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Collaborative governance in forestry issues: A bibliometric analysis with VOS viewer software using Scopus database

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Abstract

This study aims to analyse scientific literature on collaborative governance in forestry issues published from 2001 to 2022. To ensure paper quality, the study will use VOSviewer software to visualise the bibliometric analysis from Scopus Database. Bibliometric analysis was used to analyse 72 papers about collaborative governance in forestry issues. VOSviewer software visualised publishing trends, country/institution/author contributions, journal distribution, highly cited articles, bibliographic coupling analysis, and keyword analysis. According to the study, collaborative governance in forestry publications has increased considerably in the last decade. Most research on this issue comes from the US, Canada, and Australia. Colorado State campus was the study's most affiliated campus, followed by Saskatchewan and Oregon. This study was published in Land Use Policy, Society and Natural Resources, and Ecology and Society. The combination of bibliographies and keyword concurrency networks showed that collaborative governance in forestry issues is closely linked to sustainable development, environmental governance, and forest governance. The study finds that collaborative governance in forestry issues needs more research, especially with collaborative governance as a framework. The bibliometric analysis provides a complete overview of publishing trends, country/institution/author contributions, journal distribution and highly cited articles, bibliographic coupling analysis, and keyword analysis in this field. Researchers, policymakers, and practitioners interested in collaborative governance in forestry may profit from the study. The results may identify key contributors, influential journals, and critical study areas linked to this topic.

Keywords: Bibliometric analysis, Collaborative governance, Forestry, Governance, Scopus database, VOS viewer.

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Transparency: The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
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1. Introduction

Collaborative governance is a theory derived from governance theory. Academics and practitioners also focus on governance processes that blur public, private, and community boundaries in response to the interconnected challenges that governments now face [1]. Collaboration between the community, the private sector, and the government eases the state's burden in providing the community's goods, services, and welfare [2]. Collaborative governance is one of the main approaches to grasping this shift. Collaboration can be defined as a situation where a group of autonomous stakeholders from different sectors engages in an interactive process [3] In recent decades, collaborative governance has become increasingly

prevalent and visible in environmental and natural resources management as an alternative to traditional forms of environmental governance. It has emerged in diverse arenas, including water management, ecosystem restoration, forest management, land use, and open-space protection [4].

I have observed an increased use of collaborative governance theory in analysing various social phenomena over the last two decades [5]. Collaboration among multiple actors is often discussed in debates about forest governance. However, little consideration is devoted to how the more complex arrangements necessary for collaboration to function actually come into existence and develop a life of their own. Forests, as critical ecosystems that help mitigate global warming, are managed collaboratively in many countries. In Australia, collaborative governance is embodied in community forest management (CFM) in managing forests [6]. In Canada and India, collaborative governance is seen as a way to protect the rights of indigenous people [7]. In the United States, collaboration and large-scale landscape restoration on federal forestlands are facilitated through the Collaborative Forest Landscape Restoration Program (CFLRP), which was established in 2009 to accelerate the pace and size of forest restoration [8]. In Nigeria, an inclusive and collaborative forest governance framework is expected to encourage local communities to assume greater responsibilities and make deeper commitments to forest management [9]. Consequently, collaborative governance is often considered as a viable approach to forest management challenges in various countries.

This article analyses the bibliometrics of various published articles on collaborative governance in forestry issues. The study aims to analyse the bibliographic characteristics and content of papers written by authors from various countries researching collaborative governance in forestry issues from 2001 to 2022. Data for this study were gathered from the Scopus database to ensure the inclusion of high-quality articles.

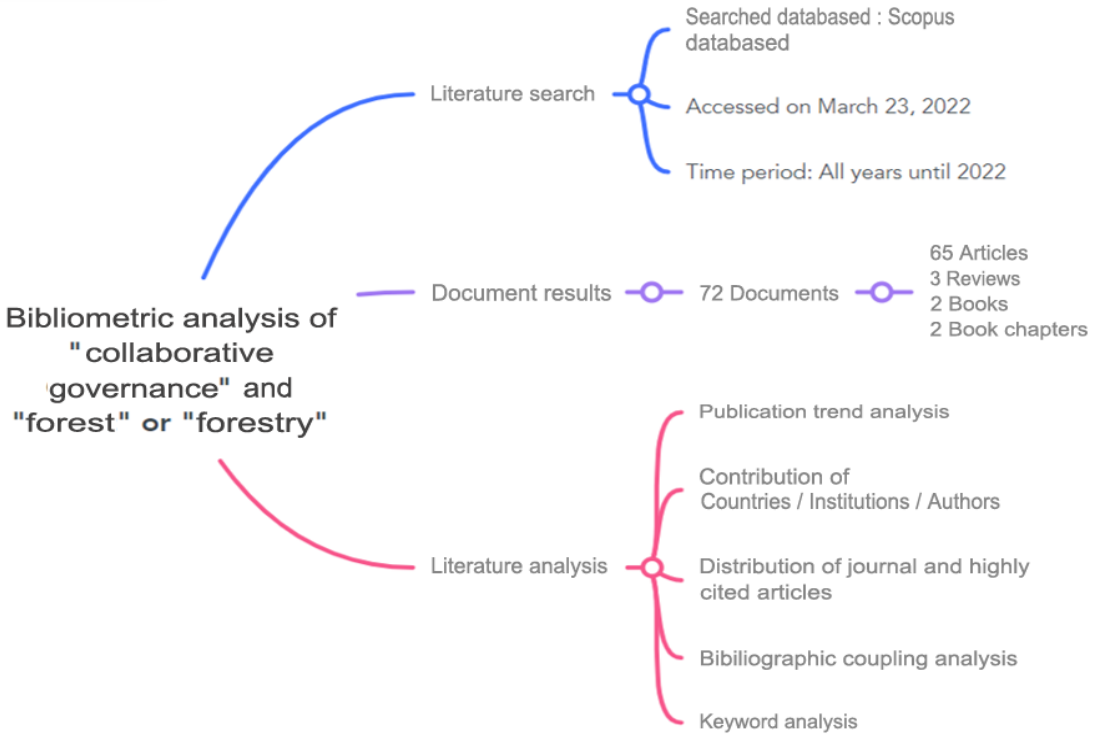

Figure 1.
The flow of the whole research process in this article.

