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A Bibliometric Study of Organic Farming Research with a Focus on Global Collaboration, Main Themes, and Future Research Directions for the Period 2005–2024

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ABSTRACT

This study presents a comprehensive bibliometric analysis of global research on organic farming published between 2005 and 2024. Using data retrieved from the Scopus database and analyzed through VOSviewer, the study maps publication trends, international collaboration networks, institutional linkages, and thematic structures within the field. The results indicate a significant increase in research output over the past two decades, reflecting the growing importance of organic farming within global sustainability discourse. Collaboration analysis reveals that research leadership remains concentrated in North America and Europe, particularly in the United States, Germany, the United Kingdom, and Italy, although developing countries are increasingly integrated into international research networks. Keyword co-occurrence and overlay visualizations show that organic farming research is strongly anchored in themes such as biodiversity, ecosystem services, climate change, carbon sequestration, and food security. Over time, the research focus has shifted from conservation and land-use concerns toward climate resilience, greenhouse gas mitigation, and smallholder livelihoods. Despite this progress, gaps remain in areas related to policy innovation, market governance, digital transformation, and economic scalability. Overall, the findings demonstrate that organic farming research has matured into an interdisciplinary and globally interconnected field that plays a strategic role in advancing sustainable agricultural systems.

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1. INTRODUCTION

Organic farming has emerged as one of the most significant agricultural paradigms in response to global environmental degradation, biodiversity loss, soil fertility decline, and food safety concerns. Since the early 2000s, increasing awareness of the negative externalities associated with conventional agriculture—such as excessive chemical fertilizer use, pesticide contamination, greenhouse gas emissions, and soil erosion—has encouraged policymakers, researchers, and practitioners to explore alternative production systems [1]. Organic farming, characterized by ecological balance, biodiversity conservation, and reduced reliance on synthetic inputs, is widely considered a sustainable approach that aligns agricultural productivity with environmental stewardship. Between 2005 and 2024, the

global organic market has expanded substantially, accompanied by a rapid increase in scientific publications examining agronomic performance, environmental impacts, certification systems, consumer behavior, and policy frameworks related to organic agriculture [2], [3].

The growth of organic farming research has been driven not only by environmental concerns but also by shifting consumer preferences and market dynamics. Rising demand for chemical-free and sustainably produced food products has encouraged countries across Europe, North America, Asia, and Oceania to promote organic agriculture through subsidies, certification schemes, and research funding. Consequently, academic institutions and research centers worldwide have intensified collaboration to investigate soil health, nutrient management, pest control, crop rotation systems, and socio-economic dimensions of organic farming [3], [4]. Interdisciplinary integration (combining agronomy, environmental science, economics, rural development, and sustainability studies) has further diversified the research landscape. However, the rapid proliferation of publications makes it increasingly difficult to systematically understand how the field has evolved over time, which themes dominate scholarly discourse, and how global collaborations shape research directions [5].

Over the past two decades, scientific communication has become more globalized, with cross-country collaboration playing a crucial role in knowledge diffusion and innovation. International research networks contribute to the exchange of methodologies, comparative field experiments, and policy learning across different agroecological contexts [6]. Countries with strong organic markets have produced substantial scholarly outputs, while emerging economies have increasingly contributed to research focusing on smallholder farming systems and sustainable rural development. Yet, disparities in research productivity and collaboration intensity persist between developed and developing regions. Understanding patterns of global co-authorship, institutional partnerships, and country-level research contributions is essential for identifying knowledge hubs and collaboration gaps in organic farming research [7], [8].

In addition to collaboration patterns, thematic evolution constitutes a critical dimension of organic farming scholarship. Early studies often concentrated on soil fertility management, composting techniques, and yield comparisons between organic and conventional systems [9], [10]. Over time, research expanded toward ecosystem services, carbon sequestration, climate change mitigation, biodiversity enhancement, food quality, and consumer trust. More recently, digital technologies, precision organic farming, circular agriculture, and regenerative practices have begun to intersect with organic production systems. Such thematic diversification indicates that organic farming research is dynamic and responsive to broader sustainability challenges. However, without a systematic mapping approach, it remains unclear which themes have become central, which topics are emerging, and which research areas require further exploration.

