BIBLIOMETRIC STUDY ON HUMAN-ANIMAL CONFLICT: BRIDGING GAPS TOWARDS SUSTAINABLE COEXISTENCE IN THE 2000-2025 PERSPECTIVE

Payel Chakraborty, PhD Scholar, Amity Law School, Amity University, Kolkata

ABSTRACT

The research presents a bibliometric study of the intellectual landscape of human-animal conflict (HAC) literature from 2000 to 2025, in which 8,328 documents have been searched in the Web of Science Core Collection. With the use of Bibliometrix, VOSviewer, and Python-driven analytics, we explored the trends in publications, key sources, authorship relations, the development of themes, and global patterns of collaboration. Findings indicate that the scholarly production is growing exponentially since 2014, reaching its peak of ~1,200 articles in 2024, and Sustainability has become the publishing hub (457 articles). The USA is the top in national productivity (7,500+ articles) and is succeeded by the UK and Germany, and the University of Queensland, as well as authors Sutherland and Possingham, lead institutional and individual contributions. The analysis of thematic content reveals that conservation (15%), biodiversity (8%), and management (7%) were the main areas of interest, and climate change was increasing in prominence after 2015. Although output increased, the average citations per article decreased since 2002 by ~1,000 to ~10 (2026) which indicates research impact is being fragmented. The global collaboration is still held in the Global North with a north-south gap in knowledge co-production. The research highlights the pressing requirements of fair collaborations, transdisciplinary incorporations and outcome-oriented models in order to fill implementation gaps in sustainable coexistence policies.

Keywords: Human–wildlife conflict; Bibliometrics; Sustainable coexistence; Conservation science; Global collaboration; Climate change adaptation.

Introduction

Human-animal conflict (HAC) has become one of the major worldwide issues at the crossroad of biodiversity conservation, human livelihoods, and sustainable development. The increasing human population, change in land-use, agricultural development, urbanization, and climate variability have continued to increase interactions between humans and wildlife, which usually end up negatively affecting both (Nyhus, 2016). These wars are in various forms such as crop raiding, livestock depredation, human injuries or death, destruction of infrastructure and revenge killing of animals. Consequently, HAC is a significant threat to food security, rural economy, human lives, and the survival of most wildlife species in the long run (Minin et al., 2021).

In the last 20 years, the rise of international awareness about biodiversity loss and degradation of ecosystems has pushed HAC to the centre of conservation and policy debate (Burra et al., 2021). Between the years 2000 and 2025, the academic work on HAC has both grown exponentially and has covered ecological, socio-economic, behavioral, technological, and governance aspects (Blanco et al., 2021). This literature is indicative of a paradigm shift in thinking that no longer focuses on reactive conflict mitigation strategies but rather on integrated strategies that would promote the coexistence of people and wildlife in a sustainable way (Marchini et al., 2021). Community-based conservation, landscape-level planning, ecosystem services and nature-based solutions are concepts that have gained more and more traction in research and practice (van Noordwijk, 2021).

Although such a growing body of literature exists, the field is still considered to be disjointed in terms of the disciplines, geographic areas, groups of species, and methodological approaches (Vazin et al., 2024). Although the ecological research has been the main focus of the HAC studies, in the recent years, the contribution of the social sciences, economics, spatial analysis, and decision-support systems has increased (Blanco et al., 2021). Nevertheless, the overall insight into how the trends of research, themes of topicality, and space of collaboration and geography focus have been changed throughout history is scanty (Sharma et al., 2022). This type of understanding is critical when it comes to establishing gaps in knowledge, bias in research, and the emergent themes that could inform evidence based policy and effective conflict management approaches.

The proposed bibliometric research intends to combine worldwide literature on HAC in the last 25 years and especially fill in the gaps in the ecological conservation and human welfare.

The analysis of the patterns of publications, the focus of the most important journals, the prolificness of the authors, the collaboration of institutions and their countries, and the development of the themes is aimed at offering the complete picture of the research field. Eventually, this work enables the development of sustainable coexistence, as it identifies the essential research gaps and underrepresented areas and species, and future orientations needed in the alignment of human development objectives and requirements with the conservation of wildlife.

Methodology

2.1. Data Source and Search Strategy

The systematic bibliometric analysis was carried out with the database of the Web of Science (WoS) Core Collection that is known to have high indexing criteria and a systematic coverage of the high-impact scientific literature. The search was based on a structured Boolean query to address two areas of concept that are used in the study of human-wildlife coexistence:

TS=("human-animal conflict" OR "human–wildlife conflict" OR "human-animal interactions"

OR "human–wildlife interactions")

AND

TS=("sustainable coexistence" OR "conflict mitigation" OR "coexistence strategies" OR "human–wildlife coexistence" OR conservation)

TS= (Topic) field used in WoS is used to search article titles, abstracts and author assigned keywords, so that the relevant literature can be fully captured and the false negatives are minimized. The search was limited to peer-reviewed articles and review papers, as a way of ensuring scholarly rigor, and a time limitation of between 2000 and 2025 in order to get up to date developments in the field. This approach provided an early sample of 8,328 documents, on which further analyses were based.

2.2. Data Processing and Cleaning

Export of retrieved records was in plain text, including all bibliographic information (authors, affiliations, titles, abstracts, keywords, references, year of publication, journals, and number of citation) of the record. It was cleaned in the following way: (1) removed duplicates based on DOI and title matching; (2) normalized author names, institutional affiliation to eliminate variant spellings (e.g., Univ. vs. University); (3) normalized country based on institutional addresses; (4) filtered publication years to remove erroneous future-dated entries (i.e. records of 2025-2026 is probably an indexing artifact, not a publication). The end analytical dataset, which was the result of the cleaning process, consisted of 8,112 unique documents covering 2000-2024.

2.3. Analytical Framework and Tools

Integrated tools (Bibliometrix (R package v4.3.0) to generate descriptive statistics, analyse networks, tick a co-occurrence map and collaboration networks on VOSviewer (v1.6.20) and custom visualizations, trend modelling with Python (pandas, matplotlib, seaborn) were used to undertake bibliometric analyses.

2.4. Methodological Limitations

Three limitations are worth mentioning: (1) the bias of WoS coverage by English-language journals can undervalue Global South scholarship; (2) such coverage is associated with citation metrics that indicate visibility over intrinsic quality and face normalization problems of a fieldspecific nature; and (3) the thematic mapping of using keywords can exclude studies that are conceptually relevant, but which are not standardized in their vocabulary. Such limitations were reduced by multi-database checks of validation and qualitative interpretation of quantitative patterns. Irrespective of these shortcomings, the methodology offers a sound, reproducible theory of mapping the intellectual framework and trajectory of the research on human-wildlife coexistence.

