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SOUNDS OF THE SUNSET COAST

A desk-based review of ecoacoustic soundscapes for urban innovation and decarbonisation

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ABSTRACT

Ecoacoustics—the study of environmental soundscapes as indicators of ecological condition—has emerged as a promising tool for urban innovation. As cities worldwide strive for carbon neutrality, nature-positive infrastructure, and climate resilience, ecoacoustics offers a unique, acoustics-driven lens to monitor change, assess environmental quality, and engage communities. This study undertakes a desk-based review of the development and application of ecoacoustic methods within urban and peri-urban settings. It explores how passive acoustic monitoring, soundscape indices, and long-term audio datasets are being used to support nature-based solutions, track biodiversity in green infrastructure, and evaluate co-benefits of decarbonisation efforts. Case studies from academic literature, policy reports, and monitoring platforms are analysed to highlight how ecoacoustics is influencing decision-making in sectors such as transport, land restoration, and city planning. While ecoacoustics is well established in ecological research, its potential contribution to urban acoustics, environmental assessment, and smart city platforms remains underexplored. This review aims to position ecoacoustics within the broader acoustics discipline—demonstrating how sound-based monitoring can complement traditional noise assessments and offer new pathways for sustainable urban development. Key gaps, standardisation challenges, and opportunities for integration into existing acoustic practice are also discussed.

1 INTRODUCTION

Ecoacoustic soundscape research is increasingly recognized as a vital component in understanding and shaping urban environments. By examining the complex interplay between natural, human-made, and technological sounds, ecoacoustics provides insights into urban biodiversity, public health, and the overall quality of life in cities (Farina & Gage, 2017). Additionally, the soundscape approach moves beyond traditional noise control, treating environmental sounds as resources (Chung & To, 2025; Kang & Schulte-Fortkamp, 2016) that can promote positive health effects, such as stress reduction and improved cognitive performance, while also highlighting the risks of noise pollution and its potential to exacerbate social inequalities if not managed equitably (Aletta et al., 2025; Lawrence et al., 2023). Integrating ecoacoustic soundscape perspectives into urban planning enables a more holistic approach to creating sustainable, healthy, and inclusive urban spaces.

The relationship between ecoacoustic soundscapes and urban development is multifaceted. Urbanization introduces a variety of anthropogenic sounds—traffic, construction, and human activity—that interact with natural sound sources like birdsong, wind, and rain, shaping the acoustic environment and influencing both human perception and wildlife behavior (Fairbrass et al., 2018; Quinn et al., 2022). Advanced technologies, such as machine learning and deep neural networks, now allow for large-scale, automated assessment of urban soundscapes, enabling urban planners to monitor biodiversity, identify resident preferences, and design interventions that enhance comfort and well-being (Fairbrass, 2018; Quinn et al., 2022; Zhao et al., 2023). These tools also help reveal spatial and temporal patterns in soundscapes, supporting evidence-based decisions for green infrastructure, noise mitigation, and habitat conservation (Fairbrass et al., 2018; Guagliumi et al., 2025; Quinn et al., 2022). Importantly, ecoacoustic indices have been shown to correlate with psychoacoustic perceptions of calm, pleasantness, and annoyance, providing measurable links between soundscape quality and human experience (Lawrence et al., 2023).

Innovation in urban development is increasingly tied to the integration of ecoacoustic soundscape research. By leveraging big data, participatory modelling, and intelligent sensing systems, cities can move toward more adaptive and responsive planning processes that balance ecological, social, and technological needs (Aletta et al., 2025; Fairbrass et al., 2018; Zhao et al., 2023). For example, deep learning systems like CityNet can automatically measure biotic and anthropogenic acoustic activity, facilitating large-scale environmental surveillance and supporting biodiversity monitoring in real time (Fairbrass et al., 2018). Furthermore, the use of street view imagery and crowdsourced data enables high-resolution mapping of urban soundscapes at low cost, democratizing access to environmental information and fostering community engagement in urban design (Zhao et al., 2023). As cities strive to become more sustainable and resilient, the integration of ecoacoustic soundscape research offers a pathway to innovative solutions that promote environmental justice, enhance urban biodiversity, and improve the quality of life for all residents (Aletta et al., 2025; Fairbrass et al., 2018; Guagliumi et al., 2025; Lawrence et al., 2023; Zhao et al., 2023).

