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Human-wildlife interaction, conflict, and coexistence: Bibliometric analysis from Scopus (1987–2023)

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Abstract Human interactions with wildlife range from conflict (negative) to coexistence (positive or neutral). The scientific interest in this topic is increasing rapidly, although the terminology used varies among authors. This study presents a bibliometric analysis of literature on human–wildlife interaction, conflict, and coexistence (HWCICx) from 1987 to October 2023 using Scopus data analyzed with VOSviewer and the Bibliometrix package in R. An exponential rise in publications was identified between 1995 and 2022, confirming HWCICx as an emerging yet robust research field. The United States and the United Kingdom lead in publication volume and international collaboration, whereas researchers from Asia and Latin America show growing involvement. Journals specializing in ecology, conservation, and wildlife, such as *Biological Conservation*, *Oryx*, and *Human–Wildlife Interactions*, dominate the field, although newer specialized journals are gaining visibility. Predominant research topics include carnivore–livestock conflicts and species conservation. However, new areas of interest are emerging, including urban wildlife interactions and the sociocultural aspects of coexistence. This study offers an updated overview of the evolution of HWCICx research and highlights the need for integrated natural and social science approaches to develop sustainable models of coexistence.

Keywords: conservation, human wildlife coexistence, human wildlife conflict, human wildlife interaction, wildlife management

1. Introduction

In the dawn of humanity, individuals coexist with wildlife (Narayan & Rana, 2023). Through competition with various species for habitats and natural resources, *Homo sapiens* has emerged as the dominant ecological force on the planet owing to its adaptability and innovation (Waters et al., 2016). Across this extensive evolutionary process, diverse behaviors have developed, including human-wildlife interaction (HWI), a neutral term referring to any encounter between individuals and wildlife, whether positive or negative (Nyhus, 2016). When these interactions result in negative consequences, such as the loss of property, livelihoods, and even lives, it is termed human-wildlife conflict (HWC). HWC affects most large carnivores, as well as various other species, including elephants, deer, primates, sharks, raptors, crocodiles, and otters (IUCN SSC HWCTF, 2023). Conversely, when a dynamic state exists where the interests and needs of both humans and wildlife are generally satisfied, it is termed human-wildlife coexistence (HWCx) (Gross et al., 2021). The concept of coexistence is emerging as the primary focus of conservation, bringing together a variety of emerging ideas. Its flexible approach allows for interdisciplinary collaboration to strengthen it (IUCN SSC HWCTF, 2023).

Conflicts have contributed to the extinction of numerous species (Su et al., 2022; Woodroffe et al., 2005) and have had a negative impact on the alteration of ecosystem structure and functioning (Estes et al., 2011; Nyhus, 2016). Additionally, they have resulted in significant losses of human life, crops, livestock, and property (Conover, 2002; König et al., 2020; Woodroffe et al., 2005). Therefore, HWC is considered one of the most complex and urgent issues facing wildlife management and conservation (Frank et al., 2019). Its mitigation is crucial for the conservation of many species, and debates on how to coexist with other animals generate social, economic, and political controversies among and within human communities (Redpath et al., 2013).

Human activities impact all ecosystems worldwide, transforming the relationship between humans and wildlife (Su et al., 2022). Consequently, humans continue to interact with wildlife, both in conflict and in coexistence (Gross et al., 2021). Given its global relevance and concern and considering that scientific articles on human-wildlife conflict (HWC) and human-

wildlife coexistence (HWCx) have rapidly proliferated in the last 20 years (König et al., 2020; Nyhus, 2016), an increase in the number of publications on this topic is likely to be observed in the coming years. The analysis of scientific literature is essential for understanding past research and current knowledge and for predicting the future trajectory of research on interactions, conflicts, and coexistence between humans and wildlife (Su et al., 2022). In this context, bibliometrics is a quantitative method used to statistically analyze publications such as articles and books to highlight the evolutionary structure of a research topic (Baker et al., 2021; Pritchard, 1969). Bibliometric parameters have become an integral part of the modern assessment of academic productivity (Choudhri et al., 2015). Various bibliometric methods, such as descriptive analyses, author productivity measures, scientific collaboration, and research networks, are employed for this purpose (Choudhri et al., 2015). Bibliometric studies enable the determination of the quality and quantity of research in a specific field by examining the characteristics of publications (Kasemodel et al., 2016; Železnik et al., 2017).

Owing to its advantages, bibliometric analysis has been employed in various disciplines and fields, including the environmental sciences (J. Gao et al., 2022; L. Gao et al., 2022; Hou, 2021), agricultural sciences (García et al., 2021; Tian et al., 2023), medical sciences (Ekenoglu-Merdan et al., 2023; Tan et al., 2023) and social sciences (Molina-Collado et al., 2022; Polat & Seyfi, 2023). With respect to interactions, conflicts, and/or coexistence between humans and wildlife, bibliometric analyses have been conducted only on conflicts (HWC) at the global level between 1991 and 2023 (Ridwan et al., 2023), between 2003 and 2021 (Su et al., 2022), and in East Africa between 1999 and 2018 (Mnzava & Sirima, 2022). These analyses utilized the Web of Science (WoS) or Google Scholar as databases, and the related terms vary in their usage depending on the author. Additionally, there is significant debate in the natural and social sciences regarding whether to replace the term “human-wildlife conflict” with “human-wildlife interaction” or “human-wildlife coexistence” (Gross et al., 2021).

Therefore, this study explores the global scientific literature in Scopus regarding HWI, HWC, HWCx, and HWCICx (collectively HWI, HWC or HWCx). Specifically, it i) analyzes the growth trend in publications on HWCICx from 1987 until October 2023, ii) identifies the collaboration network of the most productive countries, iii) identifies the sources of publication and the network of journals, iv) identifies the co-occurrence of keywords, v) identifies the conceptual thematic map, and vi) identifies the historiographical authors and citations.

2. Materials and Methods

2.1. Data source

Articles from journals indexed in Scopus were analyzed until October 22, 2023. This database was chosen because it supports a wide range of scientific tasks in various knowledge domains and contains datasets for large-scale studies with intensive data usage (García et al., 2021). Although gray literature may document findings in emerging or niche research areas, it was not included since the study focused on the scientific impact pursued by the academic world (Silva et al., 2022). Therefore, only academic publications that underwent a formal and rigorous peer-review process were selected. Boolean searches (AND and OR) were conducted with eight combinations of the three keywords of interest ("human wildlife conflict", "human wildlife interaction", and "human wildlife coexistence") within the title, abstract, and keywords of the articles (TITLE-ABS-KEY). For comparative purposes, the results of four searches were exported in CSV format. In other words, the set of publications in the overall field under study (HWC or HWI or HWCx, HWCICx henceforth) and the three subsets comprising it (HWC, HWI, and HWCx) are included.