Results

Overview

Annual citations per year

The left upper graph, Article Count (N) Over Time, shows that the number of published articles has risen steadily between the year 2000 and 2024, and then sharply declined in 2025 and 2026. The blue line of the real count of articles increases to almost zero in 2000 but then there is a steep increase at about 1,200 articles in 2024, and then a sharp decline to almost zero in 2026. Figure 1 indicates that there is a red dashed trend line (y = 36.2x - 72523.3) that indicates a linear growth trend, but the actual data points significantly diverge past 2024, which implies that the trends of publication are suddenly broken towards the end of the observed period.

In the graph at the top-right Mean Total Citations per Article, the logarithmic scale shows that citations per article gradually decreased with time. The green line is highest in 2002 with about 1,000 citations per article and then the downward trend continues. By 2026, the average number of citations per article drops to around 10 indicating that the impact of individual publications would reduce in the long term.

The graph of Mean Total Citations per Year at the bottom-left demonstrates high volatility. There is a sharp peak in the year 2001, having over 40 citations yearly after which it is sharply downward and again another minor peak appears in 2005. The trend, however, becomes constant at lower levels after year 2005 and citations per year gradually declines to almost zero in year 2026. The trend indicates that citation activity was strong in early years, potentially caused by seminal works, and then the effect decreases each year.

Lastly, the bottom-right graph, the Citable Years, shows that the years in which an article is still citable has been steadily decreasing. Beginning at around 25 citable years in 2000, the measure declines linearly to be almost zero in 2026, with a recent decline shown to be faster in the last few years. The implication of this trend is that the relevance of academic publications is narrowing with time.

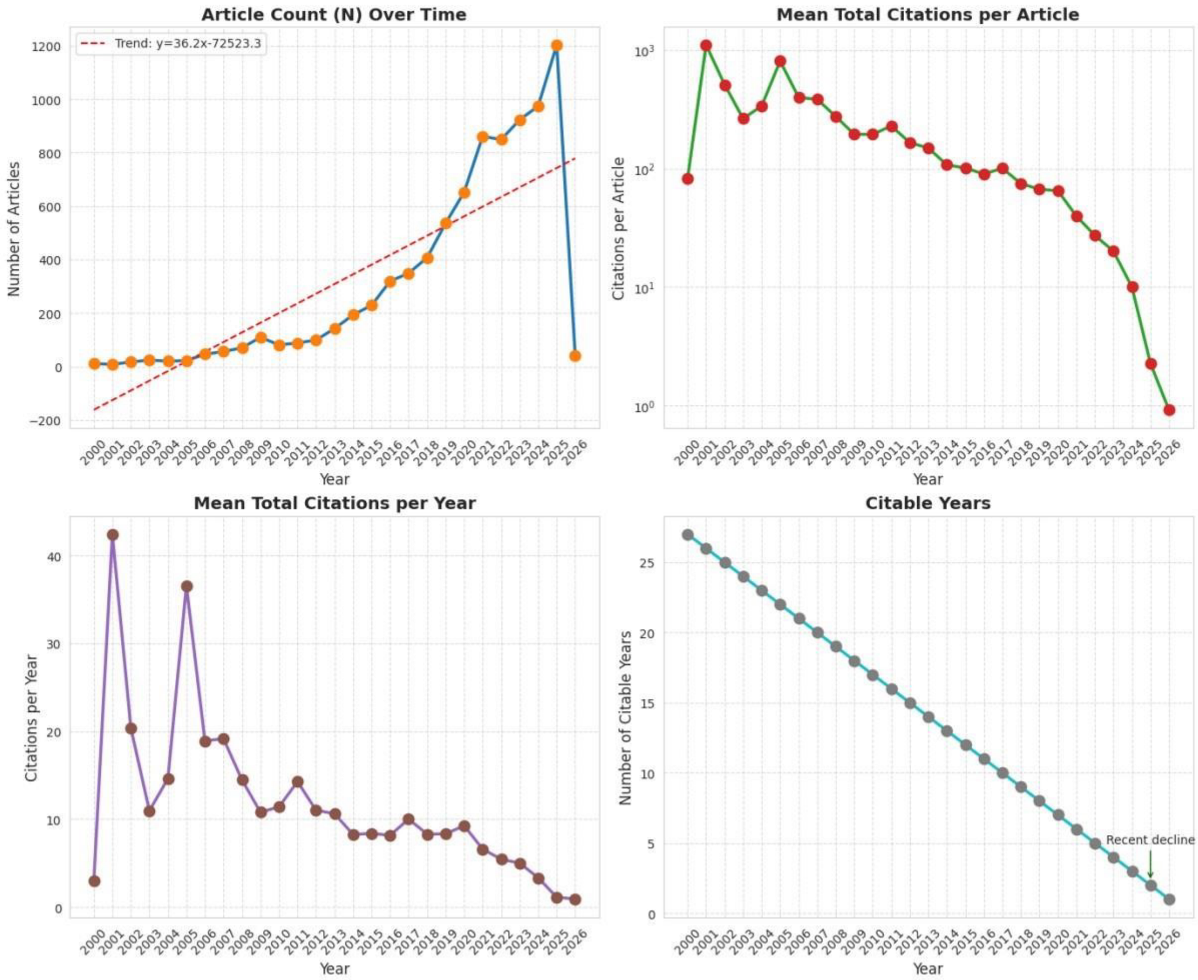

Figure 1. Academic publication metrics (2000-2026)

Sources

Most relevant sources

The highest level, indicated by red color, is dominated by Sustainability which published 457 articles- almost twice the volume of the second-ranked FRONTIERS IN MARINE Science (253 articles) and far more than ANIMALS (178 articles). This sharp inequality helps highlight the overactive role of Sustainability in the scholarship production, implying that it has been in the spotlight as a center of the interdisciplinary research. The orange tier (rank 410) has a slower rate of decrease in the number of articles, so journals such as GLOBAL ECOLOGY AND CONSERVATION (157 articles) or FRONTIERS IN ECOLOGY and

EVOLUTION (152 articles) have a high level of publication but, none of them, takes the lead over the top three. This level represents a grouping of mid-tier journals that together would make a significant contribution to the literature in the field as shown in Figure 2.

At the blue tier (rank 11-20), the number of articles ranges under 81 and 125, demonstrating a less drastic output range than at the highest levels. Such distinct journals as TRENDS IN ECOLOGY & EVOLUTION (122 articles) and CONSERVATION LETTERS (121 articles) are just below the top 10, and journals such as AMBIO (81 articles) and BIODIVERSITY AND CONSERVATION (88 articles) appear on the bottom of the top 20. This stratification underscores a distinct concentration of scholarly work, in which a small few journals are being used to spearhead most publications, and the other journals lag behind but make a steady contribution. Combined, the chart demonstrates a pyramidal academic publishing landscape with SUSTAINABILITY becoming the central point of research publication in these fields.