While the previously mentioned references offer valuable recommendations and insights on utilizing ecoacoustic soundscapes for urban planning and management from various viewpoints, it remains essential to adopt a comprehensive perspective on the evolution of ecoacoustic soundscapes within urban and peri-urban contexts. Consequently, this study utilizes a bibliometric approach to investigate this development through a desk-top review of academic literature and policy reports. The findings of this study enhance the understanding of ecoacoustic soundscapes in relation to urban innovation and issues related to decarbonization.

2 METHOD

A bibliometric study typically consists of two primary analyses: performance analysis and science mapping (Donthu et al., 2021; To et al., 2024; Van Eck and Waltman, 2010). Performance analysis uncovers the most productive authors, institutions, and countries, as well as the most popular source titles, and the publications that are cited most frequently. Science mapping, on the other hand, reveals the structural and interactive dimensions of the chosen topic. This usually focuses on keyword co-occurrence analysis.

This study employed bibliometric methods to investigate the applications of ecoacoustic soundscapes in relation to urban innovation, ultimately contributing to decarbonization. For the academic literature, the study relied on Scopus as the data source. This choice is due to Scopus being the largest and reputable academic indexing and abstracting database, which also offers many useful tools for straightforward bibliometric analyses, such as identifying document types, the most prominent authors, institutions, and countries, along with the key funding bodies and the most cited publications (Chung & To, 2025; To & Yu, 2025; To et al., 2024). A search was conducted using the term “ecoacoustic*” in the “Article title, Abstract, Keywords” fields in Scopus on July 28, 2025, to identify all documents related to “ecoacoustic*.” The search was subsequently narrowed down to include “soundscape” AND “soundscapes” in the keywords, pinpointing “ecoacoustic* AND soundscape(s)” as the key search terms for the selected documents. The chosen documents were then meticulously examined through performance analysis and science mapping.

For policy documents and guidelines, the study utilized Overton as the data source. A search was conducted using “ecoacoustics” AND “soundscapes” in policy documents. The identified policy documents were then carefully reviewed.

3 RESULTS

A search using the term “ecoacoustic*” in the “Article title, Abstract, Keywords” in Scopus was performed on July 28, 2025. The search results yielded 437 documents with 332 articles, 27 reviews, 6 editorials, 2 data papers, 2 notes and 2 short surveys in journals, 40 conference papers, 2 books and 24 book chapters. Before 2011, there were only two documents. Both of these documents were authored by M. Burtner from the University of Virginia, who viewed ecoacoustics as a means to integrate music with sounds derived from natural and human cultural activities (Burtner, 2004, 2005). It was not until 2015 that A. Farina and his associates referred to ecoacoustics as a scientific process aimed at exploring the role of sound in ecological processes (Farina et al., 2015; Sueur & Farina, 2015).

3.1 Performance analysis using Scopus tools

Figure 1 illustrates the number of documents published from 2011 to 2025 (up to July). It demonstrates that the number of documents has increased to over 50 documents per year since 2020. Among them, 435 was categorized as “final” and 2 were “articles in press.”

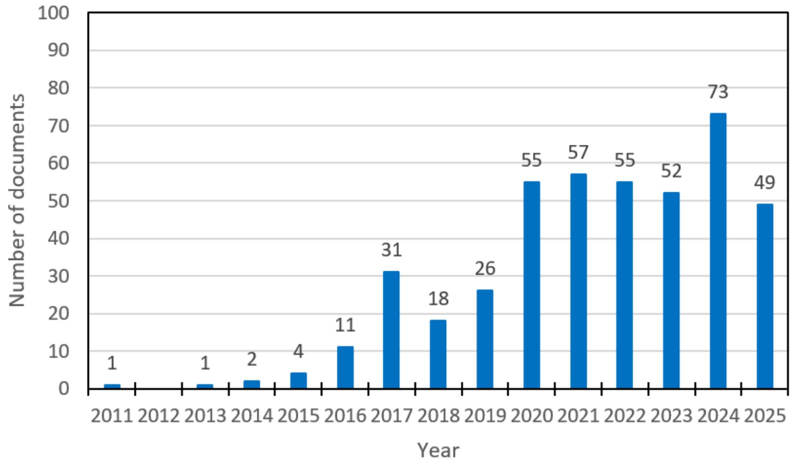

Figure 1: Number of documents about “ecoacoustic(s)” from 2011 to 2025 (July)