Bibliometric analysis offers a robust methodological framework for quantitatively mapping scientific literature, identifying influential authors, institutions, journals, and countries, as well as uncovering thematic clusters and research trends. By analyzing large datasets from academic databases, bibliometric techniques can reveal co-authorship networks, keyword co-occurrence patterns, citation structures, and temporal evolution of research topics. In the context of organic farming research from 2005 to 2024, a bibliometric study can provide a comprehensive overview of global collaboration structures, dominant themes, and future research directions. Such an approach contributes not only to academic knowledge synthesis but also to strategic planning for policymakers, funding agencies, and researchers aiming to strengthen sustainable agricultural systems worldwide.

Despite the rapid growth of organic farming literature over the past two decades,

there is limited comprehensive bibliometric evidence that systematically maps global collaboration networks, identifies dominant and emerging research themes, and clarifies the trajectory of future research directions for the period 2005–2024. Existing studies often focus on specific subtopics—such as soil health or consumer behavior—without offering an integrated perspective of the entire research landscape. As a result, stakeholders lack a holistic understanding of how international collaborations influence knowledge production, which thematic clusters dominate the field, and where research gaps remain. Without such mapping, it becomes challenging to design strategic research agendas and foster equitable global partnerships in organic farming scholarship. This study aims to conduct a comprehensive bibliometric analysis of organic farming research published between 2005 and 2024.

2. METHOD

This study employed a bibliometric approach to systematically map and analyze global research trends in organic farming for the period 2005–2024. The bibliographic data were retrieved from the Scopus database, selected due to its comprehensive coverage of peer-reviewed journals, conference proceedings, and interdisciplinary research outputs. Scopus was chosen because it provides high-quality metadata, including author affiliations, country information, keywords, abstracts, citations, and references, which are essential for conducting co-authorship, co-occurrence, and citation network analyses. The search strategy was constructed using relevant keywords such as "organic farming," "organic agriculture," and related terms appearing in titles, abstracts, and author keywords. Inclusion criteria were limited to publications within the specified time frame (2005–2024), written in English, and categorized as articles or review papers to ensure consistency and academic rigor. After data cleaning—removing duplicates, incomplete records, and irrelevant documents—the final dataset was exported in CSV format for further analysis.

The bibliometric analysis was conducted using VOSviewer, a widely used software tool for constructing and visualizing bibliometric networks. VOSviewer enables the analysis of co-authorship networks (authors, institutions, and countries), keyword co-occurrence, citation analysis, and bibliographic coupling. In this study, co-authorship analysis was used to examine global collaboration patterns and identify leading countries and institutions in organic farming research. Keyword co-occurrence analysis was performed to detect major thematic clusters and explore the intellectual structure of the field. Citation and co-citation analyses were applied to identify influential publications and core knowledge foundations. Threshold values (e.g., minimum number of documents or citations) were determined to ensure clarity and reliability of the visualized networks. The strength of relationships between nodes was measured using total link strength, and clusters were automatically generated based on similarity measures within the VOSviewer algorithm. To analyze thematic evolution and emerging research directions, overlay visualization and density visualization features in VOSviewer were utilized. Overlay visualization enabled the identification of temporal trends by mapping the average publication year of keywords, thereby highlighting emerging topics and declining themes. Density visualization helped determine the concentration of research activity within specific thematic areas.