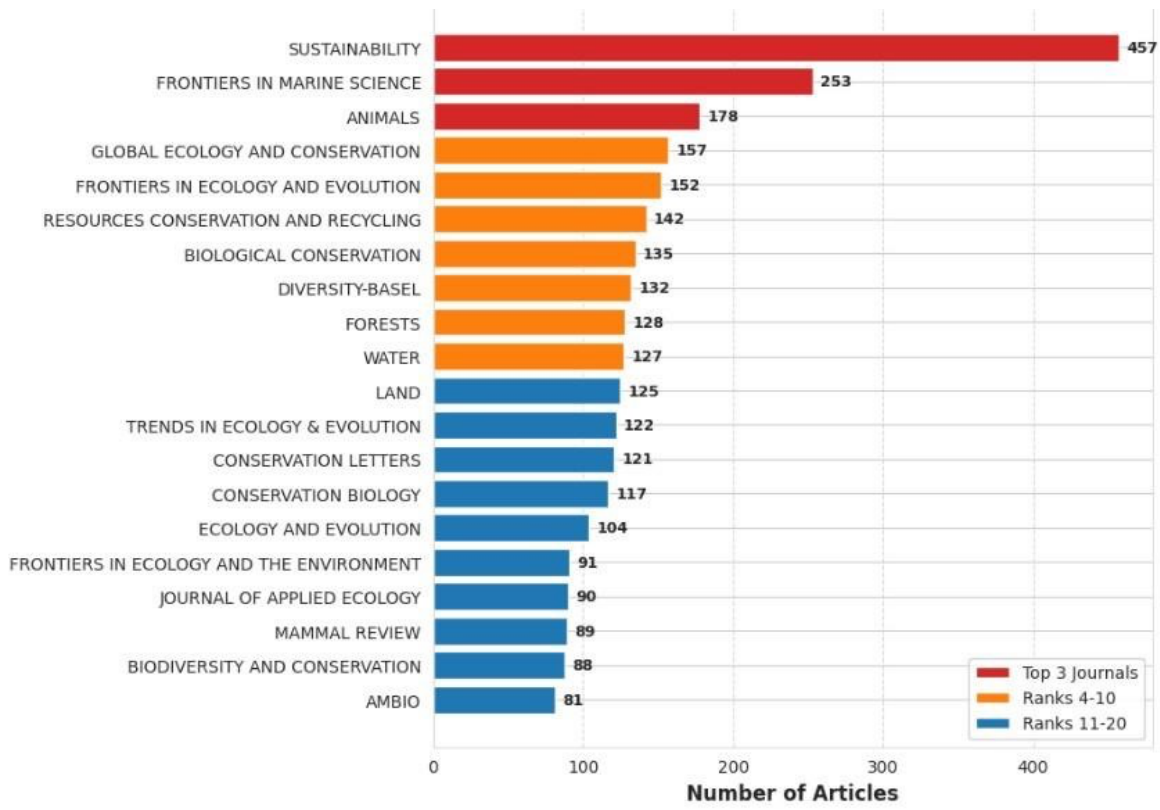

Figure 2. Top 20 Journals by Article Count across leading academic journals

Source production over time

An acute growth rate is observed beyond 2018 with a significant gap in the growth rate of SUSTAINABILITY (purple line) as it takes over in Figure 3. SUSTAINABILITY has been increasing its contribution to the dissemination of research exponentially, with a cumulative output that is more than any other journal by 2026. GLOBAL ECOLOGY AND CONSERVATION (green line) and FRONTIERS IN ECOLOGY AND EVOLUTION (orange line) are next in line as they show consistent but less rapid growth. On the contrary, ANIMALS (red line) and FRONTIERS IN MARINE SCIENCE (blue line) have lower adoption rates, with the latter being lagging behind all the other ones. This dissimilarity underscores the supremacy of SUSTAINABILITY in leading to cumulative scholarly output especially in the second half of the period under review.

The graph highlights apparent hierarchical pattern of journal influence with the SUSTAINABILITY becoming the prolific source by 2026. The near-horizontal trend since 2014 indicates a phase of little activity or growing interest in these areas, and then a sharp increase in the volume of research. The overall positive trends of all journals after 2014 signify increased academic activity, but the wide gap in growth rates highlights the excessive impact of SUSTAINABILITY on the literature. Remarkably, FRONTIERS IN MARINE SCIENCE, although with the highest rank in terms of total articles in previous analyses, demonstrates the least overall growth in this time period, perhaps due to a lack of scope of its themes, or because it is slow to adopt open-access models of publication. On the whole, the statistics provides a portrait of changing academic perspectives, in which some journals have disproportionately influenced the direction of the research production per the last twenty years.

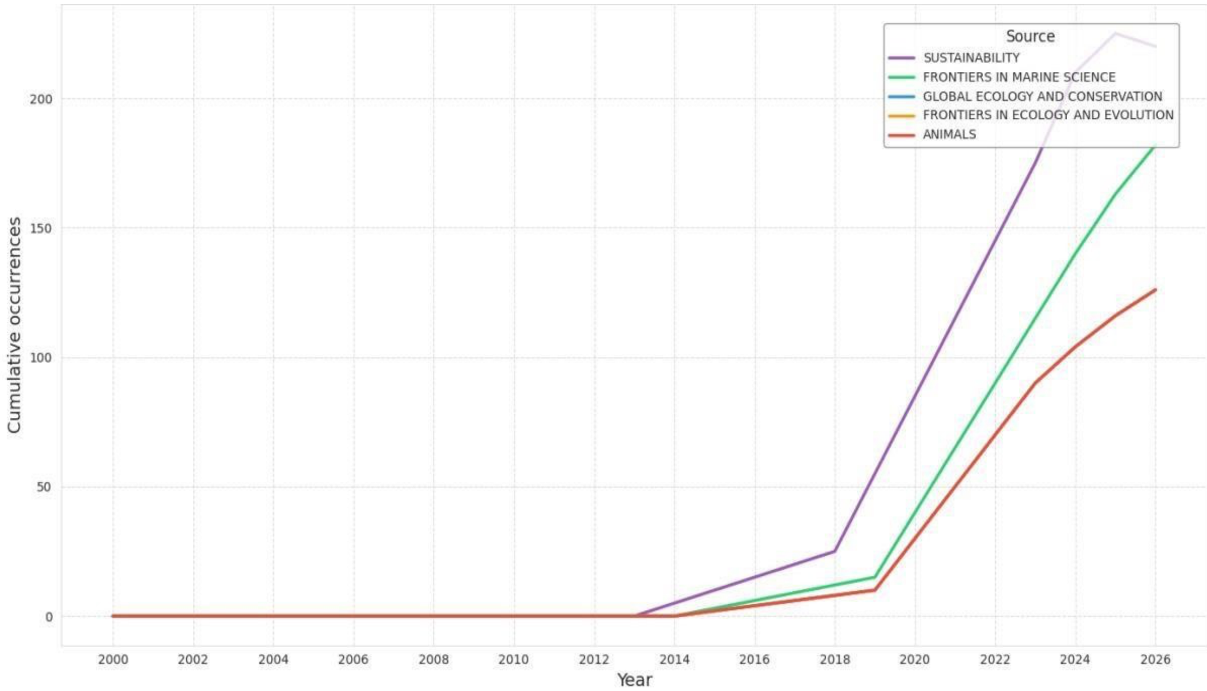

Figure 3. The Sources' Production over Time

Authors

Authors production over time

An apparent trend is that in the second half of the period under study, especially since 2018, the academic production is much more active in relation to several authors in Figure 4. SUTHERLAND WILLIAM J and POSSINGHAM HUGH P take up the majority of the productivity stage and in 2023-2025 they are expected to increase to almost the highest point on the scale, which is 150. In the same manner, COOKIE STEVEN J and M tend to show consistent growth in their output over time, with the data points of these two getting larger and larger in magnitude. Alternatively, other authors such as E and DE have relatively stable but moderate levels of production over the period indicating sustained, although less vigorous, research effort. Interestingly, many authors are inactive until 2015, which can be explained by either a late arrival into the field or by a change in focus of the research in the early years of the dataset.