Among the top authors, A. Farina of Università degli Studi di Urbino Carlo Bo in Italy was the most productive one with 38 publications. He was followed by P. Roe of Queensland University of Technology in Australia with 26 publications and J. Sueur of Sorbonne Université in France with 25 publications. When looking into the identified keywords of the 437 publications, the top keyword was ecoacoustics with 297 occurrences. It was followed by bioacoustics (161 occurrences), biodiversity (114 occurrences), passive acoustic monitoring (103), soundscape (95), soundscapes (81), ecoaoustic (58), acoustics (54), animals (48), and acoustic indices (48).

When the document search was refined to “soundscape” AND “soundscapes” in keywords, 193 documents were retained among the 437 publications. They include 153 articles, 11 reviews, 1 note and 1 short survey in journals, 18 conference papers, and 9 book chapters. Figure 2 shows the first document was published in 2015. The number of publications has increased to over 20 in 2020. The top author was still A. Farina with 18 publications. The second most productive author was T. Bradfer-Lawrence of the UK Royal Society for the Protection of Birds with 8 publications. He was followed by N. Pieretti – an independent researcher in Italy with 7 publications.

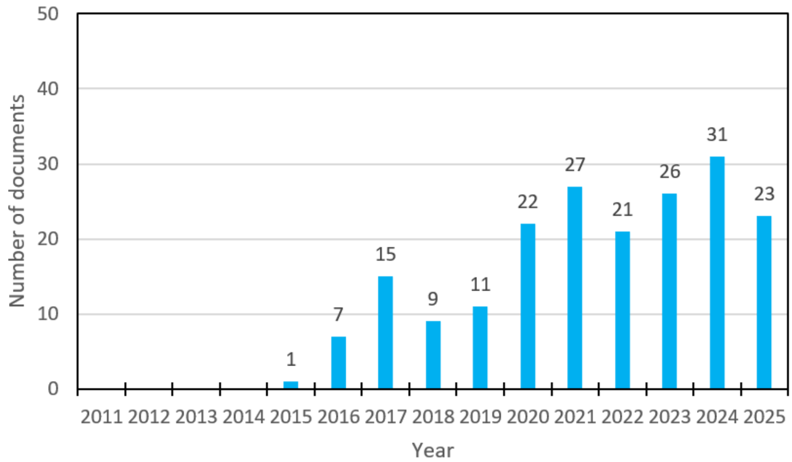

Figure 2: Number of documents about “ecoacoustic(s)” and “soundscape(s)” from 2011 to 2025 (July)

Table 1 shows the institutions that produce 8 or more documents on “ecoacoustic(s)” and “soundscape(s),” while the top five countries were the United States producing 70 documents, the U.K. producing 48 documents, Italy producing 28 documents, Australia producing 24 documents, France producing 23 documents, and Brazil producing 20 documents.

Table 1: The most productive institutions

Rank	Institution	Number of documents
1	Università degli Studi di Urbino Carlo Bo	17
2	CNRS Centre National de la Recherche Scientifique	16
2	Cornell University including Cornell Lab of Ornithology	13
4	Sorbonne Université	10
4	Queensland University of Technology	10
4	Museum National d'Histoire Naturelle	10
7	Purde University	9
7	Universidad de Antioquia	9
9	University of Exeter	8

Regarding the sources of document, the search reveals that the most popular journal was Ecological Indicators with 39 publications. It was followed by Methods in Ecology and Evolution with 9 publications, Frontiers in Ecology and Evolution with 8 publications, and Science of the Total Environment with 5 publications.

Table 2 presents the ten most frequently cited publications. These publications are distributed across eight different journals, with both “Methods in Ecology and Evolution” and “Ecological Indicators” featuring two highly cited articles each. The most cited document is a review titled “Terrestrial passive acoustic monitoring: review and perspectives,” authored by Sugai et al. (2019) in Bioscience. This document garnered 449 citations over the last five and a half years.