2.2. Bibliometric analysis

Two widely used bibliometric tools, VOSviewer version 1.6.20 (van Eck & Waltman, 2010), and the Bibliometrix package in R (Aria & Cuccurullo, 2017), were employed. In the HWC context, Su et al. (2022) summarized the key technical terms used by VOSviewer, such as documents, citations, links, and total link strength. Coauthorships (authors and countries) and the bibliographic coupling of journals were analyzed. Principal journals were identified via Bradford's Law (Orăștean & Mărginean, 2023). For the keyword co-occurrence analysis, hyphens (- and –) and slashes (/) were replaced with spaces, and plurals were singularized to avoid overestimating the total number of keywords and to achieve a better ranking without repetitions. For example, the variants human-wildlife conflict(s), human–wildlife conflict(s), human/wildlife conflict(s), and human wildlife conflict(s) were standardized to human wildlife conflict.

Callon's centrality and density (Cobo et al., 2011) were used to measure the performance of topics in each subset of data, employing the Walktrap algorithm and a minimum cluster frequency of five (per thousand documents). Centrality indicates the importance of a topic in a complete set of publications, whereas density reflects topic development (Yu et al., 2021). Topics with high density and centrality were labeled core topics; those with low density and high centrality were developing and isolated topics; those with low density and low centrality were emerging or declining topics; and those with low density and high centrality were basic and cross-cutting topics. Additionally, a historiographic citation analysis was conducted to assess the trajectory of research topics (Garfield, 2004).

3. Results

3.1. Growth trend in publications

The combined search with at least one of the terms (HWCICx) yielded 3,404 publications, with the first one in 1987 (Figure 1A). The highest annual productivity for this set of publications occurred in 2022 (n=446, 13.1%), and it increased exponentially between 1995 and 2022 (R2=0.9681). From the combined search, only 22 documents (0.6%) contained all three terms of interest simultaneously (HWC, HWI, and HWCx). The number of publications from individual searches for HWI, HWC, and HWCx were 708, 2,751, and 196, respectively, with peak annual productivity observed in 2021 (n=113, 16.0%), 2022 (n=351, 12.8%), and 2023 (n=46, 23.5%), respectively (Figure 1A). Publications on HWCICx were predominantly original articles (n=2,857, 83.9%), followed by reviews (n=221, 6.5%) and books or book chapters (n=162, 4.8%) (Figure 1B). The proportions were similar in the HWI, HWC, and HWCx subsets. The set of documents (HWCICx) and HWC were published in eight languages, whereas HWI and HWCx were published in only two (Figure 1C). In all the cases, English was predominant, accounting for 99% of the publications.

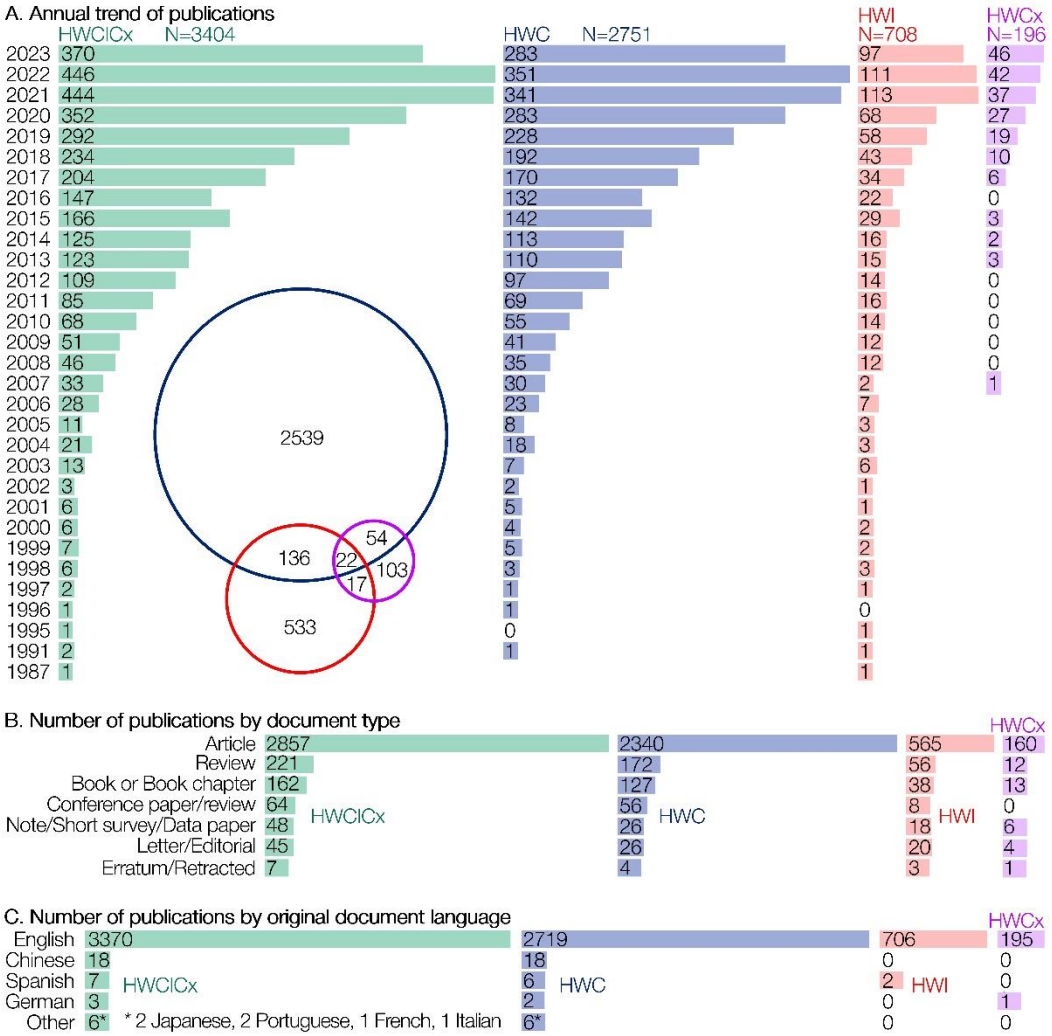

Figure 1 Annual trends and characteristics of publications on Human-Wildlife Conflict, Interaction, and Coexistence (HWCICx) published in Scopus up to October 2023. Data are shown for four datasets: HWCICx (green), Human-Wildlife Conflict (HWC, blue), Human-Wildlife Interaction (HWI, red), and Human-Wildlife Coexistence (HWCx, purple), including a Venn diagram illustrating the overlap of documents containing combinations of the three terms.