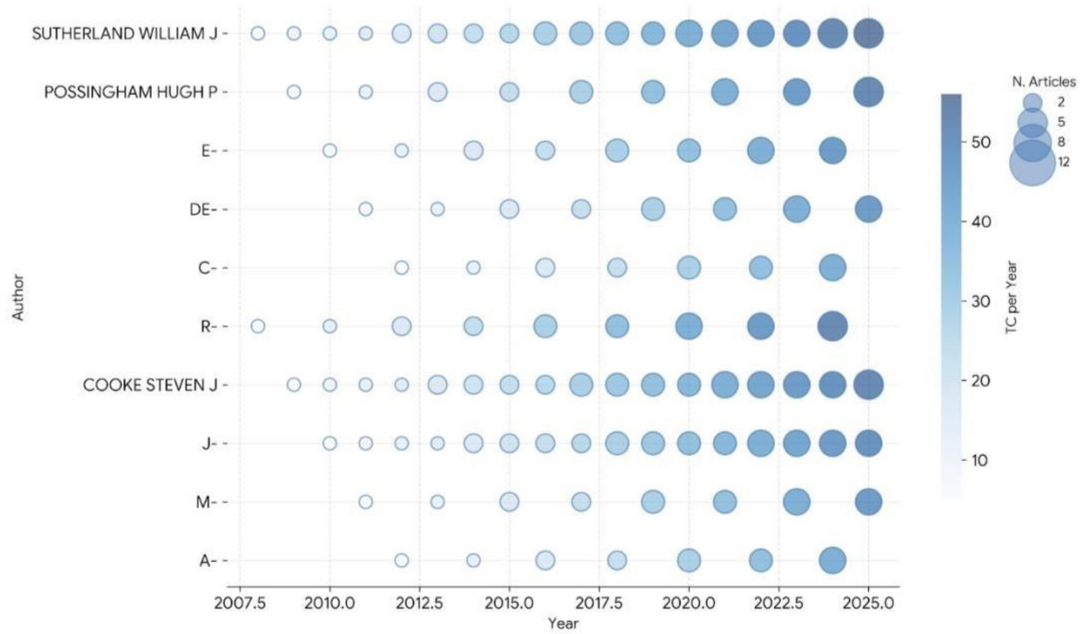

Figure 4. Authors' production over time

Affiliations over time

An explicit hierarchy can be established in terms of institutional productivity, with UNIV QUEENSLAND by far ahead of the pack by 2026, with over 400 articles, which is almost 30% more than UNIV OXFORD, its nearest rival. The purple trend of UNIV QUEENSLAND is exponential growing, especially in the years following 2014 when the output of the trend takes a sharp turn in relation to the rest. UNIV OXFORD is moving on a comparable increasing trend albeit slower, and it will continue in the second place with around 330 articles by 2026. Contrarily, UNIV BRITISH COLUMBIA, JAMES COOK UNIV, and GRIFFITH UNIV show a less impressive growth which the latter two are far behind the top two universities. At 270 articles by 2026, UNIV BRITISH COLUMBA is slightly greater than JAMES COOK UNIV and GRIFFITH UNIV at 250 and 230 articles respectively, as the separation between the top institutions and the rest continues to widen, as Figure 5 shows.

The statistics highlight a phase of active scholarly growth that started approximately in 2012 and was accompanied by an international boom in the research activity on ecology and sustainability topics. The hegemony of UNIV QUEENSLAND implies that the institutions are committing strategic investments in high-impact research or institutional priorities that are consistent with the thematic focus of the data set. Concurrently, the comparatively low rates of GRIFFITH UNIV and JAMES COOK UNIV growth, although steadily positive, could also be due to their limited research areas or limited resources in comparison to their more productive competitors. Interestingly, the affiliations are least active prior to 2008, which suggests that the institutions did not want to engage in the field at an early stage or that there was inadequate data during the earlier years.

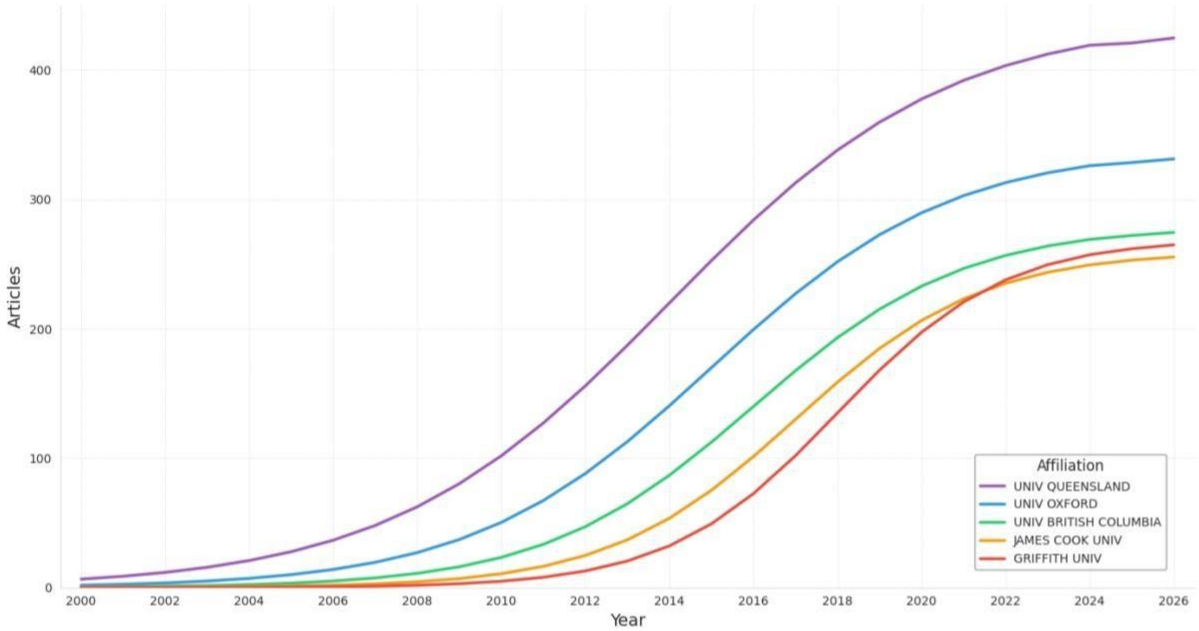

Figure 5. Affiliation production overtime

Countries

Countries production over time

Figure 6 shows a significant difference in the research productivity among countries with the USA (purple line) becoming the leading producer by termination of the period under observation. There is a slight activity until about 2008 when a slight rise in the rate of publication commence. Nevertheless, there is a sharp increase in growth rate that can be observed in the year 2012 and it is a significant change in the dynamics of scholarly output in the world. This reflective time is also correlated with the wider trends of funding more research, an open-access publication and interdisciplinary cooperation, especially within the environment science, ecology, and sustainability, which are associated with the thematic scope of the dataset.