3. RESULT AND DISCUSSION

Co-Authorship Network

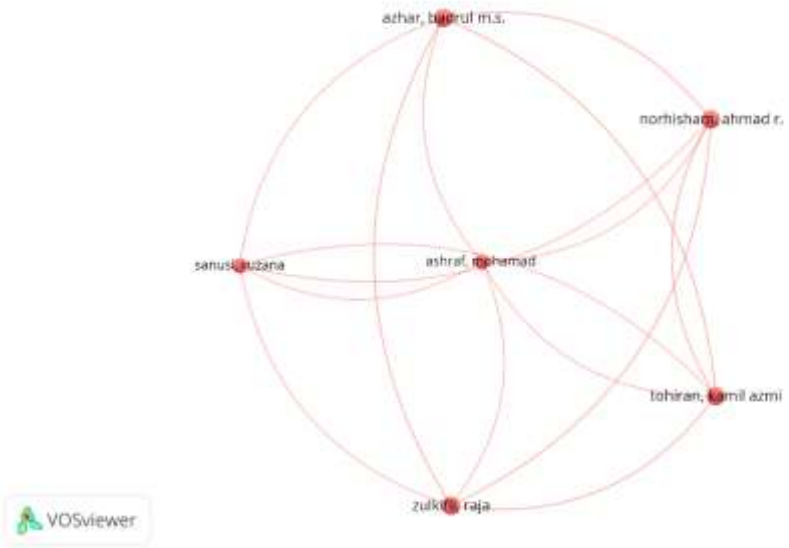

Figure 1. Author Visualization
Source: Data Analysis

Figure 1 shows a relatively small but tightly interconnected collaboration cluster among six authors. Ashraf Mohamad appears to occupy a central position in the network, acting as a key connector who collaborates with nearly all other authors, indicating a strong coordinating or leading role within this research group. Surrounding nodes such as Azhar, Badrul M.S., Norhisham, Ahmad R., Tohiran, Kamil Azmi, Zulkifli, Raja, and Sanusi, Ruzana are also interconnected, forming a dense web of collaboration rather than isolated pairings. The thickness and number of links suggest repeated or strong co-authorship relationships, particularly between Ashraf Mohamad and the other members. The circular structure of the network implies a cohesive research team, likely working within the same institution or collaborative project framework.

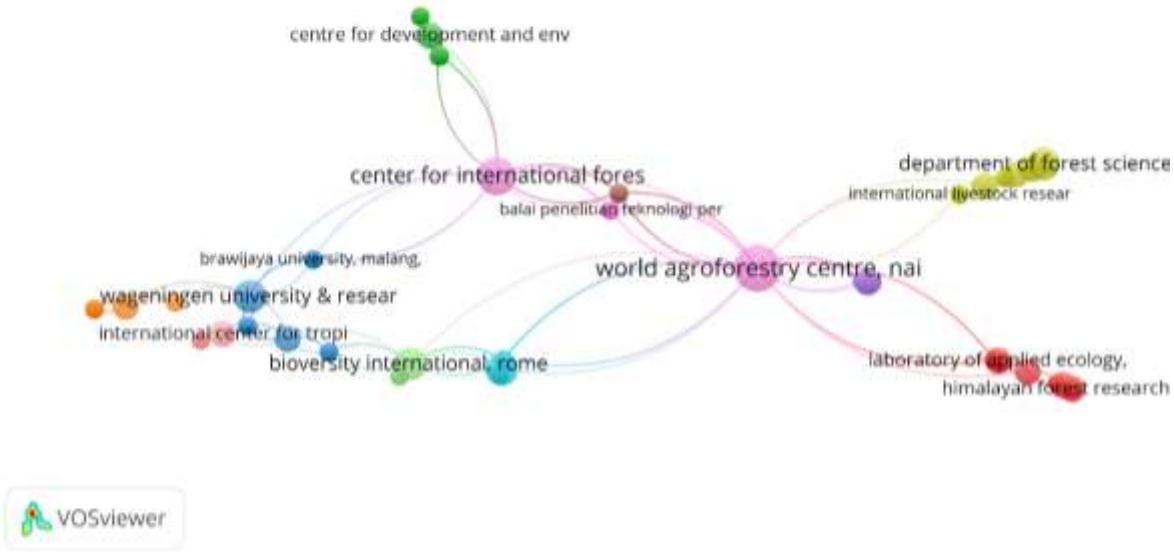

Figure 2. Institution Visualization
Source: Data Analysis

Figure 2 reveals that the World Agroforestry Centre (ICRAF) occupies the most central and influential position, acting as the primary hub connecting multiple research institutions across different clusters. It links strongly with institutions such as the Centre for International Forestry Research, Biodiversity International (Rome), and several Asian research bodies, indicating its pivotal role in facilitating global agroforestry research partnerships. On the left side of the network, European institutions such as Wageningen University & Research and Brawijaya University, Malang, form a collaborative subgroup connected through international research centers. On the right side, Asian institutions including a Department of Forest Science, International Livestock Research, and ecological laboratories are linked through ICRAF, suggesting regional specialization in forestry and applied ecology. The presence of multiple colored clusters reflects thematic and geographic sub-networks, yet the strong connecting lines toward ICRAF demonstrate that global organic and agroforestry research collaboration remains highly centralized around key international research organizations rather than being evenly distributed across institutions.