The second most cited publication is an article named “Measuring acoustic habitats,” published by Merchant et al. (2015) in Methods in Ecology and Evolution. In this article, Merchant et al. (2015) examined the signal processing techniques necessary for obtaining calibrated measurements of both terrestrial and aquatic acoustic habitats. They outlined key metrics and terminology for characterizing biotic, abiotic, and anthropogenic sounds. Additionally, they provided MATLAB and R computer codes in their supplementary materials, enabling researchers to calibrate their spectrograms and statistically analyse the recorded sounds. This article received 418 citations in the past ten and a half years. The third most cited publication is an article titled “Guidelines for the use of acoustic indices in environmental research,” published by Bradfer-Lawrence et al. (2019) in Methods in Ecology and Evolution. Recognizing that over 60 acoustic indices have been created for biodiversity monitoring across various habitats, Bradfer-Lawrence et al. (2019) formulated guidelines for designing studies that utilize audio recordings to assess multiple sites, along with a workflow for comparing seven commonly used acoustic indices. They specifically recommended that a minimum of 120 hours of continuous audio recordings per site should be carried out. This article received 220 citations in the past six years.

The fourth most cited document is an article titled “Biases of acoustic indices measuring biodiversity in urban areas” by Fairbrass et al. (2017) published in Ecological Indicators. Fairbrass et al. (2017) gathered 2452 hours of audio recordings from 15 locations throughout Greater London, supplemented with visual data. They discovered that the four commonly used acoustic indices, which include the acoustic complexity index, acoustic diversity index, bioacoustics index, and normalised difference soundscape index, were unable to distinguish between biotic and anthropogenic activities. Consequently, these indices would not be appropriate for monitoring biodiversity acoustically in habitats dominated by anthropogenic influences without first eliminating biasing sounds from the recordings. This article has garnered 151 citations over the last seven and a half years. The fifth highly cited document is an article entitled “Acoustic indices as proxies for biodiversity: a meta-analysis” authored by Alcocer et al. (2022) in Biological Reviews. Alcocer et al. (2022) conducted a meta-analysis based on 34 studies and found that acoustic indices exhibited a moderate positive correlation with the diversity metrics (Correlation r=0.33, Confidence Interval = [0.23,0.43]). Among the acoustic indices evaluated, Alcocer et al. (2022) indicated that the acoustic complexity index, normalised difference soundscape index, and acoustic entropy index were more effective in retrieving biological information, with the acoustic abundance of sounds being the most accurate estimate of diversity facet of local communities. The article received 142 citations in the past three years. The sixth to tenth most cited publications received between 82 and 117 citations.

Table 2: The highly cited publications

Author (year)	Institution	Journal	Citations
Sugai et al. (2019)	Terrestrial passive acoustic monitoring: review and perspectives	Biosci.	449
Merchant et al. (2015)	Measuring acoustic habitats	Methods in Ecol. & Evol.	418
Bradfer-Lawrence et al. (2019)	Guidelines for the use of acoustic indices in environmental research	Methods in Ecol. & Evol.	220
Fairbrass et al. (2017)	Biases of acoustic indices measuring biodiversity in urban areas	Ecol. Ind.	151
Alcocer et al. (2022)	Acoustic indices as proxies for biodiversity: a meta-analysis	Biolog. Rev.	142
Sethi et al. (2020)	Characterizing soundscapes across diverse ecosystems using a universal acoustic feature set	PNAS	117
Bradfer-Lawrence et al. (2020)	Rapid assessment of avian species richness and abundance using acoustic indices	Ecol. Ind.	111
Ross et al. (2023)	Passive acoustic monitoring provides a fresh perspective on fundamental ecological questions	Fun. Ecol.	100
Deichmann et al. (2018)	It's time to listen: there is much to be learned from the sounds of tropical ecosystems	Biotrop.	95
Aide et al. (2017)	Species richness (of insects) drives the use of acoustic space in the tropics	Remote Sen.	82