Figure 1 illustrates the flow of the whole research process in this article.

2. Methodology

This research is a bibliometric analysis that uses data from the Scopus database and the VOS viewer application to assist in interpreting the gathered bibliometric data. On March 23, 2022, bibliometric data was extracted from the Scopus database. The study employed a technique involving the use of Boolean operators (TITLE-ABS-KEY ("Collaborative Governance") AND TITLE-ABS-KEY ("Forest") OR TITLE-ABS-KEY ("forestry")). Using this search strategy, 72 documents were identified that contained the keywords "Collaborative governance," "Forest," and "Forestry." Among the 72 documents, there were 65 articles, three reviews, two books, and two book chapters. Following that, a bibliometric study using the VOS viewer software was performed. The bibliographic data include the year of publication, affiliations, authors and co-authors from other nations, journals, keywords, and citations.

3. Result and Discussion

3.1. Publication Trend

It can be observed in Figure 2 that the first-time research on collaborative governance with forestry as the subject of analysis was published in 2001. Brown AJ was the first to publish his article on this topic [10], [11]. He published it

consecutively in 2001 and 2002. In 2001 his article entitled "Beyond public native forest logging: National Forest Policy and Regional Forest Agreements after South East Queensland," was published in Environmental and Planning Law Journal 18(2), pp. 189-210. In 2002 he republished the article in Environmental Science and Policy 5(1), pp. 19-32, under the title "Collaborative governance versus constitutional politics: Decision rules for sustainability from Australia's South East Queensland Forest agreement." Both articles present an analysis of collaborative governance in forest management in South East Queensland, Australia. After the publication of these two articles by Brown A.J., there was a gap of up to 4 years before further articles on this topic were published. Another publication of articles on this topic occurred in 2006.

As shown in Figure 2, there were no publications related to collaborative governance in forestry issues in 2003, 2004, 2005, 2007, 2008, and 2011. However, there has been a significant increase in the last decade. It started with 2 publications in 2012, experienced fluctuations until 2018, and then slowly increased in the following years until it reached 13 publications in a year in 2021. At the time of data collection on March 23, 2022, there were no publications on collaborative governance in forestry issues. It can be concluded that research using a collaborative governance framework in forestry issues has experienced a significant spike in the last ten years. The trend indicates that the visibility of publications on this topic was relatively low from 2001 to 2011. However, the publication trend has been quite promising in the last decade (2012-2022).

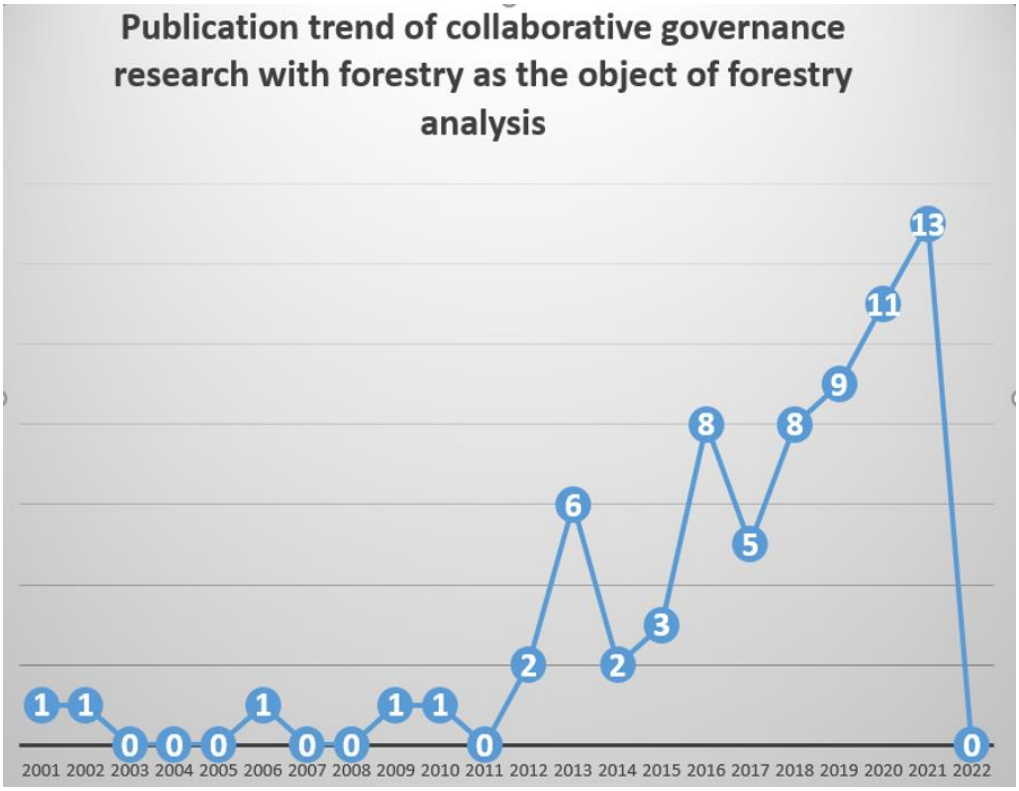

Figure 2.
Publication trend of collaborative governance research in forestry issues.

3.2. Author Contributions by Country of Origin and Their Affiliations

Based on the metadata obtained from the Scopus database, authors from 39 countries have authors published on collaborative governance in forestry issues. Figure 3 shows the eight countries with the highest number of authors. The United States has the most author affiliations, with 22 papers (15.84%), followed by Canada with 14 papers (10.08%). Australia and the Netherlands come next, each with eight papers (each 5.76%). Sweden occupies the fifth position with seven papers (5.04%), followed by Germany with six papers (4.32%), Indonesia with five papers (3.6%), and the United Kingdom with four papers (2.88%).

Table 1 shows the top eight author affiliation institutions conducting research on "collaborative governance in forestry issues." Colorado State University leads in terms of the number of Scopus-indexed papers, producing nine papers. However, when considering the quality of the paper as measured by total citation per paper, the United States Department of Agriculture (USDA) Forest Service ranks first with a collaboration score of 4, which indicates that each paper is collaboratively written by at least four authors. In terms of paper quality based on total citations per paper, the University of Oregon ranks highest with an average of 17.6 citations per paper.

