serbia, University of Belgrade, Belgrade, Serbia.²¹⁵Conservation Alpha, Cape Town, South Africa.²¹⁶Department of Conservation Management, Faculty of Science, Nelson Mandela University, George, South Africa.²¹⁷Instituto Multidisciplinario sobre Ecosistemas y Desarrollo Sustentable, Universidad Nacional del Centro de la Provincia de Buenos Aires, CONICET, Buenos Aires, Argentina.²¹⁸Centro para el Estudio y Conservación de las Aves Rapaces en Argentina, Universidad Nacional de La Pampa, La Pampa, Argentina.²¹⁹Universidade Federal de São Carlos, Araras, Brazil.²²⁰Norwegian Institute for Nature Research (NINA), Trondheim, Norway.²²¹Department of Ecoscience, Aarhus University, C.F. Møllers Allé 8, 8000, Aarhus, Denmark.²²²Department of Forestry and Wildlife Management, University of Inland Norway, Koppang, Norway.²²³Faculty of Humanities and Social Sciences, Oxford Brookes University, Oxford, UK.²²⁴Bulindi Chimpanzee and Community Project, Hoima, Uganda.²²⁵Depto. Biologia Animal, Universidade Federal de Viçosa, Viçosa, Brazil.²²⁶Depto. Engenharia Florestal, Universidade Federal de Viçosa, Viçosa, Brazil.²²⁷University of Turin, Department of Veterinary Sciences, Grugliasco (Torino), Turin, Italy.²²⁸Feline Research Group, Mamiraua Institute for Sustainable Development, Amazonas, Brazil.²²⁹Department of Ecology and Conservation, Federal University of Mato Grosso do Sul, Campo Grande, Brazil.²³⁰Ethiopian Biodiversity Institute, Mekelle Biodiversity Center, Animals Biodiversity Case Team, Mekelle, Ethiopia.²³¹Wildlife Ecology, Massey University, Palmerston North, New Zealand.²³²Universidade do Estado de Mato Grosso (UNEMAT), Programa de Pós-graduação em Ecologia e Conservação. Campus de Nova Xavantina, Mato Grosso, Brazil.²³³Universidade Estadual de Santa Cruz (UESC), Programa de Pós-Graduação em Ecologia E Conservação da Biodiversidade, Ilhéus, Bahia, Brazil.²³⁴Forestry and Forest Products Research Institute, Tsukuba, Japan.²³⁵Department of Environmental Science and Engineering, Faculty of Natural Resources, University of Jiroft, Jiroft, Iran.²³⁶Centre de Recerca i Educació Ambiental de Calafell (CREAC), Calafell, Spain.²³⁷Center for International Environment & Resource Policy (CIERP), the Fletcher School, Tufts University, Medford, MA, USA.²³⁸University of Granada, Granada, Spain.²³⁹Zetta UFPA Agency for Innovation in Geotechnologies and Intelligent Systems in Agribusiness - Zetta UFPA, Federal University of Lavras (UFLA), Lavras, Brazil.²⁴⁰Czech Academy of Sciences, Institute of Vertebrate Biology, Brno, Czechia.²⁴¹Masaryk University, Faculty of Science, Department of Botany and Zoology, Brno, Czechia.²⁴²Faculty of Biology, Institute of Ecology, Department of Animal Ecology and Evolution, University of Warsaw, Warszawa, Poland.²⁴³Association for Nature Wolf, Twardorzeczka, Poland.²⁴⁴Universiti Teknologi MARA (UiTM) Kuala Pilah, Kuala Pilah, Malaysia.²⁴⁵Grupo de trabajo para Salvar las Lagunas de Ambroz y su entorno, Madrid, Spain.²⁴⁶Department of Animal Ecology and Zoogeography, Faculty of Biology, Institute of Zoology, University of Belgrade, Belgrade, Serbia.