3.2. Collaboration network of countries

At the aggregate level (HWCICx), 141 countries have contributed to the advancement of the field. A total of 93% (n=38) and 76% (n=38) of Asian and European countries, respectively, contributed to at least one publication (Figure 2A). The number of countries contributing to the HWI, HWC, and HWCx subsets were 94, 136, and 76, respectively. For all four datasets, the United States (US) and the United Kingdom (UK) had the highest values in terms of documents, citations, links, and total link strength. Specifically, the US has twice as many documents as the UK does, and the UK has twice as many documents as the country in the third position (Australia or Germany) (Figure 2B). In other geographical regions, India and China in Asia, South

Africa in Africa, and Brazil in South America stand out with a greater number of publications. Notably, 100% of South American countries have contributed at least one publication to HWCICx and HWC.

The collaboration network of countries with at least 10 publications in the HWCICx reveals 62 countries in five primary collaborative clusters (Figure 2C). In terms of total link strength, the US has the strongest cooperative network, followed by the UK, Germany, South Africa, and Australia. Cooperation networks emerged among neighboring countries: cluster 1, consisting of 21 mainly European countries, is led by Germany; cluster 2 (17 countries) in Africa is led by the UK and South Africa; cluster 3 (14 countries) in Asia is led by Australia; and cluster 4 (9 countries) in the Americas is led by the US. India leads and represents only a fifth collaboration cluster.

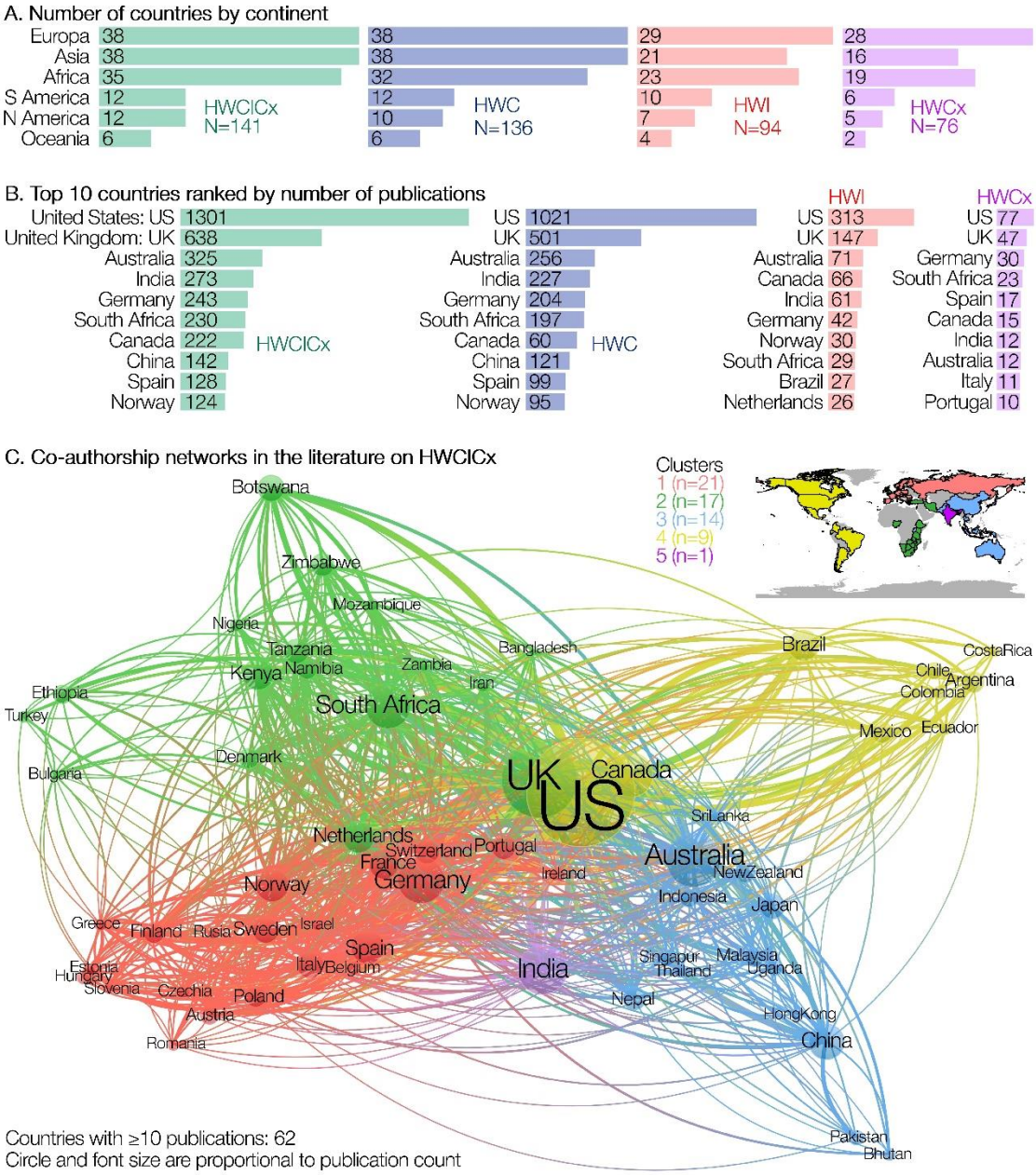

Figure 2 Geographic patterns and collaboration networks of countries in the Scopus literature on Human-Wildlife Conflict, Interaction, and Coexistence (HWCICx). Bar colors correspond to four datasets: HWCICx (green), Human-Wildlife Conflict (HWC, blue), Human-Wildlife Interaction (HWI, red), and Human-Wildlife Coexistence (HWCx, purple). In the co-authorship network and world map, countries are grouped into five collaboration clusters, each represented by a distinct color.

3.3. Publication sources and journal network

A total of 727 sources (primarily journals and certain books) have published on HWCICx, of which 122 exceeded the threshold of five publications, 36 exceeded 20 publications (Figure 3A), and 412 had only one publication. The number of sources published on the subsets HWI, HWC, and HWCx were 256, 640, and 86, respectively. The bibliographic coupling of the

36 journals that exceeded 20 publications generated five groups (Figure 3A). *Oryx* (cluster 1) and *Biological Conservation* (cluster 3) have the highest total link strengths; hence, they are authoritative journals in HWCICx. *Biological Conservation* was the first journal to publish on the topic and has remained relevant throughout the last decade, although there have also been journals with high interest in the subject in the past four years (the entire Cluster 4 and *Conservation Science and Practice* from Cluster 1).