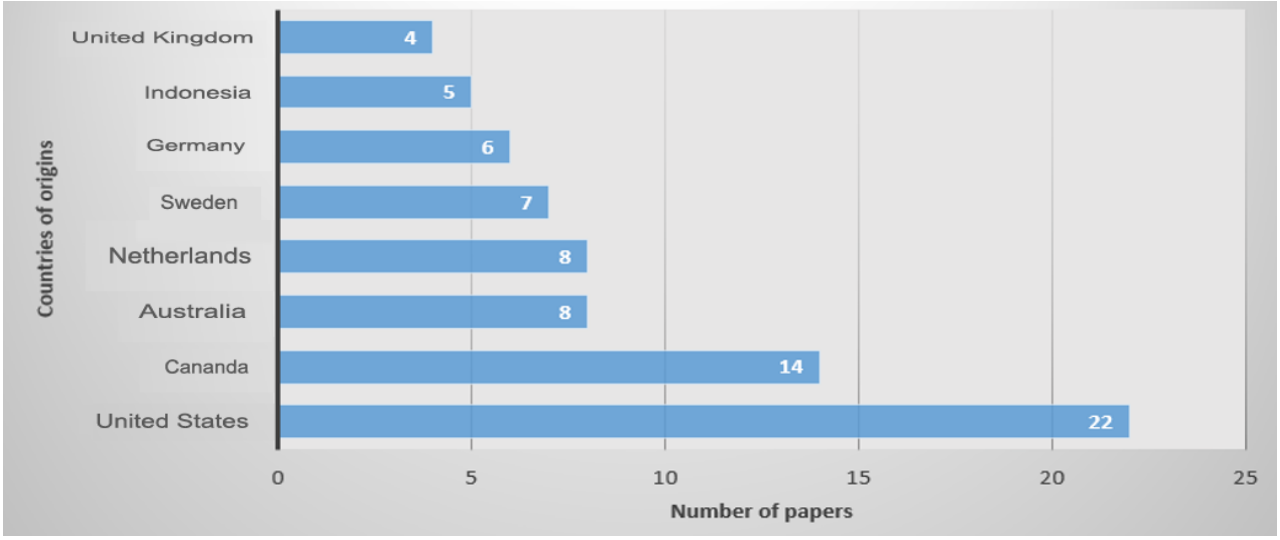

Figure 3.
Top 8 countries of origin of authors who publish collaborative governance in forestry issues.

Table 1.
Top 8 author affiliation institutions researched collaborative governance in forestry issues.

Rank	Institutions	Total paper	Total authors	Total citation
1st	Colorado state university	9	18	129
2nd	University of Saskatchewan	6	15	69
3rd	University of Oregon	5	15	88
4th	Wageningen University & research	4	10	88
5th	University of Manitoba	4	6	27
6th	Umeå Universitet	4	3	52
7th	Center for international forestry research, West Java	4	9	36
8th	USDA forest service	3	12	40

Table 2.
Top 8 authors researching collaborative governance in forestry issues based on the number of published papers.

Rank	References	Institutions	Number of papers	Number of citations	Quality of paper
1st	[8, 12-16]	Colorado State University, Fort Collins, United States	6	80	13.33
2nd	[17-20]	University of Saskatchewan, Saskatoon, Canada	4	16	4
3rd	[21], [22]	Colorado State University, Fort Collins, United States	3	18	6
4th	[13-15]	University of Oregon, Eugene, United States	3	33	11
5h	[14-16]	University of Oregon, Eugene, United States	3	40	13.33
6th	[19], [23], [24]	University of Manitoba, Winnipeg, Canada	3	16	5.33
7th	[23-27]	Dalhousie Faculty of Management, Halifax, Canada	3	17	5.67
8th	[26], [27]	Sveriges Lantbruks Universitet, Uppsala, Sweden	2	12	6

Based on the Scopus database, there are 164 authors who collaborate with colleagues on research related to collaborative governance in forestry issues. Table 2 shows the top 8 authors with the highest number of publications on this theme. Leading the list is Schultz, C.A. from Colorado State University, Fort Collins, United States, who has published six papers. Reed, M.G. from the University of Saskatchewan, Saskatoon, Canada, holds the second position with four papers. The third to seventh are occupied by Cheng, A.S. (Colorado State University, Fort Collins, United States), Huber-Stearns, H.R. (University of Oregon, Eugene, United States), Moseley, C. (University of Oregon, Eugene, United States), Sinclair, AJ (University of Manitoba, Winnipeg, Canada), (Dalhousie Faculty of Management, Halifax, Canada), each with three papers. In eighth place is Angelstam from Sveriges lantbruksuniversitet, Uppsala, Sweden, with two published papers. When

considering the quality of the paper based on total citations per paper, Schultz, (Colorado State University, Fort Collins, United States) and Moseley, C. (University of Oregon, Eugene, United States) are the top-ranked authors with a score of 13.33

3.3. Distribution of Journals and Highly Cited Articles

There have been 72 papers published on collaborative governance in forestry issues across 51 sources from 2001 to 2022 (March). Table 3 presents the Top 8 sources of "Collaborative governance in forestry issues" based on several publications. Land Use Policy and Society and Natural Resources occupy the first and second positions, respectively, with four papers each. Ecology and Society, Environmental Management, Environmental Science and Policy, and the Journal of Environmental Management rank third, fourth, fifth, and sixth, with several published papers each. Ambio and the Canadian Journal of Forest Research hold the seventh and eighth positions, with two published papers each.

Table 3.
Top 8 sources of collaborative governance in forestry issues based on several publications.