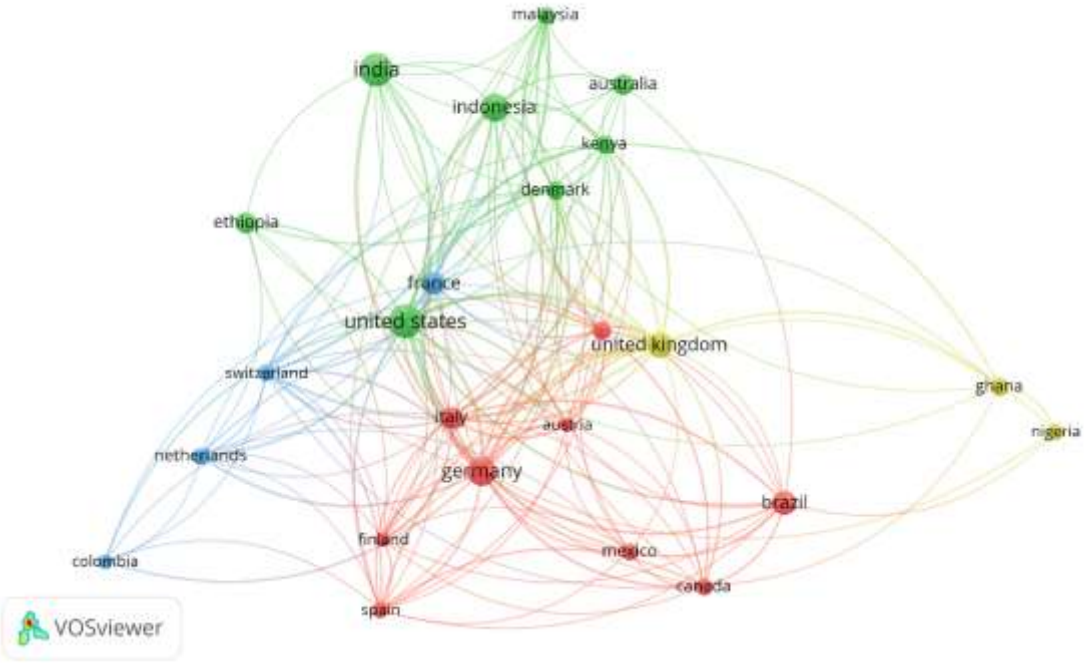

Figure 3. Country Visualization
Source: Data Analysis

Figure 3 llustrates a dense and globally interconnected research landscape in organic farming, with several dominant hubs. The United States, Germany, the United Kingdom, Italy, and India appear as central nodes, reflecting their strong publication output and extensive international collaboration. European countries, particularly Germany, Italy, Spain, France, Austria, Finland, and the Netherlands, form a tightly linked cluster, indicating intensive intra-European cooperation. Meanwhile, the United States connects broadly across Europe, Asia, and Africa, reinforcing its role as a global bridge in research partnerships. Emerging and developing countries such as Brazil, Mexico, Indonesia, Kenya, Ethiopia, Ghana, and Nigeria are also integrated into the network, often linked through collaborations with major Western research hubs. The clustering pattern suggests both regional collaboration blocs and cross-continental partnerships, highlighting that organic farming research between 2005 and 2024 is not geographically isolated but shaped by strong North–South and South–South knowledge exchanges, although leadership

remains concentrated in North America and Europe.