Except for HWCx, there is similarity among the top 10 sources that published the most documents on HWI, HWC, and HWCICx, with notable journals including *Human-Wildlife Interactions*, *Biological Conservation*, *Human Dimensions of Wildlife*, and *Oryx* (Figure 3B). The journals are divided into three zones according to Bradford's Law, and Zone 1 (Figure 3C) is highly productive and represents major sources. Thus, the main sources are 14 journals (out of a total of 727 sources) that published approximately 33.1% of the documents in the entire HWCICx collection (3404 articles).

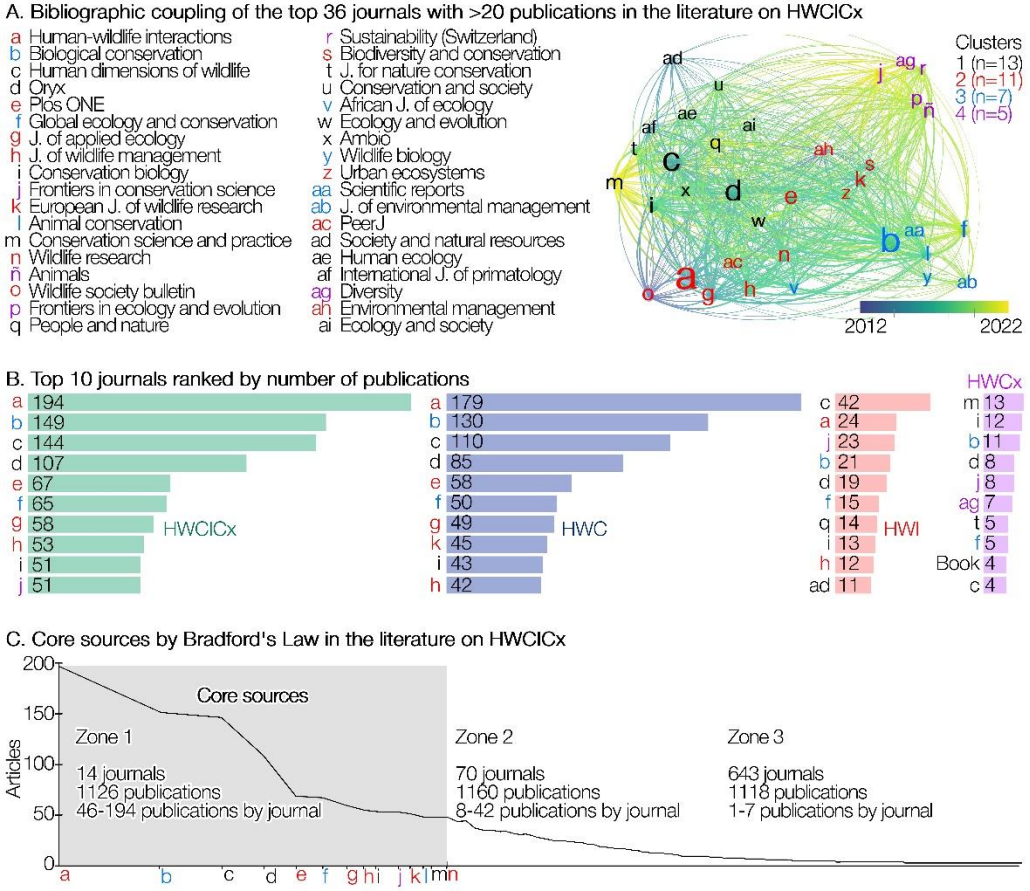

Figure 3 Journals in the Scopus scientific literature on Human-Wildlife Conflict, Interaction, and Coexistence (HWCICx). Letters and their colors correspond to journal labels and the bibliographic coupling clusters shown in panel A. The color gradient of the nodes and lines in the network indicates the average publication year of each journal's connections. Bar colors indicate the relevance to each dataset: HWCICx (green), Human-Wildlife Conflict (HWC, blue), Human-Wildlife Interaction (HWI, red), and Human-Wildlife Coexistence (HWCx, purple).

3.4. Keyword co-occurrence

A total of 7749 author-generated keywords related to the HWCICx joint matrix were identified, 510 of which surpassed the threshold of at least 5 occurrences, whereas only 69 exceeded 25 occurrences. Among these keywords, "human-wildlife conflict" and "human-wildlife interaction" were the two most frequently occurring, whereas "human-wildlife coexistence" ranked tenth (Figure 4A). The keywords from the HWI, HWC, and HWCx subsets were 2236, 6520, and 739, respectively. The three terms of interest were simultaneously the most commonly used keywords within their respective subsets of keywords. "Conservation" was among the top 3 keywords in all four datasets, suggesting that wildlife conservation is a major focus in the literature on the HWCICx. Additionally, within the top 10 for all four datasets, keywords such as "carnivore," "wildlife," "coexistence", and "attitude" were repeated.

The 69 keywords that surpassed 25 occurrences generated a map of four main clusters (with 11 to 14 keywords in each cluster) and three secondary clusters (each with six keywords). Additionally, "wildlife damage management" leads and represents only an eighth co-occurrence cluster. Primary Cluster 1, with the highest number of occurrence nodes, includes "HWC", three groups of animals (wolves, bears, and leopards), "large carnivore" in general, and its victim "livestock" in a

process of “predation” and “depredation”. Primary Cluster 2 includes “HWI”, three groups of animals (coyotes, ungulates, and wild boars), and two species characteristics (endangered and invasive), highlighting urbanization as a geographical area and revolving around “wildlife management” as the most common keyword. Primary Cluster 3 revolves around the “conservation” of “biodiversity” and “wildlife” through “protected area” and “ecotourism” given the multiple “ecosystem services”. Primary Cluster 4 is related to Cluster 2 regarding carnivores (“lion” and “leopard”) and their “livestock predation”, but it also emphasizes the conflict over “crop damage” and “crop raiding” by herbivores (exemplified by the “elephant”) and strategies of “mitigation” and “compensation”. The three secondary clusters revolve around the four main clusters. Notably, Cluster 5 includes “HWCx” and is framed within the “human dimension” (“attitude”, “perception”, and “tolerance”).