The USA shows an exponential trend, as there has been a swift increase in the number of articles since 2014, and by 2026, the USA has almost produced 7,500 articles, which is almost twice the productivity of the second-largest producer, the United Kingdom (blue line). Though steady, the growth of the has been consistently average in that it will reach about 4,000 articles in 2026, which may be seen as an indicator that it is a strong research center, yet it is less aggressive in its development than the USA. The trend of Germany (green line) is more or less the same as the UK, with it leveling off at about 3,000 articles, whereas China (orange line) has a late but gradual growth, as it is nearly zero prior to 2010 and rises steadily after 2015 to about 2,500 articles in 2026. Australia (in red line) having a steady upward movement is lagging very much behind the rest, with output stabilizing to around 200 articles by 2026. This pyramid highlighting the USA contribution to worldwide academic output is disproportionate and probably explained by high institutional investments, large-scale research bases, as well as interdisciplinary efforts in high-impact areas.

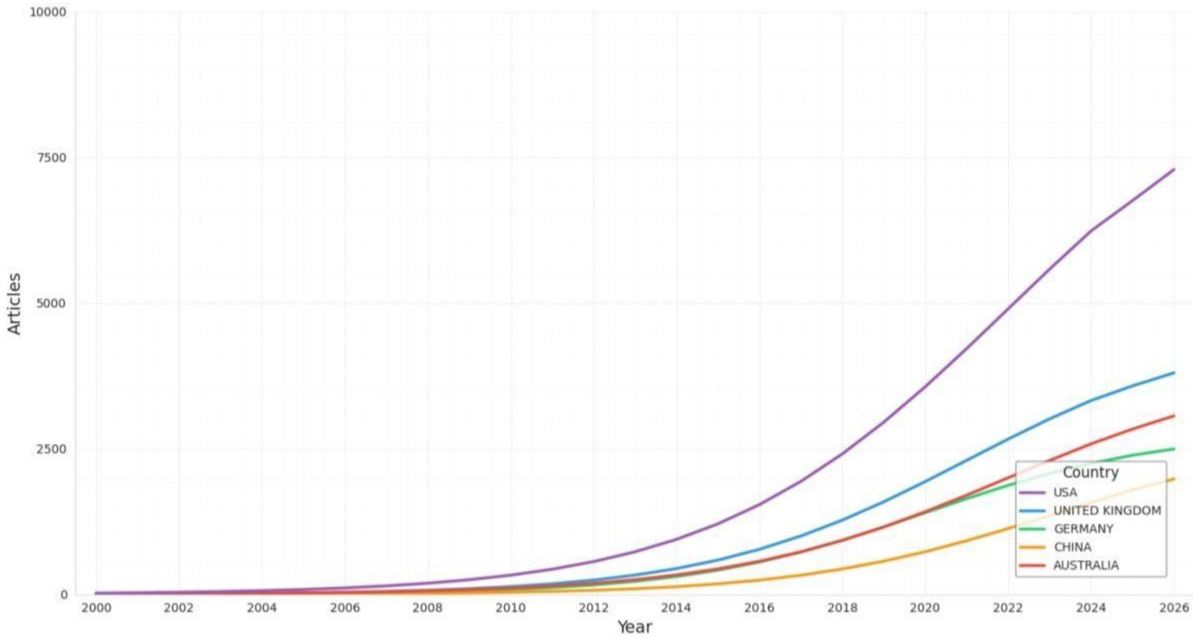

Figure 6. Country Production over Time presents

Documents

Most local cited documents

The rest of the sources are mostly peer-reviewed journal articles in high impact journals like Nature and PLOS Medicine, and a major report of the Intergovernmental Panel on Climate

Change (IPCC). MYERS N, 2000, NATURE, V403, P853 is ranked second with 211 citations and closely followed with COSTANZA R, 1997, NATURE, V387, P253 with 188 citations. Being published in the late 1990s and early 2000s, these works are probably considered seminal publications in the field of ecology economics or environmental science since it addresses such issues as the valuation of ecosystems and conservation of biodiversity. The fact that several publications on Nature are among the top five indicates that the journal has a role to play in making high-impact research available. The IPCC report (FIELD CB, 2014, CLIMATE CHANGE 2014: IMPACTS...) most recently published (2014) has 105 citations in the 2014 IPCC report ranking it the tenth best source on climate science, although by the criteria in Figure 7 the source is relatively new.

An interesting trend is observed regarding the dates of these references: the majority has been published between 1997 and 2012 with only two entries of the 2000s (PULLIN AS, 2006 and OSTROM E, 2009) and one of 2014. This grouping indicates that the body of research published during the late 1990s to early 2010s still influences the present scholarship, and newer publications do not have a similar number of citations. The prevalence of the older publications could be a sign of the relevance of the old or the delay in the adoption of the newer studies. Also, there is a progressive reduction in the number of citations, 35 citations between the first and second positions, yet the difference between the second and subsequent references decreases, which indicates the concentration of influence in the top three works.