Rank	Source title	CiteScore (2020)	The Scimago journal rank (SJR) (2020)	Source normalized impact per paper (SNIP) (2020)	Number of papers	Number of citations
1st	Land use policy	7.5	1.668	1.908	4	44
2nd	Society and natural resources	3.9	0.816	1.208	4	37
3rd	Ecology and society	7.2	1.528	1.501	3	49
4th	Environmental management	5.1	0.886	1.209	3	36
5th	Environmental science and policy	8.4	1.716	1.759	3	61
6th	Journal of environmental management	9.8	1.441	1.888	3	36
7th	Ambio	9	1.564	1.937	2	24
8th	Canadian journal of forest research	3.6	0.677	0.885	2	10

Out of 72 papers on collaborative governance in forestry issues, there have been a total of 782 citations. Thus, the average citation per paper can be rounded to 11. Among these 72 papers, Table 4 displays the top eight papers based on the number of citations they have received. The article titled "Impacts of nonstate, market-driven governance on Chilean forest," written by Heilmayr and Lambin [28] holds the first position with a total of 60 citations. Following that, in the second place is the paper titled "Participatory mapping to identify indigenous community use zones: Implications for conservation planning in Southern Suriname" by Ramirez-Gomez, et al. [29]. The third-ranked paper is “Engaging women and the poor: Adaptive collaborative governance of community forests in Nepal” by McDougall, et al. [35].

3.4 Bibliographic Coupling Analysis

This form of analysis covers bibliographic patterns from one article referenced by two additional articles [36]. The objective of bibliographic coupling is to provide a more accurate understanding of the research issue under current settings [37]. This bibliographical amalgamation examines three elements of study, namely documents, article sources, and organizations.

Figure 4 shows the results of bibliographic coupling on the network of collaborative governance in forestry issues, represented by documents organized into seven clusters. Among these clusters, four clusters have the most significant nodes, namely cluster 1 (red), cluster 2 (Green), Cluster 4 (Yellow), and cluster 5 (Purple). In cluster 1 (red), two articles received the most citations, namely "Participation and deliberation in Swedish forest governance: The process of initiating a National Forest Program" by Johansson [34] and "Participatory mapping to identify indigenous community use zones: Implications for conservation planning in southern Suriname" by Ramirez-Gomez, et al. [29]. These two articles have had a significant influence on many other articles in the field.

Moving on to cluster 2 (green), three articles were cited the most and have also influenced the writing of other articles. These three articles are "Impacts of non-state, market-driven governance on Chilean forests" by Heilmayr and Lambin [28] , "From target to implementation: Perspectives for the international governance of forest landscape restoration" by Pistorius and Freiberg [33] and "Identifying governance gaps among interlinked sustainability challenges" by Bergsten, et al. [38].

In addition, cluster 4 (yellow) contains one paper that has received the most citations and is interconnected with other papers. The title of the paper is "Community forestry: Local values, conflict, and forest governance" by Bullock and Hanna [39].

Lastly, in cluster 5 (purple), two articles have been cited the most and have influenced other papers in the cluster. These articles are "Social capital, conflict, and adaptive collaborative governance: Exploring the dialectic" by McDougall and Banjade [30] and "Engaging women and the poor: Adaptive collaborative governance of community forests in Nepal" by McDougall, et al. [40].

Table 4.
Top 8 articles on collaborative governance in forestry issues with the most citations.

Rank	Title	Author (Year)	Source title	Document Type	Total Citation
1st	Impacts of nonstate, market-driven governance on Chilean forests	Heilmayr and Lambin [28]	Proceedings of the National Academy of Sciences of the United States of America	Article	60
2nd	Participatory mapping to identify indigenous community use zones: Implications for conservation planning in southern Suriname	Ramirez-Gomez, et al. [29]	Journal for Nature Conservation	Article	38
3rd	Engaging women and the poor: Adaptive collaborative governance of community forests in Nepal	McDougall and Banjade [30]	Agriculture and Human Values	Article	38
4th	Collaborative governance versus constitutional politics: Decision rules for sustainability from Australia's South East Queensland forest agreement	Brown [11]	Environmental Science and Policy	Article	34
5th	Accountability in Networked Governance: Learning from a case of landscape-scale forest conservation	Jedd and Bixler [31]	Environmental Policy and Governance	Article	33
6th	The success of SEA in the Dutch planning practice. How formal assessments can contribute to collaborative governance	Van Buuren and Nooteboom [32], Pistorius and Freiberg [33]	Environmental Impact Assessment Review	Article	33
7th	From target to implementation: Perspectives for the international governance of forest landscape restoration	Pistorius and Freiberg [33], Heilmayr and Lambin [28]	Forests	Article	32
8th	Participation and deliberation in Swedish forest governance: The process of initiating a National Forest Program	Johansson [34]	Forest Policy and Economics	Article	28