3.5. Conceptual thematic map

The fundamental and overarching themes related to HWCICx (lower right quadrant in Figure 5A) are connected to the concepts of HWC, HWI, and HWCx and their utility concerning the “management” and “conservation” of “biodiversity” and “wildlife”. For the four subsets of data, there are no highlighted themes of high relevance or with a high degree of development (upper right quadrant in Figure 5A-D). At the HWCICx joint level (Figure 5A), the interaction (conflict and/or coexistence) between carnivores and humans (in the livestock environment) is more prominent than the interaction between herbivores and humans (left quadrants in Figure 5A). Conflicts in urban environments are gaining relevance and currently have a high degree of development (upper quadrants in Figure 5A and 5B). The maps of the HWI, HWC, and HWCx subsets highlight independently relevant themes for each subset. For example, the theme of “hunting” as a lethal measure of wildlife control is located in the lower quadrants of Figure 5B and 5C. “Zoonoses” and “wildlife trade” stand out for their high degree of development and medium relevance in the HWI subset (upper left quadrant in Figure 5C). With an equal degree of development and relevance, the “human dimension” (“anthropomorphism” and “anthrozoology”) stands out in the HWCx subset (upper right quadrant in Figure 5D).

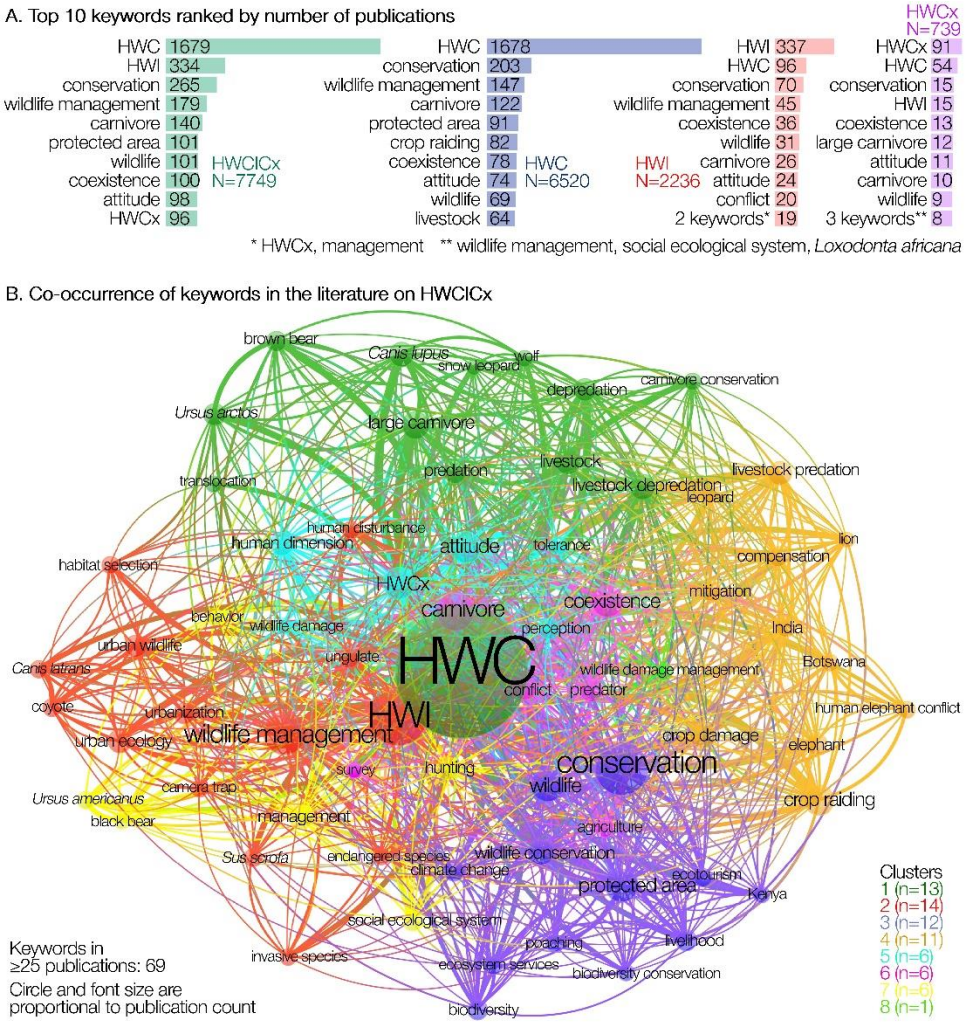

Figure 4 Author keywords in the Scopus scientific literature on Human-Wildlife Conflict, Interaction, and Coexistence (HWCICx). ar colors correspond to four datasets: HWCICx (green), Human-Wildlife Conflict (HWC, blue), Human-Wildlife Interaction (HWI, red), and Human-Wildlife Coexistence (HWCx, purple). Network colors denote eight clusters of keywords that co-occur within the same publication.

3.6. Authors and historiographic citations

A total of 10,274 authors published on HWCICx, of whom 251 exceeded the threshold of five publications, 49 surpassed 10 publications (Figure 6A), and 8,597 had only one publication. The collaboration network of authors with at least 10 publications at HWCICx shows 49 authors in 10 collaborative clusters (Figure 6A). In terms of the total strength of links, Macdonald David W has the strongest cooperation network, followed by Loveridge Andrew J, Johnson Paul J, Marchini Silvio, and Dickman Amy J. Additionally, Dickman authored the most cited publication (Figure 6B), and Macdonald is the author with the highest number of publications (Figure 6C) within the HWCICx dataset. Dickman also stands out for having the highest number of local citations within the historiographic analysis of 50 nodes (Figure 6B). The number of authors contributing to the HWI, HWC, and HWCx subsets were 2,688, 8,322, and 916, respectively. The HWCICx dataset and the HWC subset share the most authors within their top 10 authors with the highest number of publications; the top three are Macdonald David W, Breck Stewart W, and Redpath Stephen Mark (Figure 6C). In the HWI and HWCx subsets, new authors have emerged, such as Hockings Kimberley Jane and König Hannes J, respectively.