²⁴⁷School of Biodiversity, One Health and Veterinary Medicine, University of Glasgow, Glasgow, UK.²⁴⁸Administration of Třeboňsko Protected Landscape Area and Biospheric Reservation, Třeboň, Czechia.²⁴⁹School of Agriculture & Food Science, University College Dublin, Dublin, Ireland.²⁵⁰Instituto Federal Goiano, Laboratório de Ecologia, Evolução e Sistemática de Vertebrados, Rio Verde, Brazil.²⁵¹University of León, León, Spain.²⁵²Çankırı Karatekin University, Çankırı, Türkiye.²⁵³Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA.²⁵⁴University of New England, Biddeford, USA.²⁵⁵Universidade Estadual do Paraná (UNESPAR), União da Vitória, Paraná, Brazil.²⁵⁶Universidade Federal do Paraná (UFPR), Toledo, Paraná, Brazil.²⁵⁷Fundación de Historia Natural Félix de Azara, Buenos Aires, Argentina.²⁵⁸Bavarian State Institute of Forestry (LWF), Freising, Germany.²⁵⁹Environment and Climate Change Canada (ECCC), LAN-SCI Landscape Science and Technology, Landscape Ecology Research Section, Ottawa, Canada.²⁶⁰Projectree Engenharia Ltda, Curitiba, Brazil.²⁶¹Postgraduation in Biodiversity Conservation, Pontifical Catholic University of Paraná (PUC), Paraná, Brazil.²⁶²Bandipur Tiger Reserve, BandipurChamarajanagar District, Karnataka, India.²⁶³Borderless Wildlife Conservation Society, Tehran, Iran.²⁶⁴Via Udine 9 -, 33028, Tolmezzo, Italy.²⁶⁵Lake Simcoe Region Conservation Authority, Newmarket, Canada.²⁶⁶Centre for African Ecology, School of Animal, Plant, and Environmental Sciences, University of the Witwatersrand, Johannesburg, South Africa.²⁶⁷Universidade Federal do Oeste do Pará, Programa de Pós-Graduação em Recursos Naturais da Amazônia, Rua Vera Paz, SantarémPará, Brazil.²⁶⁸Red de Biología Evolutiva, Instituto de Ecología, A. C. (INECOL), Xalapa, Mexico.²⁶⁹Instituto Nacional de Pesquisas da Amazônia, Coordenação de Biodiversidade, Manaus, Brazil.²⁷⁰Department of Biology, Norwegian University of Science and Technology, Trondheim, Norway.²⁷¹General Directorate for National Roads and Motorways, Division Gdańsk,

Gdańsk, Poland. ²⁷²Instituto Internacional en Conservación y Manejo de Vida Silvestre (ICOMVIS), Universidad Nacional, Heredia, Costa Rica. ²⁷³Programa de Pós-Graduação em Ecologia, Department of Ecology, Institute of Biosciences, Federal University of Rio Grande do Sul, Porto Alegre Rio Grande do Sul, Brazil. ²⁷⁴Instituto Nacional de Biodiversidad (INABIO), Quito, Ecuador. ²⁷⁵Forestry and Game Management Research Institute, Jíloviště, Czechia. ²⁷⁶Project Consulting Juan León Mallorquín N° 1317 casi Yhaka, Lambaré, Paraguay. ²⁷⁷Department of Fish and Wildlife Sciences, College of Natural Resources, University of Idaho, Moscow, USA. ²⁷⁸Universidade Estadual de Goiás, Curso de Graduação em Licenciatura em Ciências Biológicas, UnU Iporá, Goiás, Brazil. ²⁷⁹USDA Forest Service, Southern Research Station, Nacogdoches, USA. ²⁸⁰San Diego State University, San Diego, USA. ²⁸¹U.S. Fish & Wildlife Service, Los Fresnos, USA. ²⁸²Canadian Wildlife Federation, 350 Michael Cowpland Dr, Ottawa, Ontario, Canada. ²⁸³Jade Consult, Thapathali, Kathmandu, Nepal. ²⁸⁴Global Institute for Interdisciplinary Studies (GIIS), Lalitpur, Nepal. ²⁸⁵School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, UK. ²⁸⁶Laboratório de Biodiversidade, Conservação e Ecologia de Animais Silvestres (LABCEAS), Programa de Pós-graduação em Zoologia, Department of Zoology, Federal University of Paraná, Curitiba, Paraná, Brazil. ²⁸⁷Secretaria do Meio Ambiente e Infraestrutura do Estado do Rio Grande do Sul, Porto Alegre, Brazil. ²⁸⁸Department of Conservation Biology, University of Göttingen, Göttingen, Germany. ²⁸⁹Geography Department, Humboldt-Universität zu Berlin, Berlin, Germany. ²⁹⁰Durrell Institute of Conservation and Ecology (DICE), University of Kent, Canterbury, UK. ²⁹¹Departament of Wildlife Conservation, Municipal Zoo of South American Fauna, Santa Cruz de la Sierra, Bolivia. ²⁹²Oceanographic Research and Marine Environment Protection Society Oceanic-Club, Constanța, Romania. ²⁹³School of Agricultural, Environmental and Veterinary Sciences, Charles Sturt University, Wagga, Australia. ²⁹⁴U.S. Fish and Wildlife Service, Alamo, USA. ²⁹⁵Conservation Biology Institute, Front Royal, USA. ²⁹⁶Department of Biological Sciences, Bridgewater State University, Bridgewater, MA, 02325, USA. ²⁹⁷SARCHI Chair on Biodiversity Value and Change in the Vhembe Biosphere Reserve, Faculty of Science, Engineering and Agriculture, University of Venda, Venda, South Africa. ²⁹⁸Conservation & Animal Welfare Trust, Uruma, Okinawa, Japan. ²⁹⁹Department of Conservation, Faculty of Forestry, Kasetsart University, Bangkok, Thailand. ³⁰⁰Institute of Biosciences, Vilnius University, Vilnius, Lithuania. ³⁰¹Institute of Life Sciences and Technology, Daugavpils University, Daugavpils, Latvia. ³⁰²Forest Resource Management Office No.2, Royal Forest Department, Wiang Sub-district, Muang District, Chiang Rai, Thailand. ³⁰³Gujarat Institute of Desert Ecology, Bhuj, India. ³⁰⁴MED – Mediterranean Institute for Agriculture, Environment, and Development & CHANGE – Global Change and Sustainability Institute, Institute for Advanced Studies and Research & Unidade de Biologia da Conservação, Departamento de Biologia, Universidade de Évora, Évora, Portugal. ³⁰⁵Dian Fossey Gorilla Fund, Kinigi, Rwanda. ³⁰⁶The Maharaja Sayajirao University of Baroda, Baroda, India. ³⁰⁷Universidad de Vigo, ECOEVO Lab, EE Forestal, Pontevedra, Spain. ³⁰⁸Department of Animal and Plant Biology, State University of Londrina, Paraná, Brazil. ³⁰⁹Department of Soil, Plant and Food Sciences, University of Bari Aldo Moro, Bari, Italy. ³¹⁰Department of Zoology, University of Venda, Thohoyandou, South Africa. ³¹¹Department of Anthropology, Durham University, Durham, UK. ³¹²Institute for Globally Distributed Open Research and Education (IGDORE), Hoedspruit, South Africa. ³¹³Research Center for Endangered Species, National Institute of Ecology, Yeongyang-gun, Korea. ³¹⁴Nashville Zoo, Nashville, USA. ³¹⁵University of Bucharest, Faculty of Biology, Bucharest, Romania. ³¹⁶Núcleo de Ecologia de Rodovias e Ferrovias, Centro de Ecologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. ³¹⁷Universidade Veiga de Almeida, Rio de Janeiro, Brazil. ³¹⁸Cerema Dter Sud-Ouest, Saint Médard en Jalles, France.