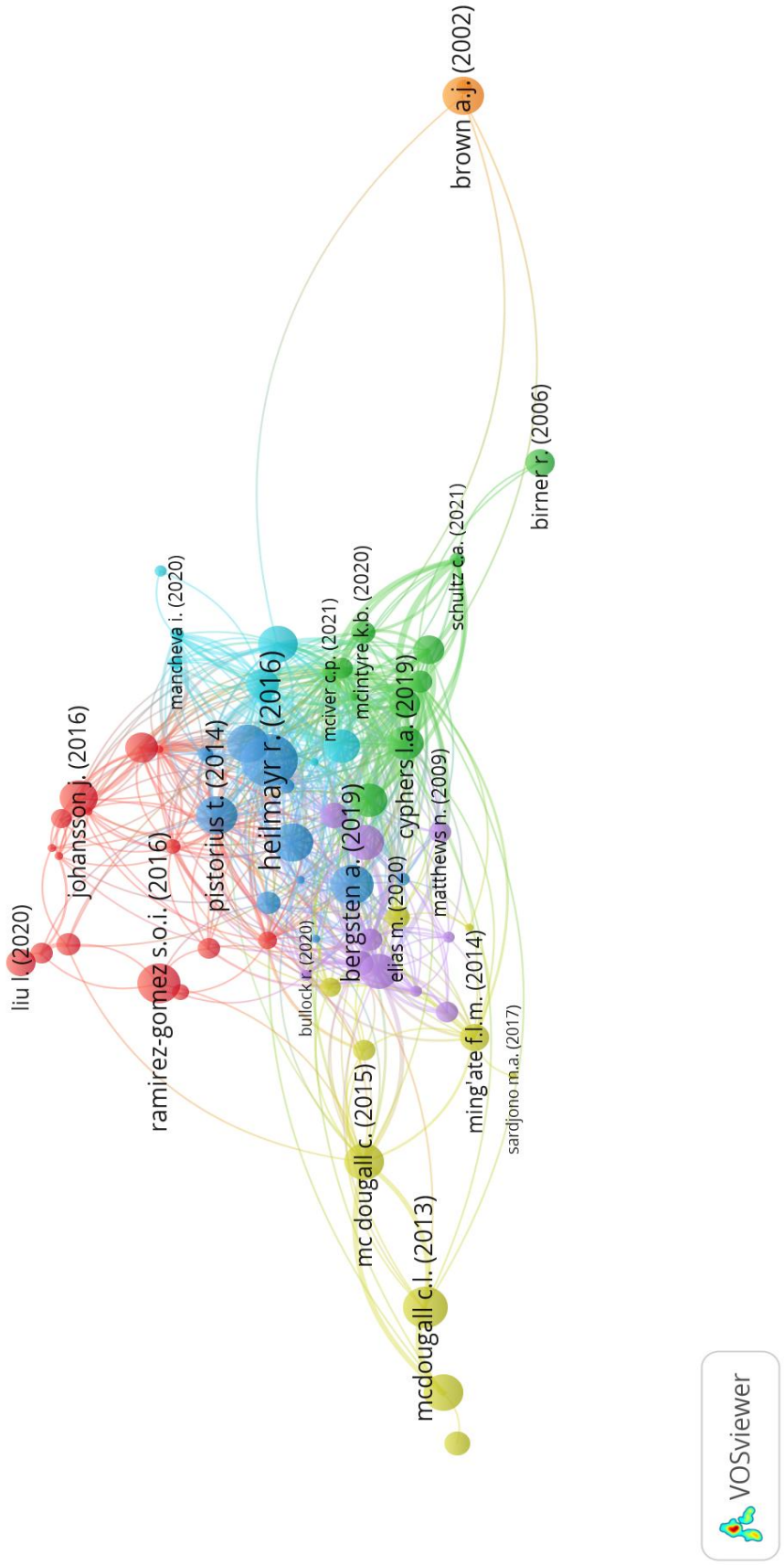

Figure 4.
Bibliographic coupling analysis on the network of collaborative governance in forestry issues by documents.
Note: Schultz, et al. [15]; Liu, et al. [41]; Johansson [34]; Ramirez-Gomez, et al. [29]; Mancheva [42]; Pistorius and Freiberg [33]; Heilmayr and Lambin [28]; Bullock, et al. [25]; McIntyre and Schultz [8]; McIver and Becker [43]; Bergsten, et al. [38]; McDougall and Banjade [30]; McDougall, et al. [35]; Elias, et al. [44]; Cyphers and Schultz [12]; Birner and Wittmer [45]; Matthews and Missingham [6]; Ming'ate, et al. [46]; Sardjono and Inoue [47]; Brown [11].

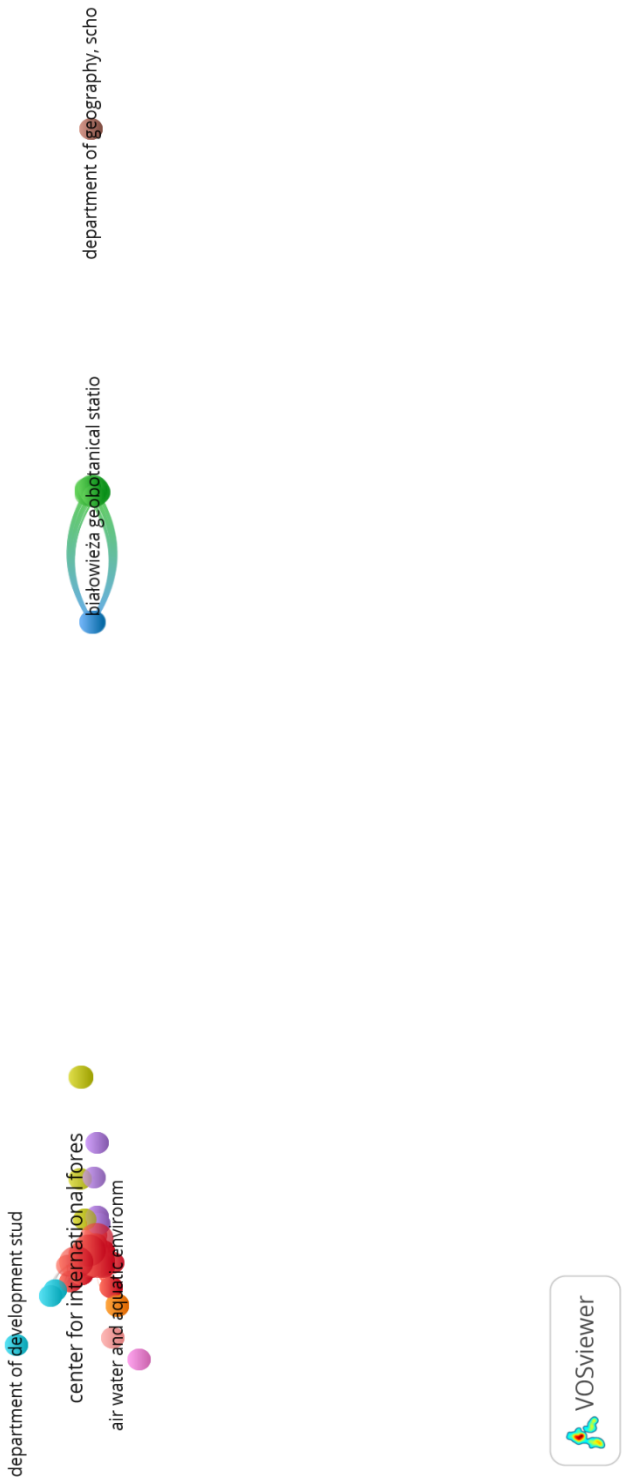

Figure 5.
Bibliographic coupling analysis on the network of collaborative governance in forestry issues by organizations.

Figure 5 describes the Bibliographic coupling analysis of collaborative governance networks on forestry issues by organisations.