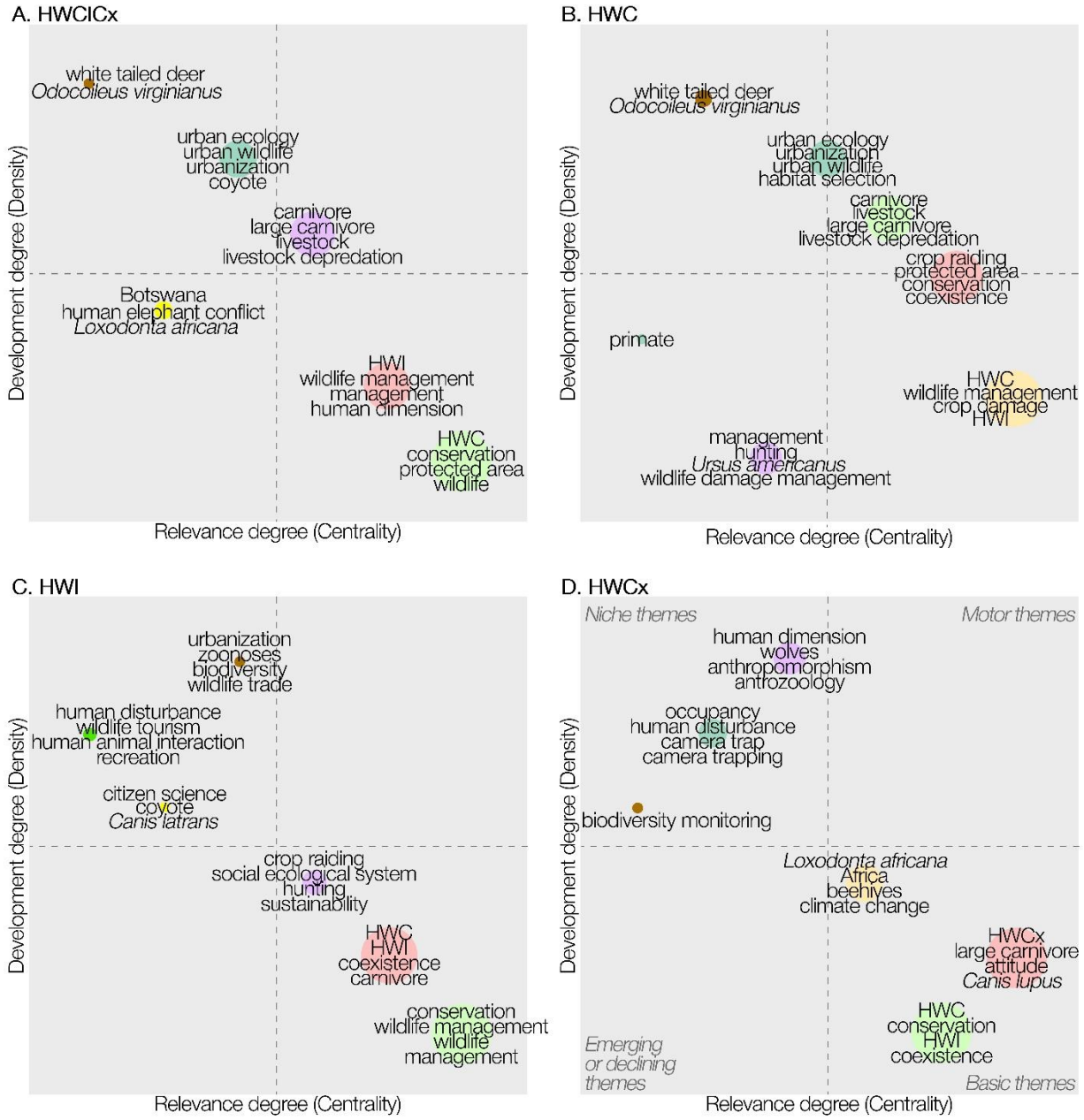

Figure 5 Conceptual thematic map of the Scopus scientific literature on Human-Wildlife Conflict, Interaction, and Coexistence (HWCICx). For four datasets, HWCICx, Human-Wildlife Conflict (HWC), Human-Wildlife Interaction (HWI), and Human-Wildlife Coexistence (HWCx), the maps represent the relevance and development level of their themes. Themes are classified into four quadrants: motor themes (high centrality and density), niche themes (high density, low centrality), emerging or declining themes (low centrality and density), and basic and cross-cutting themes (high centrality, low density).