3.2 Science mapping using VOSviewer

Co-authorship analysis was performed utilizing VOSviewer, based on the identified 193 documents. With a threshold of 3 documents per author, 62 out of the 720 identified authors satisfied this criterion. As anticipated, A. Farine from Italy emerged as the most active researchers, having produced 17 publications. He was succeeded by T. Bradfer-Lawrence from the United Kingdom and N. Pieretti from Italy. The co-authorship map illustrated in Figure 3 revealed that A. Farina was indirectly connected to T. Bradfer-Lawrence through A. Eldridge, a Professor of Sonic Systems at the University of Sussex. Furthermore, A. Farina was frequently found to co-author publications with Stuart H. Gage, an Emeritus Professor at Michigan State University, focusing on soundscape ecology. Figure 3 also highlighted some other active groups, including E. Parmentier (5 documents) and X. Raick (4 documents) from the University of Liège in Belgium, who concentrate on marine soundscapes and coral reef ecosystems, G. Zambon, R. Benocci, and A. Potenza – co-authoring 4 documents - from the University of Milano-Bicocca in Italy, who are engaged in the development of acoustic indices for urban environments, and S. Matsubayashi, T. Arita, K. Nakadai, H.G. Okuno, and R. Suzuki – co-authoring 3 documents - from Nagoya University, Tokyo Institute of Technolgy, and Kyoto University in Japan, who have investigated bird vocalizations across various environments.