Keyword Co-Occurrence Analysis

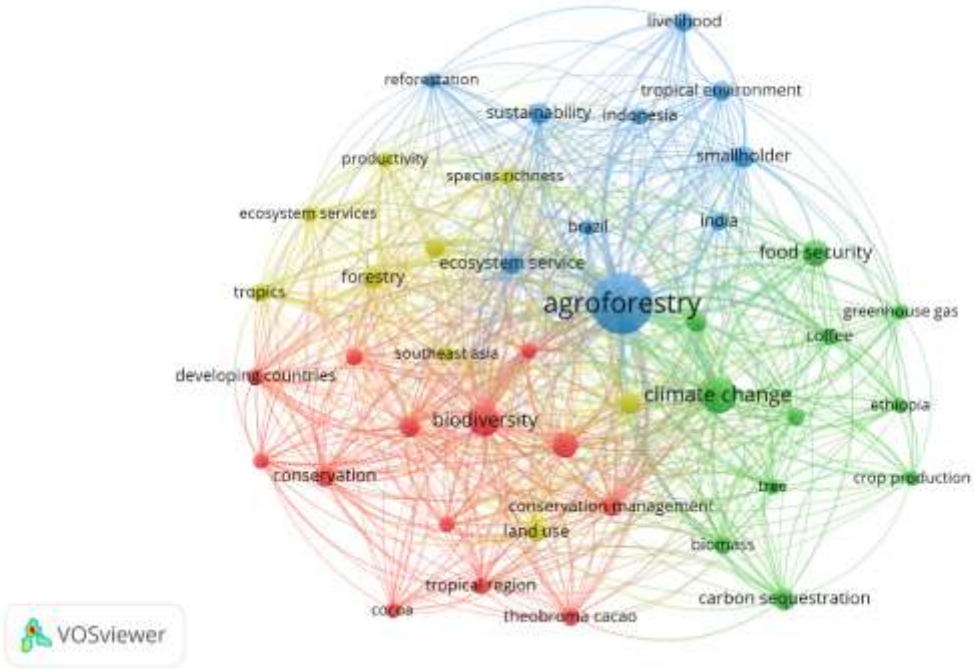

Figure 4. Network Visualization
Source: Data Analysis

Figure 4 shows that "agroforestry" functions as the central and most dominant term, indicating that it is the core conceptual anchor of the research field. Surrounding it are highly interconnected themes such as climate change, biodiversity, ecosystem service, food security, and sustainability, demonstrating that agroforestry research is strongly embedded within broader environmental and socio-economic discourses. The density of links suggests that studies rarely examine agroforestry in isolation; rather, they integrate ecological, climatic, and livelihood dimensions simultaneously. One prominent cluster (green) revolves around climate change, carbon sequestration, biomass, crop production, coffee, and food security. This indicates a strong research emphasis on agroforestry as a climate mitigation and adaptation strategy. The presence of terms such as greenhouse gas and carbon sequestration reflects growing interest in agroforestry's role in reducing emissions and enhancing carbon storage. At the same time, links to crop production and food security suggest that productivity and resilience remain central concerns, especially in developing regions.

Another cluster (red) is centered on biodiversity, conservation, land use, tropical region, cocoa, and developing countries. This grouping highlights agroforestry's ecological and conservation-oriented research trajectory, particularly in tropical landscapes. The inclusion of commodity crops like cocoa indicates case-study-driven research that evaluates biodiversity conservation within agroforestry systems. This cluster reflects a strong alignment between agroforestry and sustainable land management debates, especially in regions experiencing deforestation and land-use change. A third thematic grouping (blue) connects livelihood, smallholder, tropical environment, Indonesia, and India, indicating a socio-economic and geographic dimension. Research in this cluster focuses on how agroforestry supports rural livelihoods, particularly among smallholder farmers in tropical countries. The integration of sustainability and species richness within this cluster suggests that social and ecological benefits are often examined together, reinforcing agroforestry's

multifunctional character. A yellow cluster linking ecosystem services, productivity, forestry, and tropics acts as a bridge between ecological and production-oriented perspectives. This bridging role shows that agroforestry research attempts to reconcile conservation goals with agricultural output.