In the case of the "collaborative governance in forest issues" network, the bibliographic coupling analysis has identified ten clusters, each comprising a collection of publications that shared references. These clusters represent various areas of research pertaining to issues of collaborative governance in forestry. Among these clusters, cluster 1 (red) stands out as the most prominent, containing 102 organisational affiliations of authors who have contributed to publications on collaborative governance in forestry issues. This indicates that researchers and organisations have paid considerable attention to this area of study. Cluster 2 (green) also contains 24 author affiliations with organisations, although smaller than cluster 1, this cluster represents a substantial body of research on collaborative governance in forestry issues.

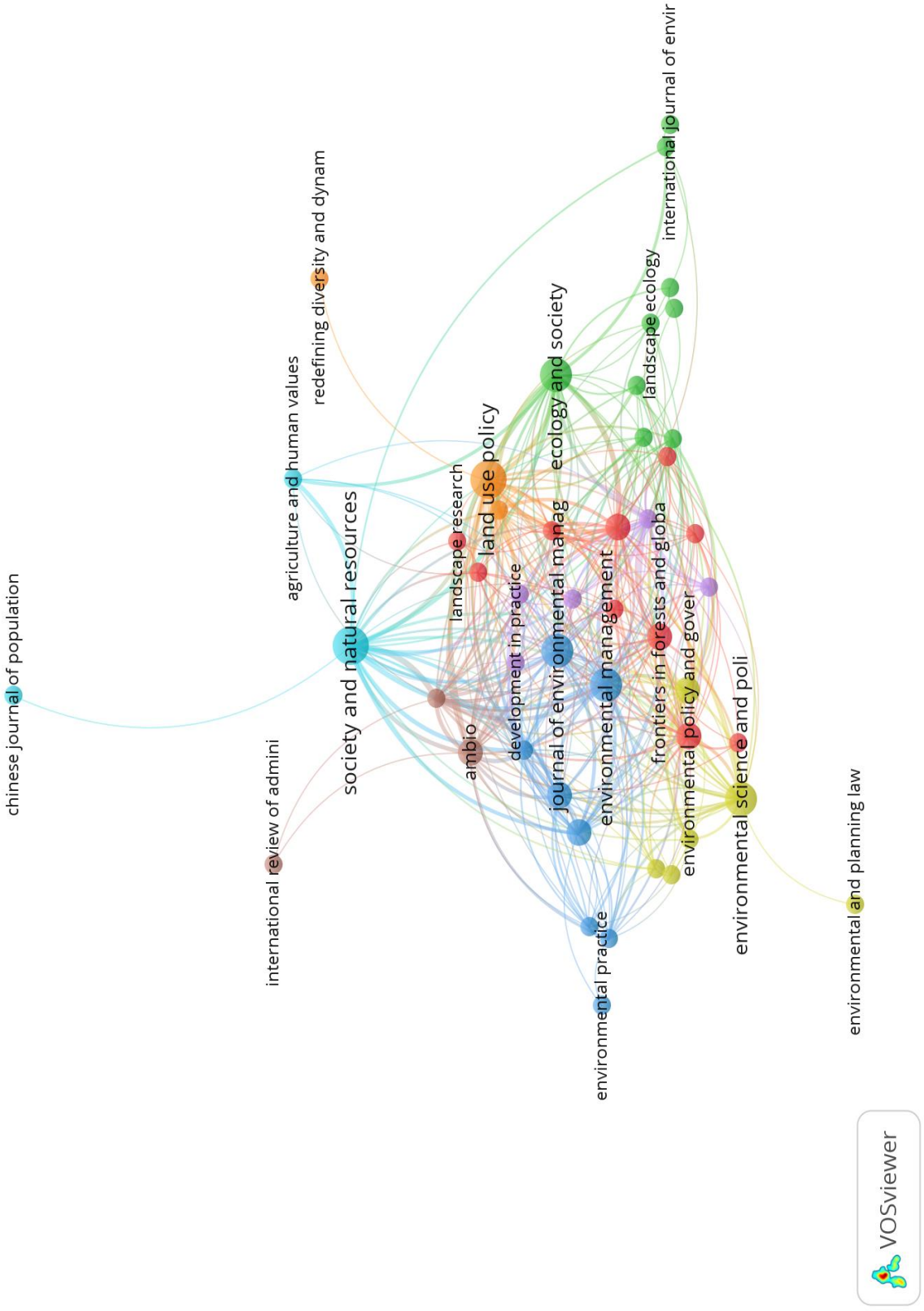

Figure 6.
Bibliographic coupling analysis on the network of collaborative governance in forestry issues by sources.

In the case of the "collaborative governance in forestry issues" network, the bibliographic coupling analysis has identified eight clusters of publications, as shown in Figure 6, based on their sources. These clusters represent distinct areas of research pertaining to issues of collaborative governance in forestry, and each cluster comprises of a collection of publications that share common sources. The fact that almost every cluster contains nodes that are not affected by the others suggests that the sources of publications on collaborative governance in forestry issues form interconnected networks, without any single source dominating the field. This indicates that the research in this field is spread across multiple sources, with each source contributing to its development in its own unique way. This discovery has significant ramifications for researchers and practitioners in the field of collaborative governance in forest issues. It suggests that a variety of sources contribute to the body of knowledge in this field, and it is essential to consider multiple sources when researching this topic. In addition, it emphasizes the need for interdisciplinary approaches that leverage the strengths of different sources to advance the understanding of the field.

3.5 Keyword Analysis

Author keywords are essential indicators of the main topics addressed in scientific articles. They provide insight into the structure of a research field and assist researchers in identifying the areas of research that are of most interest to authors. In the case of the "collaborative governance in forestry issues" network, the analysis of author keywords has revealed 263 keywords grouped into 26 clusters.

Cluster 1 (red) contains 17 nodes, with keywords such as governance, policy, landscape ecology, Baltimore, community uses zones, and ecosystem services being the most prominent. This indicates that research in this cluster focuses on the governance and policy aspects of collaborative governance in forestry issues, with an emphasis on landscape ecology and community use zones.

Cluster 2 (green) consists of 17 nodes, with keywords like environmental governance and sustainable development being the most prevalent. This cluster highlights the importance of sustainable development in this field, as it concentrates on the environmental aspects of collaborative governance in forestry issues.

Cluster 3 (dark blue) contains 16 nodes, with dominant keywords including social learning, evaluation, jurisdictional approach, deforestation, and certification. This cluster focuses on the significance of social learning, evaluation, and certification in collaborative forest governance, with a particular emphasis on the jurisdictional approach and deforestation.