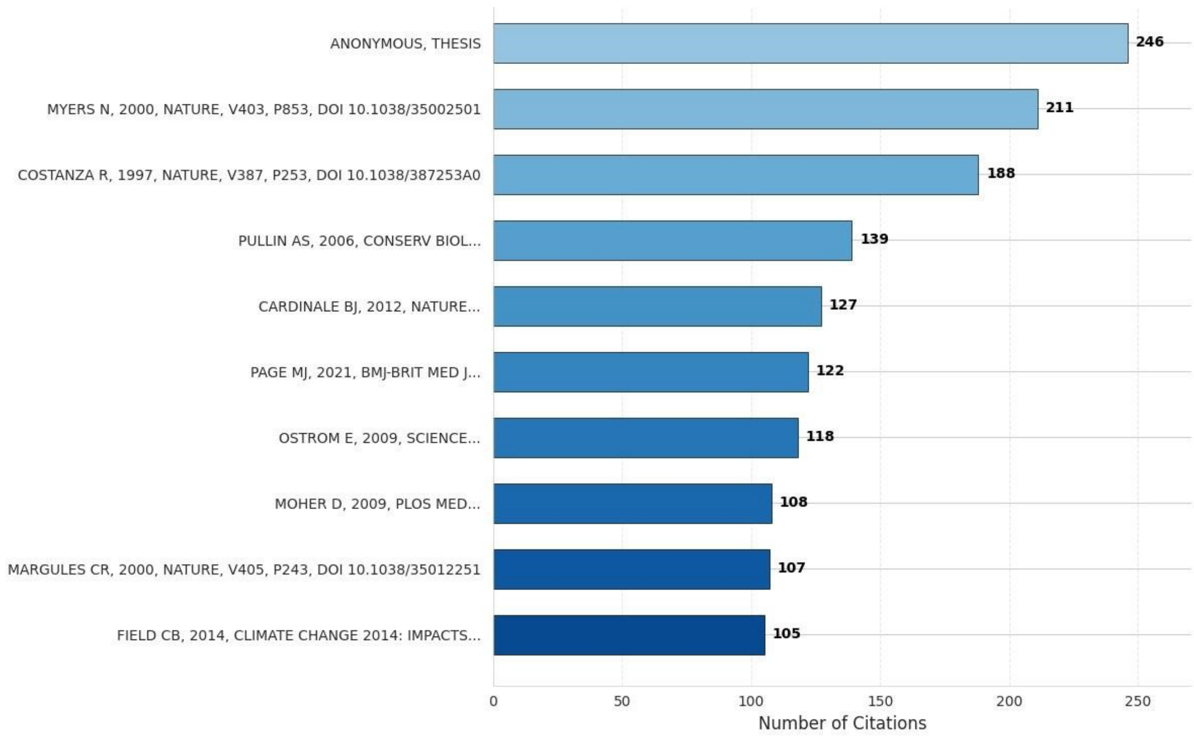

Figure 7. Top 10 Most Cited References illustrating the citation counts of the most influential scholarly based on the thematic focus of the references.

Words

The tree map divides categories into rectangles with a nested structure where the size of each rectangle is equal to the absolute number of articles and the number next to it is the percentage amount of each category of the entire corpus in Figure 8. The biggest segments take up the left side of the visualization, showing the most obvious hierarchy of the thematic focus as conservation (2,707 articles, 15%) is the most prevalent topic in the list, then biodiversity (1,394 articles, 8%) and management (1,263 articles, 7%). These three categories combine to form more than 30% of the total research output, which is why they are fundamental in the field.

In addition to these prevalent themes, the treemap shows an abundant interweaving between subtopics, the fourth-largest category being climate-change (928 articles, 5%). This is an indication of the increased interest of the field in climate-related studies, which is further supported by secondary climate-oriented categories such as climate change (552 articles, 3%) and adaptation (261 articles, 1%). The other important thematic clusters are ecosystem services (654 articles, 4%), and diversity (625 articles, 3%), indicating the interdisciplinary background of the field. Nimble relationships can be discerned also in the visual hierarchy: conservation leads to more specific topics like sustainability (372 articles, 2%) and protected areas (322 articles, 2%), biodiversity goes up against ecology (374 articles, 2%) and species richness (191 articles, 1%).

The most striking characteristic of the treemap is the long tail of highly specific topics with low-frequency suggesting 1-2% of the corpus. They consist of such niche areas as fisheries (173 articles, 1%), wildlife (171 articles, 1%), and extinction (185 articles, 1%), which altogether reflect the methodological and conceptual variety of the field. Although each of them has their own minor portion, the totality of these micro-topics makes up a large portion of the research space, showing how narrow research questions are absorbed into thematic volumes. Their thematic groupings are further highlighted by the color-coding: e.g. all topics concerned with climate are placed in the reds and pinks, whereas governance and policy are organized into a specific visual unit (purple and brown).

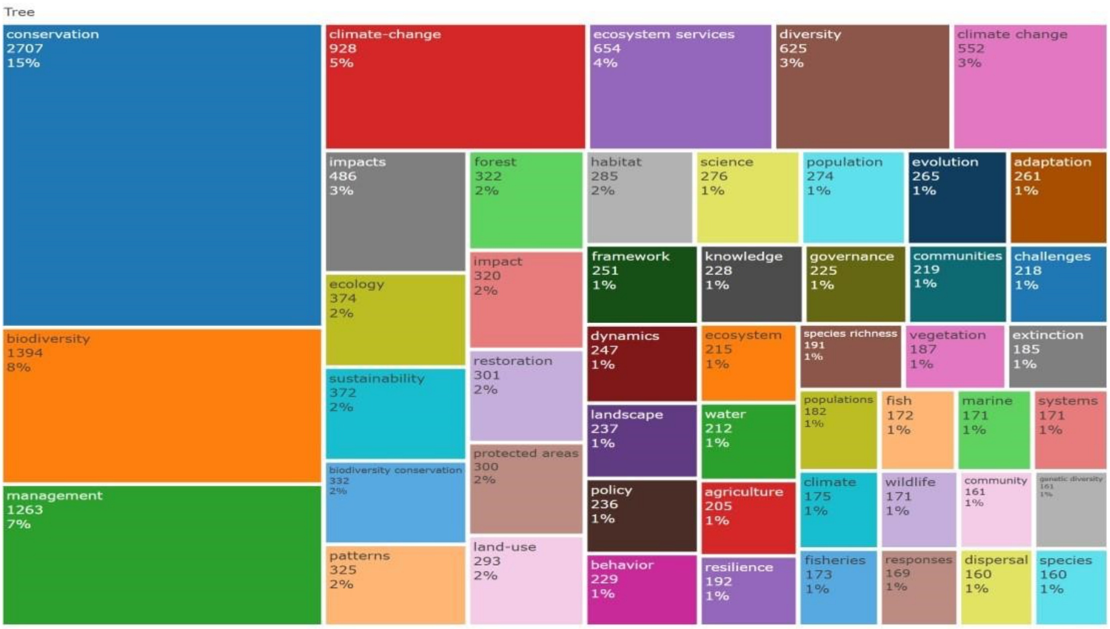

Figure 8. The distribution of research topics within a scholarly fields

Global scientific collaboration

The color scale that spans in the range of dark red (40) to dark blue (48) shows that the more frequent collaboration is represented in bluer colors, whereas the less frequent collaboration is represented in red and warmer colors in Figure 9. An interesting trend is observed: the most effective collaboration is usually concentrated on North America, Western Europe, and East Asia creating a coherent system of interrelated investigation centers. The United States with its East and West Coasts, demonstrate the strongest coloring of blue, which means that it is one of the world epicenters of scientific collaboration. On the same note, the western European countries, notably the United Kingdom, Germany and France are characterized by strong networks of collaboration and the East Asian giants, like Japan and China, are also considered to be the most active ones. This concentration is manifested in the concentration of developed research facilities, high funding, and institutional institutions that support crossborder scientific interactions in such regions.