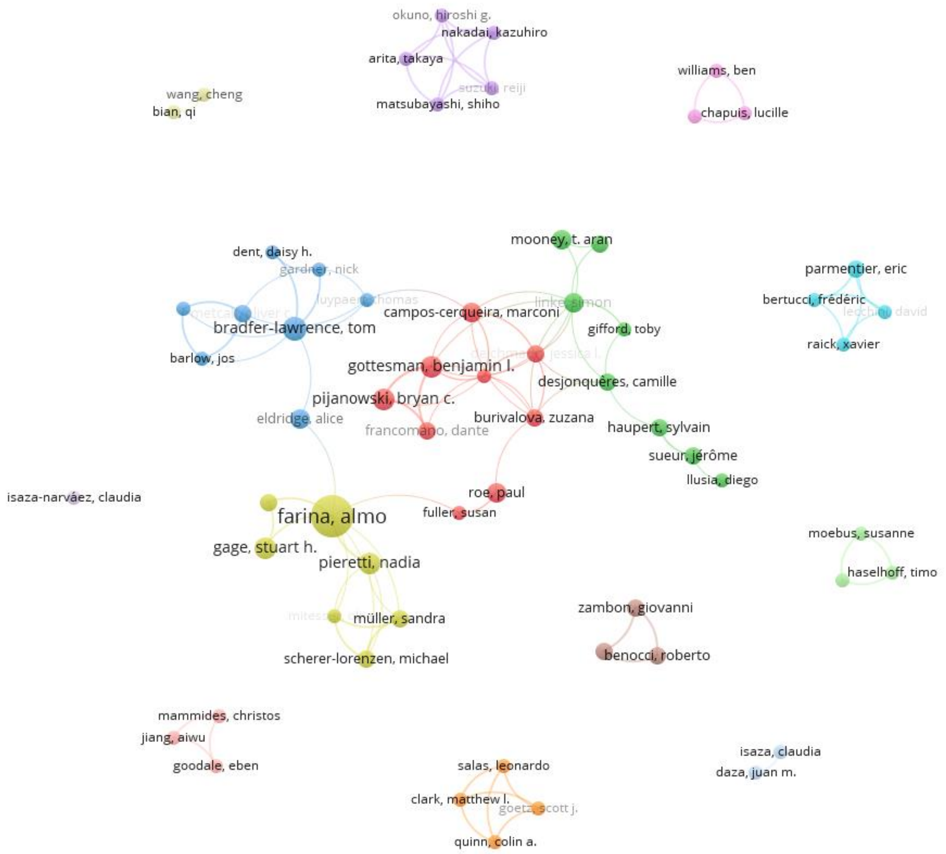

Figure 3: Co-authorship analysis using the 193 identified documents

The co-occurrence of keywords analysis was performed using VOSviewer based on the 193 documents featuring key search terms: ecoaoustic(s) and soundscape(s). The keywords encompass both author keywords and indexed keywords. With a minimum occurrence threshold of 5, 105 out of the 1480 identified keywords satisfied this criterion. Figure 4 reveals the presence of four clusters. The largest cluster, Cluster 1 depicted in red, contains 30 keywords. It focuses on ecoaoustics (140 occurrences), passive acoustics monitoring (49 occurrences), soundscape ecology (39 occurrences), and environmental monitoring (19 occurrences). The second largest cluster, Cluster 2 represented in green, comprises 29 items. It centres on bioacoustics (69 occurrences), biodiversity (59 occurrences), acoustic indices (26 occurrences), birds (19 occurrences), ecology (19 occurrences) and forestry (16 occurrences). The third cluster, Cluster 3 shown in blue, consists of 28 items, focusing on soundscape (95 occurrences), acoustics (29 occurrences), animals (24 occurrences), article (19 occurrences), and nonhuman (13 occurrences). The fourth cluster, Cluster 4 coloured in yellow, contains 18 items. It concentrates on soundscapes (81 occurrences), ecoacoustic (38 occurrences), acoustic measuring instruments (11 occurrences), and audio recordings (11 occurrences). Table 3 presents the top 10 keywords for each cluster with their frequency of occurrences. Overall, these clusters can be labelled as: “ecoacoustics – passive acoustics monitoring for marine ecosystem,” “biodiversity monitoring using acoustic indices in forestry,” “soundscape including spatiotemporal analysis for animals and human(s),” and “audio recordings for ecoacoustic soundscapes.”

Specifically, the keyword “urban area” appears in Cluster 4 (the yellow cluster) and is closely linked to “ecoacoustic index,” “sound recording,” “audio recording,” and “soundscapes” in the same cluster. This keyword is also closely connected to “monitoring,” “biodiversity,” “bioacoustics,” and “ecosystems” in Cluster 2 (the green cluster).

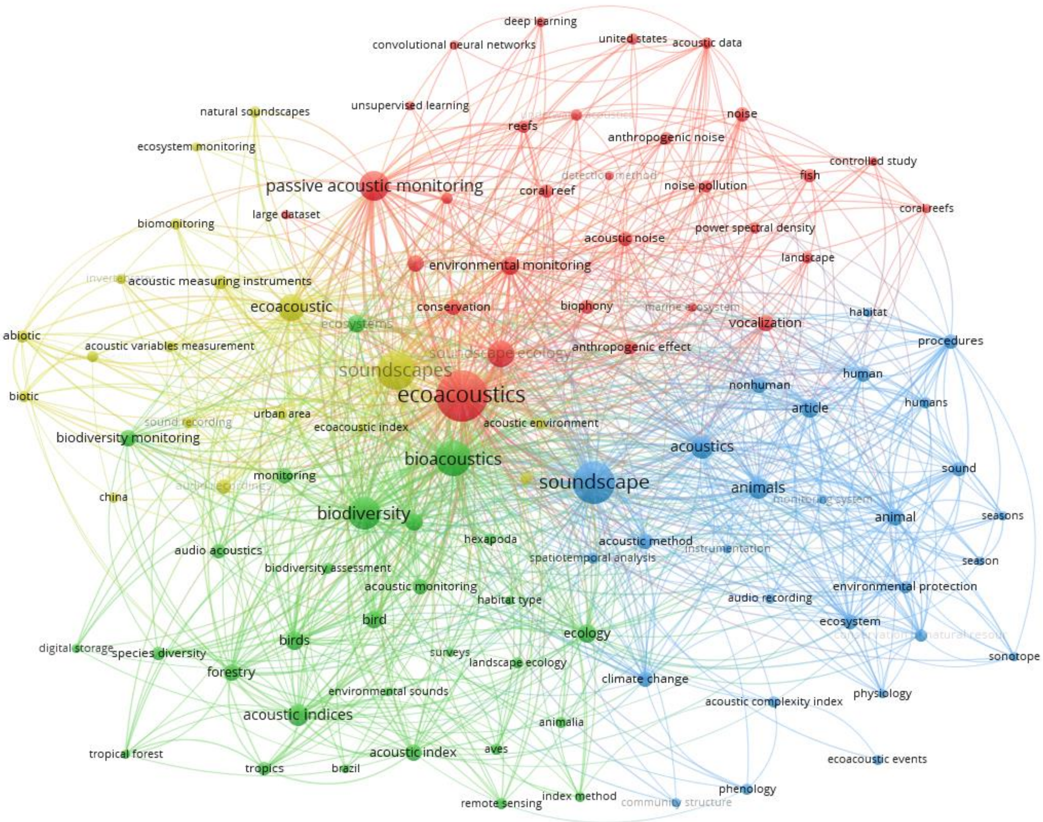

Figure 4: Keyword occurrence analysis using the 193 identified documents

Table 3: Keywords of the 4 identified clusters with their frequency of occurrences