Cluster 4 (yellow) consists of 16 nodes, with keywords such as Canada, law, India, and first being the most prevalent. This cluster emphasises the legal and policy aspects of collaborative forest governance, with an emphasis on Canada and India.

Cluster 5 (purple) 15 nodes comprise the keywords livelihoods, Nepal, gender, and British Columbia. This cluster emphasises the social and economic aspects of collaborative forest governance, particularly highlighting livelihoods, gender, and cases from British Columbia and Nepal.

Cluster 6 (light blue) comprises 13 nodes, with forest management being the most prominent keyword. This cluster highlights the significance of forest management in collaborative forest governance, with an emphasis on sustainable forest management.

Cluster 7 (orange) comprises 12 nodes, with forest policy, Estonia, and fire management as the predominant keywords. This cluster emphasizes the importance of forest policy and fire management in collaborative forest governance, particularly in the context of Estonia.

Cluster 8 (brown) contains 11 nodes, with co-management, Kenya, collaborative natural resources, and Arabuko Sokoke Forest as the most prominent keywords. This cluster highlights the significance of co-management and collaborative natural resource management in Kenya, with a specific focus on the Arabuko Sokoke Forest.

Lastly, cluster 12 (black) contains the most prominent keyword, collaborative governance, and has a significant connection to keywords in other clusters. This indicates that collaborative governance is a central concept that connects various aspects of research on collaborative governance in forest issues.

In conclusion, the analysis of author keywords in the network of "collaborative governance in forestry issues" provides valuable insights into the field's most important topics and themes. It assists researchers in identifying the areas of research that authors are most interested in and the relationships between various topics and themes.

Figure 7 provides a visual representation of the network and occurrence of keywords in collaborative governance in forestry issues.

Figure 8 presents a keyword co-occurrence overlay of collaborative governance in forestry issues. The visualisation is divided into two sections: the left side displays the keyword network, while the right side depicts a timeline signifying the research period. In the network, nodes represent keywords, and connections between nodes indicate the co-occurrence of keywords within the same publication. The colour of the network nodes indicates the frequency and recency of the keyword's appearance in the literature.

The degree of purple in a node indicates that extensive research has been conducted on that keyword over an extended period of time. On the other hand, the degree of yellow in a node suggests that the research on that keyword is more recent. The legend in the lower right corner of the visualisation explains the time range for each color, enabling the viewer to quickly comprehend the temporal distribution of the keyword research. For example, keywords such as “Black Sea region”, “comprehensive river management”, “fire management”, “Estonia”, “forest policy”, “Argentina”, and “dialogue process” represent relatively new research areas, as they have emerged between 2020 and 2022. In contrast, “sustainable development”, “livelihoods”, “Nepal”, and "Arabuko Sokoke Forest” have been the subject of extensive research during the

period from 2014 to 2016. The visualization of the keyword co-occurrence overlay in Figure 8 serves as a valuable tool for researchers to gain insights into the temporal distribution of research on collaborative governance in forestry issues.

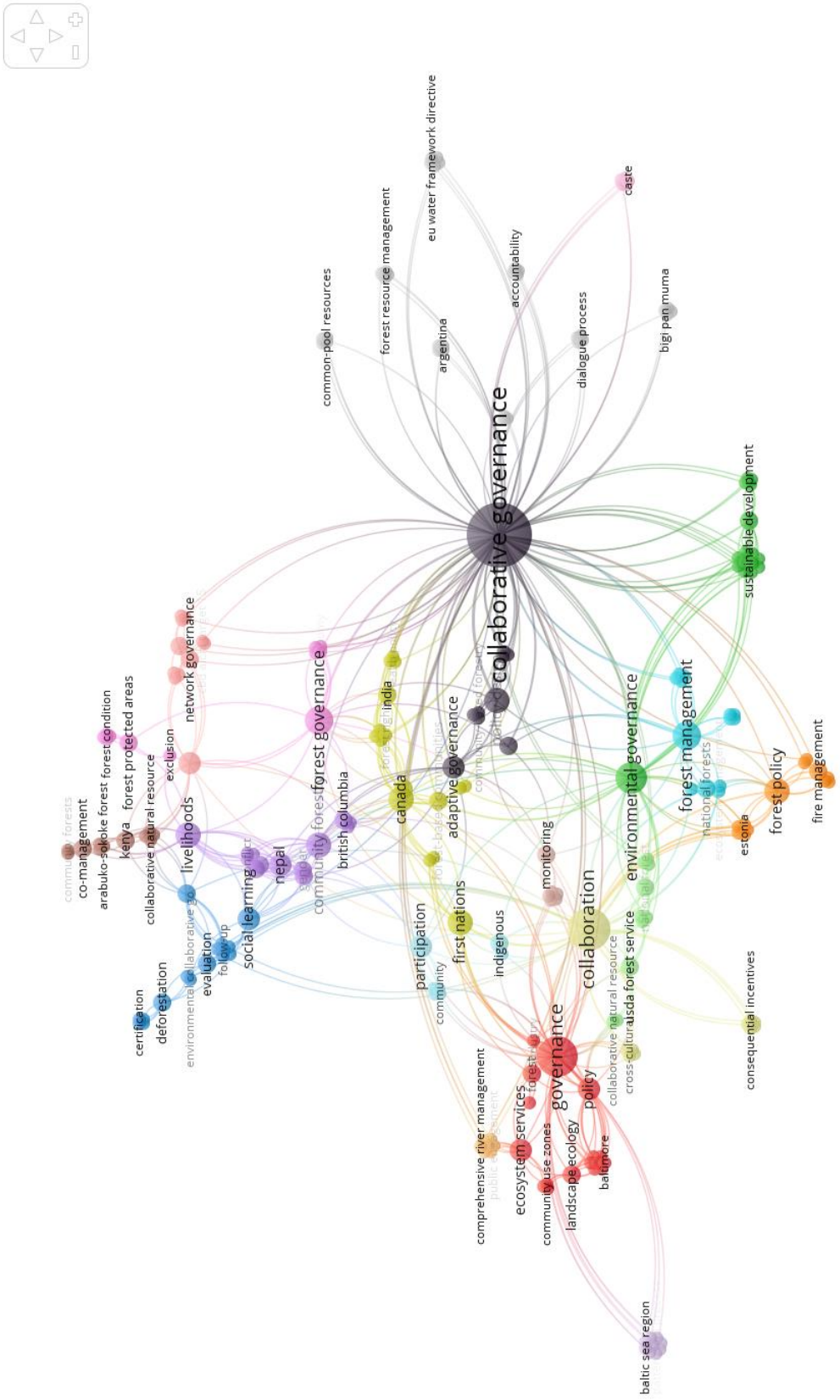

Figure 7.
Keyword co-occurrence network visualization of collaborative governance in forestry issues.