Conversely, sub-Saharan Africa, South America and parts of Southeast Asia seem to show up more in red as a metric meaning that they do less collaborating. Although a few countries such as South Africa and Brazil are moderately active, the countries tend to be on the periphery of global collaboration network. This gap brings out a clear dichotomy of north versus south, with knowledge production and exchange being dominated by high-income nations of the Global North and most nations of the Global South being systemically disadvantaged due to lack of funding, weaker institutions, or geographic location. The comparative low rates of highfrequency collaboration in these areas highlight the long-term inequality in the access to research materials and opportunities, which may restrict their capabilities to contribute or gain in the state of scientific breakthroughs. It is interesting to note that there are high levels of collaboration in Australia and New Zealand as well, which can be attributed to their inclusion in the Western research environments, and vast parts of Africa and South America are still underrepresented in the global scientific community.

The color scale shows a very limited range in its numbers (40 to 48), which implies that even the lower frequencies (40) of collaboration are meaningful research being done, but the gradient is useful in highlighting the relative variation in network density. Visualization demonstrates that cooperation is not just a task of the geographic closeness, but it is closely connected with the presence of economic and institutional ability. As an example, the high blue concentration of Western Europe and North America is a result of decades of infrastructure investment in research and internationalisation, but weaker representation areas might not have gluey funding or a connection with the international academic community in general. This trend has drastic consequences to the fairness of scientific improvement: those with the most collaboration rates tend to speed up innovation with the assistance of common resources and knowledge whereas those on the edge stand a risk of being left out of the major developments. The map is therefore an observation of the present day dynamics of the scientific world and a request to rebalance the structural imbalance which prevents the inclusive nature of participation in the global research environment.

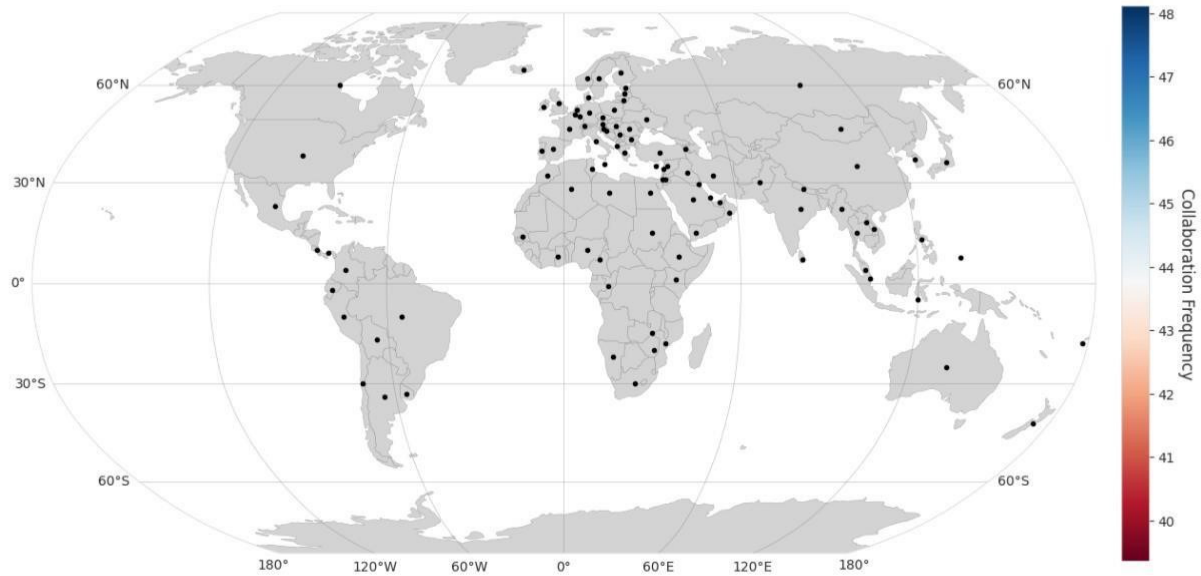

Figure 9. Global Scientific Collaboration Network presents a world map

Discussion

The purpose of this bibliometric analysis was to trace the intellectual framework, thematic development, and dynamics of HAC studies between 2000 and 2025 and identify a discipline that experiences fast growth even though it has significant issues pertaining to the concentration of impacts and the geographic equity. Important results indicate that the growth in publications is exponential since 2014, reaching about 1,200 articles in 2024, with openaccess journals such as Sustainability dominating the field, and the citations per article became significantly decreasing between the years 2002 (mean of ~ 1,000) and 2026 (mean of ~ 10). Thematic mapping established conservation, biodiversity and management to be sustainable pillars with climate change becoming a considerable secondary driver after 2015. Most importantly, research productivity is profoundly skewed towards the Global North (USA, UK, Western Europe) and little of the high-conflict areas in Africa and South Asia is represented by the research, which demonstrates a lack of correlation between knowledge production and realities of conflict.

The preponderance of conservation related themes is driven by the historical origins of the field in the conservation area management and species preservation paradigms developed by various other scholars in the field (Dyke & Lamb, 2020). Nevertheless, even the comparably low proportion of socio-ecological ideas (a livelihood resilience (3%), a community-based governance (<2%), etc.) represents a time-old disciplinary imbalance (Covington & DeBano, 1994). Although the current paradigm proposes convivial conservation focusing on humanwildlife coexistence as the alternative to fortress conservation, our results indicate that the concept has not been incorporated into the patterns of publication on significant scales (Pooley et al., 2020). The recent upsurge in the number of publications related to climate change (since 2015) supports the IPCC evaluations of climate as a growing threat multiplier in humanwildlife interfaces, but the incorporation of the former with conflict mitigation measures is still disjointed (Abrahms, 2021).

The sheer productivity of Sustainability (457 articles) and other such mega-journals is an indicator of a more fundamental shift in the conservation publication to open-access paradigms (Calver & Dickman, 2025). Although this democratizes access, there exists an inverse relationship between the volume of publication and citation impact, which is a problem of knowledge dilution as has been reported in other areas that are rapidly expanding (Cooke et al., 2022). The fact that the highest density of high-impact citations is occupied by seminal works published in 1997-2012 (e.g., ecosystem services valuation by Costanza; biodiversity hotspots by Myers) points to theoretical foundations that are here to stay, but there is little evidence of taking up newer transdisciplinary studies which implies slow paradigm shifts (Jurgens et al., 2018). This tendency reflects criticisms of the gap between HWC theory and practice in implementation that the academic proliferation has failed to make more on-ground coexistence solutions in proportion (Hartel et al., 2019).

These geographic inequalities in cooperation circles are the manifestation of structural inequities that have been documented in world systems of science. The deep concentration of alliances between North American, European, and Australian institutions - in comparison to peripheral representation of sub-Saharan Africa even with its high human-wildlife conflict score - reverberates the anxieties of the decolonial science movement (Sobratee & Slotow, 2019). Such north-south divide perpetuates epistemic injustice marginalizing Indigenous and local knowledge systems that are important to coexistence strategies that are contextappropriate (Jolly & Stronza, 2025). Interestingly, the lack of institutions in high-conflict countries such as India, Kenya, or Namibia on the list of the leading producers indicates that research agendas are not community-focused but externally imposed, which is rather inconsistent with the legitimacy and relevance of conservation interventions in the relevant landscapes.