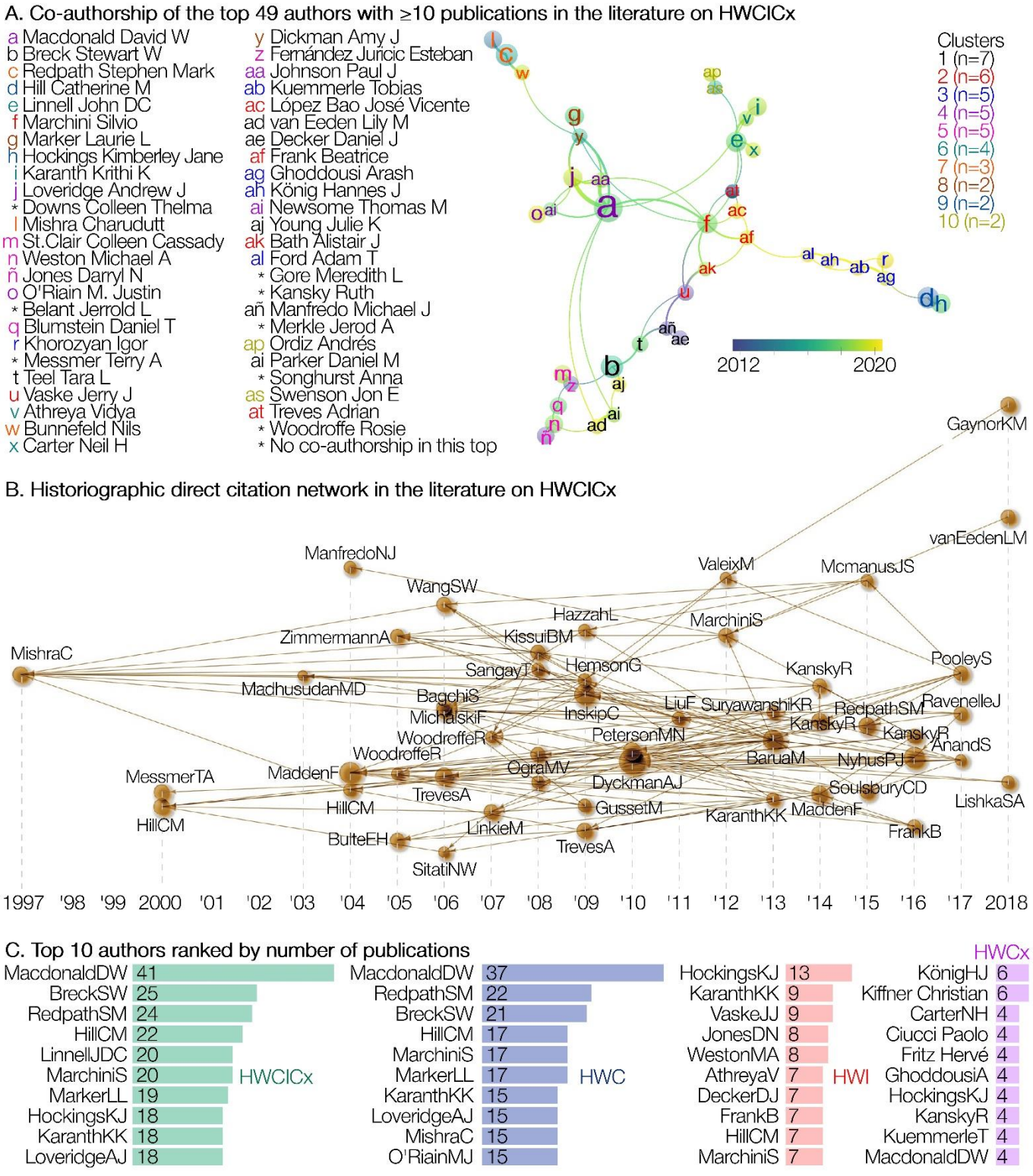

Figure 6 Authors in Scopus scientific literature on Human-Wildlife Conflict, Interaction, and Coexistence (HWCICx). Letters and their colors correspond to author labels and co-authorship clusters shown in panel A. The color gradient of the nodes in the network represents the average publication year of each author. Bar colors correspond to four datasets: HWCICx (green), Human-Wildlife Conflict (HWC, blue), Human-Wildlife Interaction (HWI, red), and Human-Wildlife Coexistence (HWCx, purple).

4. Discussion

4.1. Growth trend in publications

The individual search for HWC yields a total of 2,751 publications, with 2022 being the most productive (n=351). These results align with those of bibliographic analyses in which the Web of Science (WoS) database was used. Su et al. (2022)

reported 2,197 publications between 2003 and May 2021, with the highest annual productivity in 2020 (n=351). In contrast, Ridwan et al. (2023) reported a total of 1,592 publications between 1991 and February 2023, with peak productivity in 2021 (n=220).

The Scopus scientific literature related to HWCICx has rapidly expanded in the last two decades. Research on conflict (HWC) has grown at a higher rate than that on coexistence (HWCx), possibly because of a more traditional focus on conflicts; that is, investigations into the interactions between humans and wildlife have focused mostly around conflicts, representing a negative perspective (Chapron & López-Bao, 2020). This trend is also influenced by the increasing number and severity of HWC each year, drawing more attention from the academic community and the general public (Ridwan et al., 2023). However, new approaches aim to understand these interactions from a coexistence perspective by redirecting studies toward the development of policies and strategies that facilitate sustainable coexistence between both actors through differentiated instruments and approaches (Frank et al., 2019; König et al., 2020).

The marked growth in HWCICx publications, particularly those focused on conflict, reflects a prevailing narrative that frames human–wildlife relations in terms of risk and damage. While this growth parallels increasing global concern over biodiversity loss, it also suggests a research bias. This emphasis on conflict, potentially driven by media visibility and funding priorities, may hinder the advancement of coexistence-oriented strategies. The emergence of coexistence (HWCx) as a concept remains underexplored in the literature, despite its transformative potential. Future research should prioritize frameworks that transcend the dichotomy of conflict versus coexistence, incorporating context-specific variables such as cultural perceptions, traditional ecological knowledge, and the legacy of land-use change.

Among the three terms of interest, HWI was the earliest to be used in a study on the influence of visitors on the activities of mountain goats (*Oreamnos americanus*) in Glacier National Park (United States, US) (Pedevillano & Gerald Wright, 1987). Four years later, HWI was used again in Zimbabwe (Africa) (Makombe, 1991), when the term HWC was also first introduced in a demographic analysis of the baboon population (Papio sp.) in southern Kenya (Africa) (Samuels & Altmann, 1991). HWCx emerged 16 years later in the Scopus literature in the assessment of the effects of the presence of canoes and pedestrians on multiple behavioral responses of the black-crowned night heron (*Nycticorax nycticorax*) in Chicago (USA) (Fernández-Juricic et al., 2007). It was used again six years later in Australia (Litchfield et al., 2013) and the US (Goswami et al., 2013).

4.2. Collaboration network of countries

According to the analysis of country-wide production, at the overall level (HWCICx), authors from 141 countries have contributed to the field, of which 136 countries contributed to the HWC topic. The United States stands out as the country with the highest frequency of publications on HWC research (1021 publications), followed by the United Kingdom (501 publications) and Australia (256 publications). This ranking aligns completely with the findings of Ridwan et al. (2023). Moreover, the United States has the strongest cooperation network, followed by the United Kingdom, Germany, South Africa, and Australia, partially aligning with the report by Su et al. (2022), where the United States has the most robust cooperation network, followed by England, Germany, and South Africa. This trend could be attributed to various factors, including a keen interest in conservation, greater financial resources, and access to high-impact indexed journals with broad dissemination (Ridwan et al., 2023).

Production on the African continent is surpassed by that on Asia and Europe, which may be influenced by various factors and their combination in East Africa or Sub-Saharan Africa, such as political stability, research budget allocation, demographic aspects such as gender, government policies, professional trajectory, and the academic rank of researchers (Mnzava & Sirima, 2022).

The dominance of the United States, the United Kingdom, and a few other countries in HWCICx research underscores structural asymmetries in scientific production. These nations benefit from robust research infrastructures, funding mechanisms, and access to prestigious publication outlets. Conversely, countries with high biodiversity and pronounced human–wildlife interfaces, particularly in the Global South, are often underrepresented in authorship and leadership roles. This raises concerns about epistemic equity. Greater inclusion of local researchers in authorship, agenda setting, and data interpretation is essential to avoid perpetuating colonial patterns of knowledge extraction. Building South–South collaborations and capacity development mechanisms could also strengthen localized research with global implications.