Cluster 1	Cluster 2	Cluster 3	Cluster 4
ecoacustics (140)	bioacoustics (69)	soundscape (95)	soundscapes (81)
passive acoustic monitoring (49)	biodiversity (59)	acoustics (29)	ecoaoustic (38)
soundscape ecology (39)	acoustic indices (26)	animals (24)	acoustic measuring instrument (11)
environmental monitoring (19)	birds (19)	article (19)	audio recordings (11)
machine learning (15)	ecology (19)	animal (15)	abiotic (9)
vocalization (15)	ecosystems (18)	climate change (14)	acoustic variables measurement (8)
conservation (13)	species richness (18)	acoustic method (13)	biotic (8)
acoustic noise (12)	bird (17)	nonhuman (13)	ecoacoustic indices (8)
biophony (12)	forestry (16)	human (12)	natural soundscapes (8)
noise (12)	acoustic index (15)	ecosystem (11)	urban area (8)

3.3 Policy documents

By employing Overton, nine documents were identified using the keywords "ecoacoustics" AND "soundscapes" (as shown in Table 3). These include two documents from Norway and two from the European Union (EU). Additionally, there is one document each from Sweden, Germany, the United Kingdom, the United States, and Argentina. Among these nine documents, one specifically discusses the creation of new music inspired by soundscapes, similar to the advocacy of M. Burtner since 2004. The majority of the remaining documents, including those from Norway, Sweden, the United Kingdom, and the United States, concentrate on acoustic monitoring in natural environments.

Table 3: Policy documents

Country (year)	Document title
Argentina (2020)	Biomusic: interdisciplinary study of the soundscape for the creation of new music
Norway (2021)	Use of sound for monitoring Norwegian nature – a feasibility study
Norway (2021)	Management-relevant applications of acoustic monitoring for Norwegian nature: the sound of Norway
Sweden (2022)	Noise data acquisition and autonomous species identification to facilitate environmental monitoring
The United Kingdom (2025)	Natural England (GME0022)
EU Commission (2021)	Energy Infrastructure Forum 2021
The United States (2019)	Anthropogenic Sound and Fishes
Germany (2021)	The exploitation of the Yasuni in the midst of the global oil collapse
EU Office (2023)	STI for 2050 – Publications Office of the EU

4 DISCUSSION AND CONCLUSIONS

The analyses presented above indicate that researchers have been investigating ecoacoustics since 2004. However, it was not until 2015 that ecoacoustic soundscapes began to appear in academic journals. Over the past decade, the majority of research efforts have focused on utilizing passive acoustic monitoring to examine biodiversity in terrestrial environments, including forestry and aquatic habitats. In natural settings, a variety of acoustic indices have been created and shown to correlate with biodiversity and/or species diversity. Nevertheless, as anthropogenic noise becomes more prevalent in urban settings, research has shown that many acoustic indices is unable to differentiate between biotic and anthropogenic activities. Consequently, these indices may not be appropriate for acoustically monitoring biodiversity in areas heavily influenced by human activities (Fairbrass et al., 2017).

To address these challenges, recent studies—including Fairbrass et al. (2019), Quinn et al. (2022), and Zhao et al. (2023)—have begun to explore the use of artificial intelligence (AI) methods, such as deep learning and machine learning, to automatically identify and classify different sound sources from audio and visual recordings in urban settings. These approaches have produced promising outcomes in separating biotic sounds from anthropogenic noise, which is particularly difficult using traditional acoustic indices alone. As AI technologies continue to evolve, they offer significant potential to improve the accuracy and scalability of urban ecoacoustic monitoring, making it more feasible to study complex soundscapes in densely populated areas.

Similarly, the identified policy documents focus mostly on utilizing acoustic monitoring to assess the state of natural environments in different countries and regions. Generally, they make reference to either journal articles or ISO acoustic standard documents for methods to analyse the subsequently collected acoustic data.