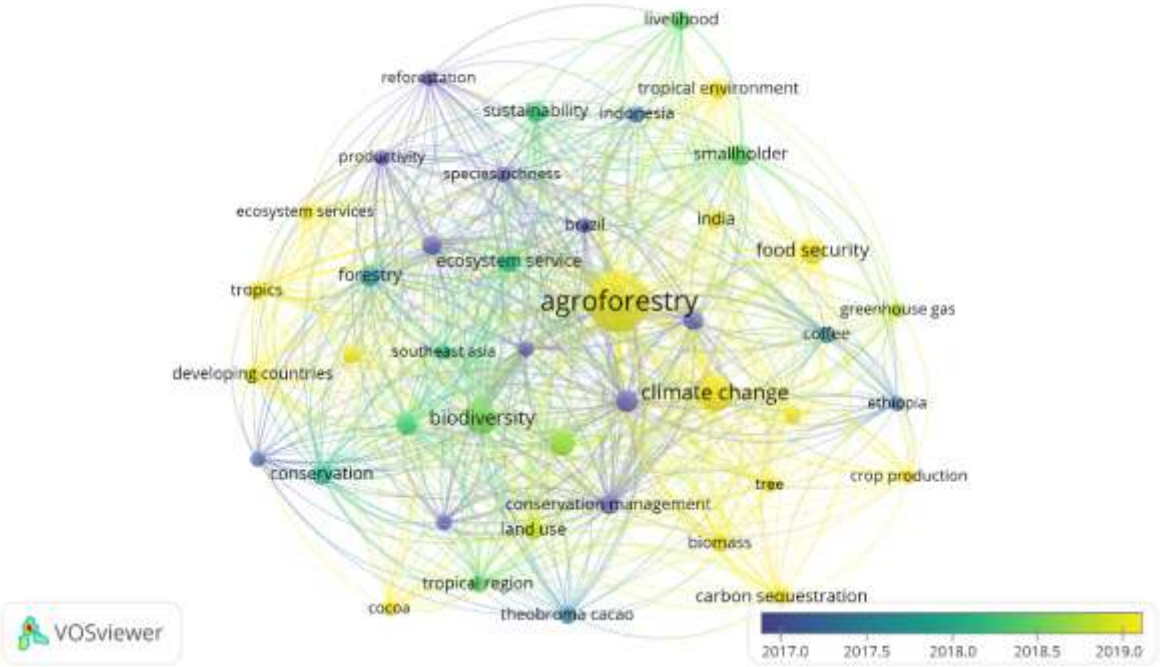

Figure 5. Overlay Visualization
Source: Data Analysis

Figure 5 highlights the temporal evolution of agroforestry research, with colors ranging from blue (earlier publications around 2017) to yellow (more recent publications around 2019). Core terms such as agroforestry remain central across the timeline, confirming their enduring relevance. However, earlier research appears more concentrated on themes such as conservation, reforestation, productivity, and ecosystem services, suggesting that initial studies focused strongly on ecological restoration and land management functions of agroforestry systems. As the timeline progresses, keywords such as climate change, carbon sequestration, biomass, and greenhouse gas shift toward greener and yellow tones, indicating growing scholarly attention in more recent years. This reflects a transition toward positioning agroforestry within global climate mitigation and adaptation debates. The increasing prominence of these climate-related terms suggests that agroforestry is being reframed not only as a biodiversity-friendly land-use system but also as a strategic solution for carbon storage and resilience under changing climatic conditions. More recent yellow-toned keywords such as food security, smallholder, and developing countries indicate a strengthening socio-economic dimension in the latest research phase. This trend implies that contemporary agroforestry studies increasingly integrate livelihood resilience, smallholder productivity, and sustainable food systems into the climate and conservation discourse.

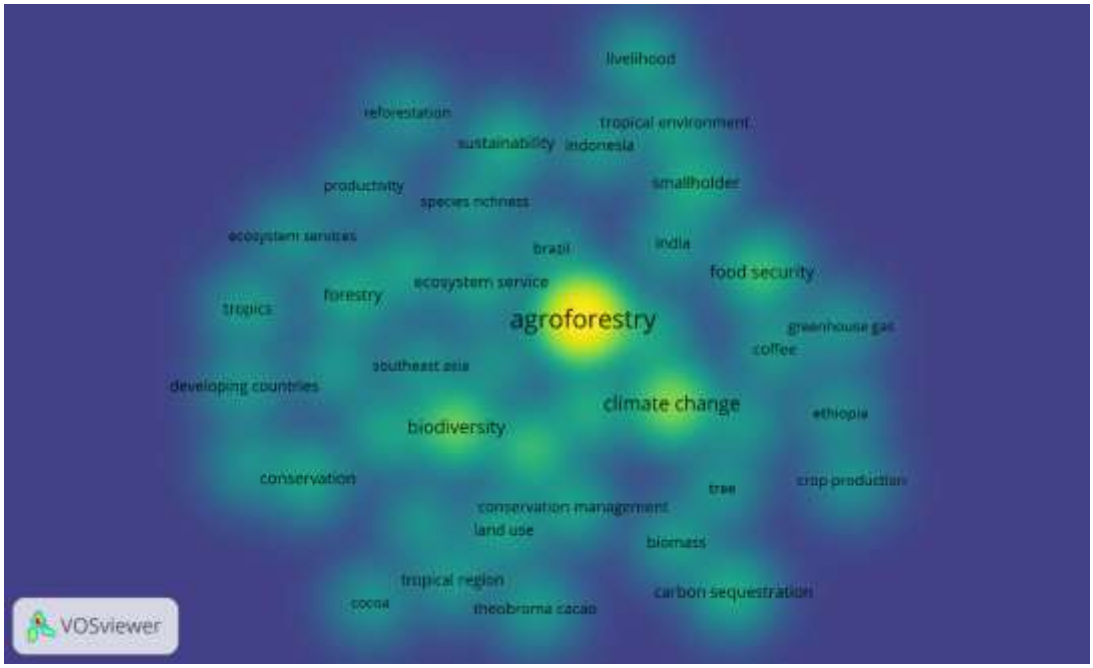

Figure 6. Density Visualization
Source: Data Analysis

Figure 6 highlights agroforestry as the most dominant and intensely researched topic, shown by the bright yellow concentration at the center of the map. Surrounding it are high-density areas related to climate change, biodiversity, and ecosystem service, indicating that these themes are frequently co-occurring and form the intellectual core of the field. The close proximity and strong color intensity suggest that agroforestry research is deeply anchored in environmental sustainability discourse, particularly in relation to ecological conservation and climate-related functions. Moderate-density areas extend toward terms such as food security, smallholder, carbon sequestration, biomass, and crop production, reflecting growing but slightly less concentrated research streams. Meanwhile, geographically oriented and commodity-specific keywords such as Indonesia, India, Ethiopia, cocoa, and coffee appear in cooler tones, indicating more specialized or regionally focused studies.