4.3. Sources of publication and journal network

At the overall level (HWCICx), 727 sources were identified, with notable contributors being the journals *Human–wildlife Interactions*, *Biological Conservation*, *Human Dimensions of Wildlife*, and *Oryx*. In the case of HWCx, with a certain exception, the journal with the highest production was *Conservation Science and Practice*, followed by *Conservation Biology*. With respect to HWC, the journal *Human-wildlife Interactions* takes the lead with 179 publications, a finding that differs from the analyses by Ridwan et al. (2023) and Su et al. (2022), who identify *Biological Conservation* as the most important and productive journal. However, the bibliographic coupling of the 36 journals with more than 20 publications resulted in five groups, where *Oryx* (Cluster 1) and *Biological Conservation* (Cluster 3) presented the highest total link strength, making them authoritative journals in the HWCICx field (Su et al., 2022). According to Bradford's law, a bibliometric principle that relates the relationship between

journals and articles published on a particular topic, a small group of journals known as “core sources” contains a significant proportion of articles linked to that field of study (Gourikeremath et al., 2021). *Biological conservation* was the first journal to publish on the topic (Pedevillano & Gerald Wright, 1987) and has remained influential until the last decade; however, journals with high interest in the topic have emerged in the last four years (entire Cluster 4 and *Conservation Science and Practice* from Cluster 1).

The concentration of publications in a small number of high-impact journals validates Bradford's Law but also suggests a gatekeeping effect that may shape what types of knowledge are legitimized. Journals favoring quantitative, ecological, or management-oriented studies might undervalue interdisciplinary approaches or community-based narratives. This is particularly relevant for coexistence studies that often emerge from social sciences or indigenous epistemologies. Encouraging special issues or journal sections dedicated to socioecological coexistence and participatory conservation could broaden the epistemological base of the field.

4.4. Co-occurrence of keywords

Keyword analysis enables the recognition of central and emerging themes by compiling and analyzing terms used in the literature of a specific topic, providing relevant information about its development (Rejeb et al., 2022). In the combined dataset (HWCICx), the three terms of interest (“human-wildlife conflict”, “human-wildlife interaction”, and “human-wildlife coexistence”) were simultaneously the most commonly used keywords within their respective subsets. “Conservation” was among the top 3 keywords in all four datasets. Similarly, it was one of the most important keywords in the analyses of Ridwan et al. (2023) and Su et al. (2022). This finding demonstrates that wildlife conservation is crucial within strategies aimed at reducing conflicts and is also a primary focus of the literature on the HWCICx.

The keyword occurrence network comprises eight clusters, providing key thematic areas within the HWCICx research field. Clusters 1, 3, and 4 align with some clusters identified by Ridwan et al. (2023) and Su et al. (2022). For example, Cluster 1 is dominated by keywords related to carnivores and conflicts between humans and livestock in the predation process. Similarly, Cluster 3 revolves around the “conservation” of “biodiversity” and “wildlife” through “protected area” and “ecotourism”, considering multiple “ecosystem services” linked to HWC management, conservation, and local perception. Cluster 4 is dominated by keywords related to HWC involving large herbivores such as elephants.

The dominance of keywords such as “conflict,” “carnivore,” and “livestock” reveals a thematic concentration on large, charismatic megafauna in rural landscapes. While this is understandable, it neglects the growing importance of human–wildlife interactions in urban and peri-urban settings, as well as with less-studied taxa (e.g., reptiles, birds, rodents). Moreover, keywords such as “attitude,” “perception,” and “tolerance” are emerging, indicating a gradual shift toward integrating human dimensions. Future bibliometric tracking should assess whether these social-ecological terms gain prevalence and how they correlate with publication impact.

4.5. Conceptual thematic map

For the four subsets of data, no themes of particular relevance or high degree of development were identified. However, the fundamental and overarching themes concerning HWCICx are related to concepts such as HWC, HWI, and HWCx and their utility for the “management” and “conservation” of “biodiversity” and “wildlife”. These themes hold significant importance in the field of study and play a fundamental role in its structure (Su et al., 2022). Biodiversity conservation, wildlife management, and the mitigation of conflicts between humans and animals are key topics that concern researchers, as noted in various studies (Artelle et al., 2016; Inskip & Zimmermann, 2009; Xu et al., 2019).

Conflicts in urban environments are gaining relevance and currently have a high degree of development (Basak et al., 2023; Kleemann et al., 2023; Taylor et al., 2023). Rapid transformations in land use which can lead to frequent encounters with wildlife in the context of changing habitats, as well as encounters with species thriving in urban environments (Wierucka et al., 2023). As development continues to eliminate wildlife, human disturbances become increasingly common (Pop et al., 2023).

Themes like zoonoses, wildlife trade, or anthropomorphism, though peripheral, could serve as entry points for interdisciplinary convergence. Bridging these emerging themes with global conservation policy (e.g., One Health, Nature Futures Framework) offers a productive avenue for future research. Greater conceptual clarity and integration could improve the field’s ability to inform evidence-based policy and adaptive management.

4.6. Authors and historiographical citations

Analysis of the collaboration network among authors with at least 10 publications in the field of HWCICx positions David W. Macdonald as the researcher with the most robust cooperation network and the author with the highest number of publications. This aligns with the findings of Ridwan et al. (2023), who identified David Macdonald as the author with the highest number of publications and the maximum number of citations received in the HWC area. On the other hand, Dickman Amy J is the author of the most cited publication. Dickman (2010) reviewed case studies to demonstrate how social factors strongly influence perceptions of human-wildlife conflict, emphasizing the need for increasingly innovative and interdisciplinary

mitigation approaches to enable people to transition from conflict to coexistence. From the historiographical analysis of citations, we can also observe two cornerstones in HWCICx research. The predation of livestock by large carnivores (Mishra, 1997) and crop raids by omnivores (Hill, 2000). Finally, the influence of human disturbance on wildlife nocturnality has been demonstrated in a recent and second most-cited article in the field (Gaynor et al., 2018). Additionally, the most-cited articles that have surpassed 500 citations are bibliographic reviews (Dickman, 2010; Gaynor et al., 2018; Inskip & Zimmermann, 2009).

Notably, the most cited works call for more innovation and interdisciplinarity, recommendations that remain only partially realized. A shift toward co-produced research with local communities, practitioners, and policymakers is needed to translate academic insights into actionable strategies. The future of HWCICx scholarship depends on breaking disciplinary silos and amplifying underrepresented voices.

5. Management Implications

This study provides an updated and prospective overview of the evolution of research concerning the intricate relationships between humanity and wildlife. It reveals the dynamism and evolution of the scientific literature on interactions, conflicts, and coexistence between humans and wildlife (HWCICx) in recent years. It is a field in full development, demanding integrated approaches between the natural and social sciences to progress toward sustainable models of coexistence.

Ethical Considerations

Not Applicable.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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