Ecoacoustic soundscapes, which capture the full spectrum of environmental sounds, are closely linked to biodiversity because the richness and complexity of a soundscape often reflect the diversity and abundance of vocalizing species within an ecosystem in natural settings. Research has demonstrated that acoustic indices derived from soundscape recordings in rural areas can reliably indicate species richness, community composition, and habitat quality, making them valuable tools for biodiversity monitoring across different terrestrial, freshwater, and marine environments. Higher biodiversity, as revealed through richer and more complex soundscapes, is associated with healthier, more resilient ecosystems that support greater biomass and more robust ecological functions. These biodiverse ecosystems, particularly forests and restored habitats, play a critical role in carbon sequestration and storage, thereby enhancing the landscape's capacity for decarbonization. By enabling rapid, non-invasive assessment of biodiversity, ecoacoustic monitoring can inform conservation and restoration strategies that maximize both ecological integrity and carbon capture potential, ultimately supporting global decarbonization efforts. However, ecoacoustic soundscapes in urban areas present challenges, as they are often dominated by sounds from anthropogenic sources and human activities.

In summary, ecoacoustic soundscapes offer a powerful framework for studying the complex interplay of natural and anthropogenic sounds in urban and peri-urban environments. Their application provides both significant opportunities and notable challenges for understanding, managing, and improving urban sound environments. When opportunities are considered, ecoacoustic soundscapes facilitate large-scale, non-invasive monitoring of biodiversity and ecosystem health, particularly in urban green spaces where traditional noise monitoring methods are often very restrictive and inaccurate. By integrating “appropriate” acoustic indices and advanced analytical tools, such as deep learning and machine learning, researchers may disentangle the contributions of biophony (biological sounds), anthrophony (human-made noise), and geophony (natural non-biological sounds) to urban soundscapes. This approach allows for the identification of spatial and temporal patterns in sound, assessment of soundscape quality, and detection of areas where anthropogenic noise disrupts natural acoustic communication, informing conservation and urban planning strategies. Soundscape mapping and classification frameworks can support ecosystem monitoring, adaptive management, and the design of restorative urban environments. Concerning the challenges, urban and peri-urban soundscapes are highly complex due to the dominance of anthropogenic noise, which can mask natural sounds and cause the failure of “existing” acoustic indices used to monitor biodiversity. This masking effect complicates the accurate assessment of ecological health and the detection of biotic activity, especially in habitats with high levels of traffic or industrial noise. Data processing and interpretation are further challenged by the sheer volume of acoustic data generated, the need for standardized protocols, the requirement to filter out non-biological sounds to avoid misinterpretation, and the essential development and deployment of Artificial Intelligence of Things (AIoT). Additionally, the effectiveness of ecoacoustic indices can vary across different urban contexts, necessitating methodological refinement and the integration of habitat features, such as vegetation structure, to improve assessment accuracy.

4.1 Limitations and future research

A bibliometric study, while valuable for uncovering trends, quantifying scholarly output, and pinpointing research themes, face several limitations. Firstly, it is a cross-sectional study, indicating that the data were collected at a specific moment of time. Given the consistent increase in the number of publications (Chung & To, 2025; To & Yu, 2023), the results of bibliometric studies conducted at different times can differ. Secondly, bibliometric analyses are contingent upon the chosen database(s), which may not encompass the entire range of research activities and policy documents. Consequently, future research could investigate the same document search utilizing other academic databases such as Web of Science and Dimensions, as well as other policy databases like Policy Commons and the ProQuest Policy File Index database. Lastly, a significant limitation of a bibliometric study is its dependence on particular search terms, which can greatly limit the coverage and comprehensiveness of the analysis. If the search term(s) are too narrow or fail to include relevant synonyms, alternative spellings, or related concepts, important literature may be omitted, leading to incomplete or biased results. Conversely, if the term(s) are excessively broad, the search may yield an overwhelming number of records, including irrelevant documents. This limitation highlights the importance of carefully defining search strategies to ensure that the dataset accurately represents the topic under study. In our case, we chose “ecoacoustic(s)” and “soundscape(s)” as the key search terms. Future studies might examine variations in search results and the subsequent co-occurrences of keyword analysis if “noise” is included as one of the key search terms.

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