Citation Analysis

Table 1. Top Cited Literature

Citations	Authors and Year	Title
1,803	[11]	Bacterial and fungal contributions to carbon sequestration in agroecosystems
1,715	[12]	Comparing the yields of organic and conventional agriculture
1,653	[13]	Environmental pollution by antibiotics and by antibiotic resistance determinants
1,592	[14]	Soil compaction in cropping systems: A review of the nature, causes and possible solutions
1,428	[15]	Pesticides, environment, and food safety
1,368	[16]	The effects of organic agriculture on biodiversity and abundance: A meta-analysis
1,354	[17]	The future of anaerobic digestion and biogas utilization
1,331	[18]	Organic agriculture in the twenty-first century
1,230	[19]	Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland
1,200	[20]	Does organic farming benefit biodiversity?

Discussion

This bibliometric study provides a comprehensive overview of the intellectual structure and global dynamics of organic farming research between 2005 and 2024. The steady increase in publication output and the expansion of international collaboration networks indicate that organic farming has transitioned from a niche agronomic topic to a mainstream sustainability research agenda. The dominance of countries such as the United States, Germany, the United Kingdom, Italy, and India suggests that leadership in knowledge production remains concentrated in North America and Europe, although emerging economies are increasingly integrated into collaborative networks. The strong interconnections between developed and developing countries reflect growing North–South knowledge exchange, particularly in addressing tropical agriculture, smallholder systems, and climate adaptation.

The institutional network analysis highlights the pivotal role of internationally recognized research centers and universities in shaping the field. Central institutions act as bridges connecting regional clusters, facilitating interdisciplinary and cross-continental collaboration. This centralization suggests that global organic farming research is influenced by a relatively concentrated set of institutions with strong research capacity and funding access. While this structure enhances coordination and visibility, it may also indicate unequal research representation, where regions with limited institutional capacity contribute less prominently to high-impact publications.

The keyword co-occurrence analysis reveals that organic farming research is strongly anchored in sustainability discourse. Core themes such as biodiversity, ecosystem services, climate change, food security, and conservation demonstrate that organic farming is widely framed as a multifunctional system that integrates environmental protection with socio-economic resilience. The presence of commodity-specific terms such as coffee and cocoa, along with geographic references to tropical countries, indicates that empirical research frequently focuses on case studies in developing regions. This pattern reinforces the importance of organic systems in biodiversity-rich and climate-vulnerable landscapes.

Overlay visualization further shows an evolution of research focus over time. Earlier studies were more concentrated on conservation, land use, and ecosystem services, while more recent publications increasingly emphasize climate change mitigation, carbon sequestration, greenhouse gas emissions, and food security. This shift reflects broader global sustainability priorities, particularly the alignment of organic farming research with climate policy frameworks and sustainable development goals. The growing prominence of livelihood and smallholder-related keywords also signals greater attention to socio-economic dimensions and rural resilience.

Despite this progress, several gaps remain visible. First, while environmental themes dominate, there is comparatively less emphasis on market governance, certification systems, digital transformation, and policy effectiveness in scaling organic farming. Second, collaboration patterns, although global, remain uneven, with limited representation from certain regions in Africa and parts of Asia. Third, the strong clustering around environmental keywords suggests opportunities for deeper integration of economic performance analysis, supply chain innovation, and consumer behavior research.

4. CONCLUSION

This bibliometric study demonstrates that organic farming research from 2005 to 2024 has evolved into a highly interdisciplinary and globally connected field, anchored primarily in sustainability, biodiversity conservation, and climate change mitigation. While leadership in publication output and collaboration remains concentrated in North America and Europe, increasing participation from developing countries reflects expanding global engagement, particularly in tropical and smallholder contexts. The thematic evolution from conservation-oriented studies toward climate resilience, carbon sequestration, and

food security highlights the alignment of organic farming research with broader global sustainability agendas. The findings confirm that organic farming is no longer treated merely as an alternative production system, but as a strategic component of sustainable agricultural transformation, with future research needing to further integrate socio-economic, policy, and innovation perspectives to enhance scalability and impact.