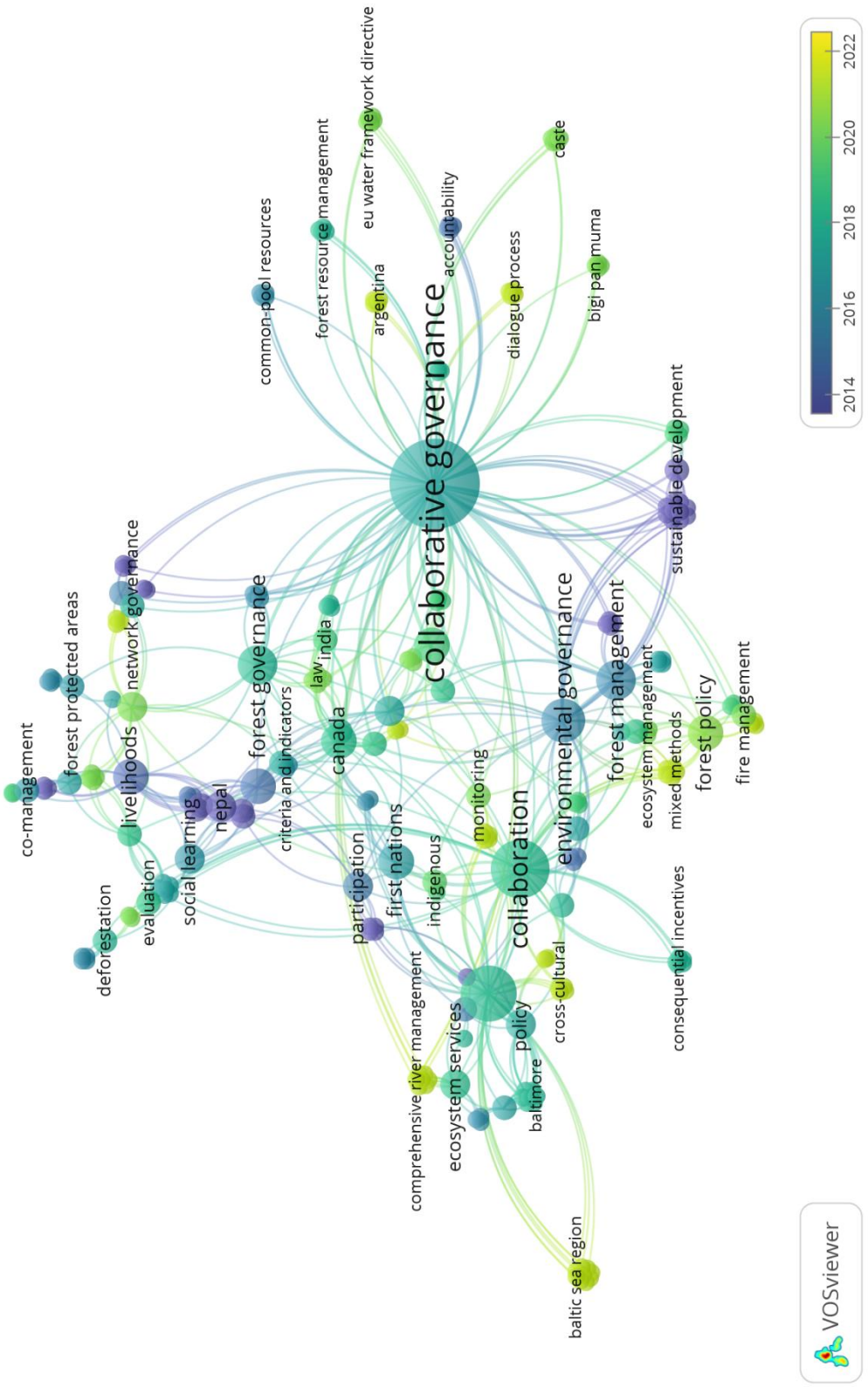

Figure 8.
Keyword co-occurrence overlay visualization of collaborative governance in forestry issues.

4. Limitation of Study

The statement acknowledges that the bibliometric analysis in this study is restricted to the Scopus database. Scopus is a comprehensive database that provides extensive coverage of scholarly literature, but it does not include all available bibliometric data. Consequently, it is conceivable that some pertinent research publications were omitted from this analysis. This limitation highlights the need to conduct bibliometric analyses using multiple databases to gain a complete understanding of the research field. By incorporating additional databases such as Web of Science and Google Scholar, further insights into the research trends and patterns associated with collaborative governance in forestry matters could be gained. In conclusion, despite the fact that this study's bibliometric analysis provides vital insights into the research field of collaborative governance

in forest issues, it is important to note that it is limited to the Scopus database. Future researchers can expand the scope of bibliometric analyses and provide more comprehensive insights by utilising additional databases.

5. Conclusion

This study provides an overview of the development of research on collaborative governance in the forestry sector by various authors worldwide. There has been a noticeable increase in the number of Scopus indexed publications in this field over the past decade. This indicates that collaborative governance theory is increasingly being applied to address forestry issues, especially forestry management across different countries. The presence of 72 documents in the Scopus database also shows that there are still numerous potential opportunities to study forestry issues for further research on forestry issues from a collaborative governance perspective.

Furthermore, this study reveals that the United States has the highest number of author affiliations compared to other countries, followed by Canada and Australia. The research on collaborative governance in forestry issues is predominantly published in the Platform research, making it a valuable reference for other researchers interested in publishing on collaborative governance, specifically in the context of forestry issues.

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