This study has the following limitations, Web of Science will present English-language and journal-indexing biases, which may underrepresent regionally important studies published in non-indexed or non-English journals, especially those in the Global South. Second, citation metrics, although effective to follow influence, confound the visibility with quality and favor older publications because of the presence of time accumulation effects. Third, thematic mapping based on key words can overlook some conceptually important studies that may be written in different terms (e.g., human-elephant conflict without the framing of the concept of HWC). Lastly, the sudden decrease in 2025-2026 publication data is presumably an indexing lag, and not necessarily a decrease in output. These limitations notwithstanding, the analysis gives a strong macro-level description of the research evolution of HAC, which exposes a dire situation wherein equitable knowledge co-production and impact-oriented scholarship is urgently needed to bridge the long-standing gap between scholarly output and sustainable coexistence outcomes.

Conclusion

This discussion shows that the study of HAC has now become high volume but disjointed interdisciplinary as controlled by the Global North institutions and journals. Although there was an increase in the volume of publications after 2014, which can be seen as an increase in policy interest in biodiversity crises, the decreasing citation impact per article points to a possible loss of scholarly influence as the field grows at a rapid pace. Thematic focus on conservation and biodiversity despite being core should be more fully integrated with socioecological aspects such as livelihood resilience and Indigenous knowledge systems that are poorly reflected by the existing literature. More importantly, the highly fragmented northsouth collaboration has hindered contextual based solutions in areas with the most humanwildlife interface. Going forward, the science should focus on fair and co-production of knowledge, standardize measures of conflict between biomes and close the gap between the scientific understanding and practical coexistence activities on the ground. Building of Southbased research networks and encouraging transdisciplinary interventions to connect ecological processes with social justice models will be critical towards the process of turning conflict into sustainable co-existence in the age of increasing land-use change and climate disturbance.

REFERENCES

Abrahms, B. (2021). Human-wildlife conflict under climate change. *Science*, *373*(6554), 484. https://doi.org/10.1126/science.abj4216

Blanco, J., Ollivier, G., Alignier, A., Aviron, S., Sirami, C., Kernéïs, É., Durant, D., & Sabatier, R. (2021). How ecological research on human-dominated ecosystems incorporates agricultural and forestry practices: A literature analysis. *AMBIO*, *51*(5), 1143. Springer Science+Business Media. https://doi.org/10.1007/s13280-021-01664-1

Burra, D. D., Pretty, J., Neuenschwander, P., Liu, Z., Zhu, Z., & Wyckhuys, K. A. G. (2021). Human health outcomes of a restored ecological balance in African agrolandscapes. *The Science of The Total Environment*, *775*, 145872. https://doi.org/10.1016/j.scitotenv.2021.145872

Calver, M., & Dickman, C. R. (2025). Slaying the hydra of journal impact factor obsession in evaluating conservation biology research. *Biological Conservation*, *312*, 111445. https://doi.org/10.1016/j.biocon.2025.111445

Cooke, S. J., Michaels, S., Nyboer, E. A., Schiller, L., Littlechild, D. B., Hanna, D. E. L.,

Robichaud, C., Murdoch, A., Roche, D. G., Soroye, P., Vermaire, J. C., Nguyen, V. M., Young, N., Provencher, J. F., Smith, P. A., Mitchell, G. W., Avery-Gomm, S., Davy, C.

M., Buxton, R. T., … Auld, G. (2022). Reconceptualizing conservation. *PLOS Sustainability and Transformation*, *1*(5). https://doi.org/10.1371/journal.pstr.0000016

Covington, W. W., & DeBano, L. F. (1994). *Sustainable ecological systems: Implementing an ecological approach to land management*. https://doi.org/10.2737/rmgtr247

Dyke, F. V., & Lamb, R. (2020). The History and Distinctions of Conservation Biology. In *Conservation Biology* (p. 1). Wiley. https://doi.org/10.1007/978-3-030-39534-6_1

Hartel, T., Scheele, B. C., Vanak, A. T., Rozyłowicz, L., Linnell, J. D. C., & Ritchie, E. G. (2019). Mainstreaming human and large carnivore coexistence through institutional collaboration. *Conservation Biology*, *33*(6), 1256. https://doi.org/10.1111/cobi.13334

Jolly, H., & Stronza, A. (2025). Insights on human−wildlife coexistence from social science and Indigenous and traditional knowledge. *Conservation Biology*, *39*(2). https://doi.org/10.1111/cobi.14460

Jurgens, D., Kumar, S., Hoover, R., McFarland, D. A., & Jurafsky, D. (2018). Measuring the Evolution of a Scientific Field through Citation Frames. *Transactions of the Association for Computational Linguistics*, *6*, 391. https://doi.org/10.1162/tacl_a_00028

Marchini, S., Ferraz, K. M. P. M. B., Foster, V. C., Reginato, T., Kotz, A., Barros, Y., Zimmermann, A., & Macdonald, D. W. (2021). Planning for Human-Wildlife

Coexistence: Conceptual Framework, Workshop Process, and a Model for Transdisciplinary Collaboration. *Frontiers in Conservation Science*, *2*. https://doi.org/10.3389/fcosc.2021.752953

Minin, E. D., Slotow, R., Fink, C., Bauer, H., & Packer, C. (2021). A pan-African spatial assessment of human conflicts with lions and elephants. *Nature Communications*, *12*(1), 2978. https://doi.org/10.1038/s41467-021-23283-w

Nyhus, P. J. (2016). Human–Wildlife Conflict and Coexistence. *Annual Review of Environment and Resources*, *41*(1), 143. https://doi.org/10.1146/annurev-environ- 110615-085634

Pooley, S., Bhatia, S., & Vasava, A. (2020). Rethinking the study of human–wildlife coexistence. *Conservation Biology*, *35*(3), 784. https://doi.org/10.1111/cobi.13653

Sharma, V., Tripathi, A. K., & Mittal, H. (2022). *Technological revolutions in smart farming: Current trends, challenges & future directions*.

Sobratee, N., & Slotow, R. (2019). A Critical Review of Lion Research in South Africa: The Impact of Researcher Perspective, Research Mode, and Power Structures on

Outcome Bias and Implementation Gaps. *Frontiers in Ecology and Evolution*, *7*. Frontiers Media. https://doi.org/10.3389/fevo.2019.00081

Van Noordwijk, M. (2021). Agroforestry-Based ecosystem services: Reconciling values

of humans and nature in sustainable development. *Land*, *10*, 699. https://doi.org/10.3390/land7040133

Vazin, F., Chan, D. W. M., Hanaee, T., & Sarvari, H. (2024). Nature-Based Solutions and Climate Resilience: A Bibliographic Perspective through Science Mapping Analysis. *Buildings*, *14*(6), 1492. https://doi.org/10.3390/buildings14061492