REFERENCES

[1] A. Häring *et al.*, *Organic farming and measures for European agricultural policy*. Universität Hohenheim, 2004.

[2] S. Dabbert, A. M. Haring, and R. Zanoli, *Organic farming: policies and prospects*. Zed Books, 2004.

[3] K. Ammann, "Why farming with high tech methods should integrate elements of organic agriculture," *N. Biotechnol.*, vol. 25, no. 6, pp. 378–388, 2009.

[4] S. Pattanayak, S. Das, and G. Biswal, "Crop disease control through application of algal biopesticides: Alternate route map in organic farming," in *Biopesticides in Organic Farming*, CRC Press, 2021, pp. 123–126.

[5] N. Lampkin, S. Padel, and C. Foster, "Organic farming.," in *CAP regimes and the European countryside: prospects for integration between agricultural, regional and environmental policies.*, CABI Publishing Wallingford UK, 2000, pp. 221–238.

[6] P. Mäder, A. Fliessbach, D. Dubois, L. Gunst, P. Fried, and U. Niggli, "Soil fertility and biodiversity in organic farming," *Science (80-.).*, vol. 296, no. 5573, pp. 1694–1697, 2002.

[7] S. Zikeli, E. Rembiałkowska, A. Załęcka, and M. Badowski, "Organic farming and organic food quality: Prospects and limitations," *Sustain. food Prod. Incl. Hum. Environ. Heal.*, pp. 85–164, 2014.

[8] M. Reckling and M. Grosse, "On-farm research to diversify organic farming systems," *Org. Farming*, vol. 8, no. 1, pp. 1–2, 2022.

[9] H. Kaur, "Challenges and Prospects for Organic Farming: A Case Study from India," *Gyan Manag. J.*, vol. 17, no. 2, pp. 75–79, 2023.

[10] R. Chitra, N. L. Balasudarsun, M. Sathish, and R. Jagajeevan, "Supply chain modelling in organic farming for sustainable profitability," *Agric. Econ. (Czech Republic)*, vol. 69, no. 6, pp. 255–266, 2023, doi: 10.17221/44/2023-AGRICECON.

[11] J. Six, S. D. Frey, R. K. Thiet, and K. M. Batten, "Bacterial and fungal contributions to carbon sequestration in agroecosystems," *Soil Sci. Soc. Am. J.*, vol. 70, no. 2, pp. 555–569, 2006.

[12] V. Seufert, N. Ramankutty, and J. A. Foley, "Comparing the yields of organic and conventional agriculture," *Nature*, vol. 485, no. 7397, pp. 229–232, 2012.

[13] J. L. Martinez, "Environmental pollution by antibiotics and by antibiotic resistance determinants," *Environ. Pollut.*, vol. 157, no. 11, pp. 2893–2902, 2009.

[14] M. A. Hamza and W. K. Anderson, "Soil compaction in cropping systems: A review of the nature, causes and possible solutions," *Soil tillage Res.*, vol. 82, no. 2, pp. 121–145, 2005.

[15] F. P. Carvalho, "Pesticides, environment, and food safety," *Food energy Secur.*, vol. 6, no. 2, pp. 48–60, 2017.

[16] J. Bengtsson, J. Ahnström, and A. Weibull, "The effects of organic agriculture on biodiversity and abundance: a meta-analysis," *J. Appl. Ecol.*, vol. 42, no. 2, pp. 261–269, 2005.

[17] J. B. Holm-Nielsen, T. Al Seadi, and P. Oleskowicz-Popiel, "The future of anaerobic digestion and biogas utilization," *Bioresour. Technol.*, vol. 100, no. 22, pp. 5478–5484, 2009.

[18] J. P. Reganold and J. M. Wachter, "Organic agriculture in the twenty-first century," *Nat. plants*, vol. 2, no. 2, pp. 1–8, 2016.

[19] F. Geiger *et al.*, "Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland," *Basic Appl. Ecol.*, vol. 11, no. 2, pp. 97–105, 2010.

[20] D. G. Hole, A. J. Perkins, J. D. Wilson, I. H. Alexander, P. V Grice, and A. D. Evans, "Does organic farming benefit biodiversity?," *Biol. Conserv.*, vol. 122, no. 1, pp. 113–130, 2005.