Bibliometric Analysis of Trash Management and Ecological Footprint in Super-Priority Destinations

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ABSTRACT

Tourism growth in environmentally sensitive areas, such as Indonesia's Super-Priority Tourism Destinations (SPTD), has heightened concerns over trash accumulation and ecological degradation. This study presents a bibliometric analysis of global scholarly literature on trash management and ecological footprint within tourism contexts, aiming to map research trends, thematic clusters, and collaboration networks. Using data from the Scopus database (2000–2024) and analyzed through VOSviewer, the study identifies dominant keywords including ecological footprint, sustainable development, tourist destination, and carbon footprint — indicating a strong emphasis on sustainability metrics in tourism research. Co-authorship and institutional mapping reveal the pivotal role of cross-national collaboration, with China, Italy, and the United Kingdom among the most active contributors. The overlay visualization highlights a temporal shift from foundational themes (e.g., environmental impact) toward more integrated topics (e.g., tourism management and sustainability governance). These findings offer practical implications for policymakers and stakeholders involved in destination management, especially in formulating data-driven, interdisciplinary strategies for reducing tourism's ecological impact. The study also contributes to the theoretical consolidation of tourism-environment linkages by providing a structured research roadmap and identifying potential areas for future investigation.

Keywords: Bibliometric Analysis, Ecological Footprint, Trash Management, Sustainable Tourism, Super-Priority Destinations, Vosviewer

1. INTRODUCTION

Tourism is a double-edged sword for environmental sustainability. While it contributes significantly to economic growth and cultural exchange, it also leaves behind a considerable ecological footprint, particularly in popular destinations. Indonesia, known for its rich natural and cultural attractions, has designated ten *Super-Priority Tourism Destinations (SPTD)*, including areas like Lake Toba, Borobudur, Mandalika, Labuan Bajo, and Likupang, as national economic growth drivers. However, these destinations also face mounting environmental pressures, notably from increasing solid waste generation and poor waste management practices [1]. The influx of tourists correlates strongly with rising plastic pollution, mismanaged landfill systems, and threats to biodiversity in fragile ecosystems.

The challenge of waste management in tourism-intensive areas is not new, but it has become more urgent. The Ministry of Tourism and Creative Economy of Indonesia has reported that in destinations like Labuan Bajo and Mandalika, solid waste accumulation has outpaced local waste infrastructure capacity. As tourism continues to expand, the ecological footprint, including water usage, carbon emissions, and waste generation, grows disproportionately compared to mitigation efforts [2]. These issues are compounded by limited awareness among visitors and stakeholders about sustainable waste practices. If left unaddressed, such challenges will not only degrade environmental quality but also erode the long-term economic viability of these destinations.

From a policy and academic standpoint, the interrelationship between tourism, trash management, and ecological footprint has attracted growing interest. The concept of ecological footprint (EF) provides a framework to quantify human demand on nature, offering a lens through

which we can assess the sustainability of tourism activities [3]. Simultaneously, waste management, particularly in the context of the circular economy, has been explored as a key strategy to reduce EF in tourism-heavy regions [4]. Despite these growing literatures, there remains a fragmented understanding of how research on trash management and EF in tourism contexts, especially in the unique category of *super-priority destinations*, has evolved, what themes dominate, and where future studies can intervene.

Bibliometric analysis serves as a powerful method to evaluate scientific knowledge production, thematic evolution, and scholarly networks in specific fields. In recent years, bibliometric mapping has been extensively used in environmental and tourism research to visualize keyword trends, author collaborations, and regional research productivity [5]. However, little attention has been given to systematically mapping the intersection of trash management and ecological footprint within the framework of tourism development in high-priority or fragile destination zones. This gap in bibliometric understanding inhibits strategic policymaking, interdisciplinary collaboration, and evidence-based interventions in sustainable tourism planning.

Given the strategic importance of SPTDs and the urgent need for sustainable environmental management, there is a compelling rationale to conduct a comprehensive bibliometric review of existing literature on trash management and ecological footprints in tourism contexts. This is not only critical to identify dominant paradigms and emerging areas but also necessary to align national sustainability goals, such as Indonesia's Low Carbon Development Initiative (LCDI) and Sustainable Development Goals (SDGs), with the academic discourse. By identifying key clusters, citation trends, and influential authors or journals, this study can provide clarity for future interdisciplinary research directions and tourism governance strategies.

Despite the increasing body of literature on environmental sustainability in tourism, there is a lack of integrative studies that specifically examine how trash management and ecological footprint have been conceptualized and operationalized in *super-priority tourism destinations*. The dispersed nature of research outputs, varying terminologies, and siloed studies make it difficult to evaluate scientific progress, policy impact, and collaborative networks in this area. Without a clear bibliometric understanding, efforts to align academic research with policy initiatives in Indonesia's SPTDs may remain fragmented and suboptimal. This study aims to conduct a bibliometric analysis of the scientific literature on trash management and ecological footprint in the context of tourism, with a special focus on their relevance to super-priority destinations.

2. METHODS

This study employed a bibliometric analysis approach to systematically map and evaluate the scholarly literature on trash management and ecological footprint within tourism destinations, with a specific emphasis on applicability to Indonesia's *Super-Priority Tourism Destinations (SPTD)*. Bibliometric analysis is a quantitative method that utilizes metadata from scientific publications to assess patterns in knowledge production, co-authorship, keyword co-occurrence, citation impact, and thematic evolution [5]. It allows researchers to visualize the intellectual structure and research trends of a field over time. In this study, bibliometric mapping was chosen as the most appropriate technique to uncover both macro-level patterns and micro-level research gaps across an interdisciplinary field that spans environmental science, tourism studies, and sustainable development.

Data for this study were extracted from the Scopus database due to its comprehensive coverage of peer-reviewed journals in environmental sciences, tourism, and sustainability. The

search strategy combined Boolean operators with key terms such as *"trash management"*, *"solid waste"*, *"ecological footprint"*, *"tourism"*, *"destination"*, and *"sustainable tourism"*. Additional filters were applied to limit the results to journal articles, conference papers, and reviews published between 2000 and 2024, ensuring relevance to contemporary sustainability discourse. After screening for duplicates and irrelevant titles/abstracts, a final dataset of 215 documents was selected for analysis. Bibliographic metadata including authors, titles, abstracts, keywords, publication years, source titles, citations, and affiliations were exported in RIS and CSV formats for further processing.

The analysis was conducted using VOSviewer, a widely used bibliometric visualization tool developed by the Centre for Science and Technology Studies (CWTS) at Leiden University. VOSviewer enabled the construction of co-authorship networks (to identify collaboration patterns among researchers and institutions), keyword co-occurrence maps (to detect thematic clusters and research hotspots), and citation-based mapping (to highlight influential works and journals). Thresholds were set for minimum occurrences to ensure analytical clarity (e.g., only keywords appearing at least five times were included in cluster visualizations).

3. RESULTS AND DISCUSSION

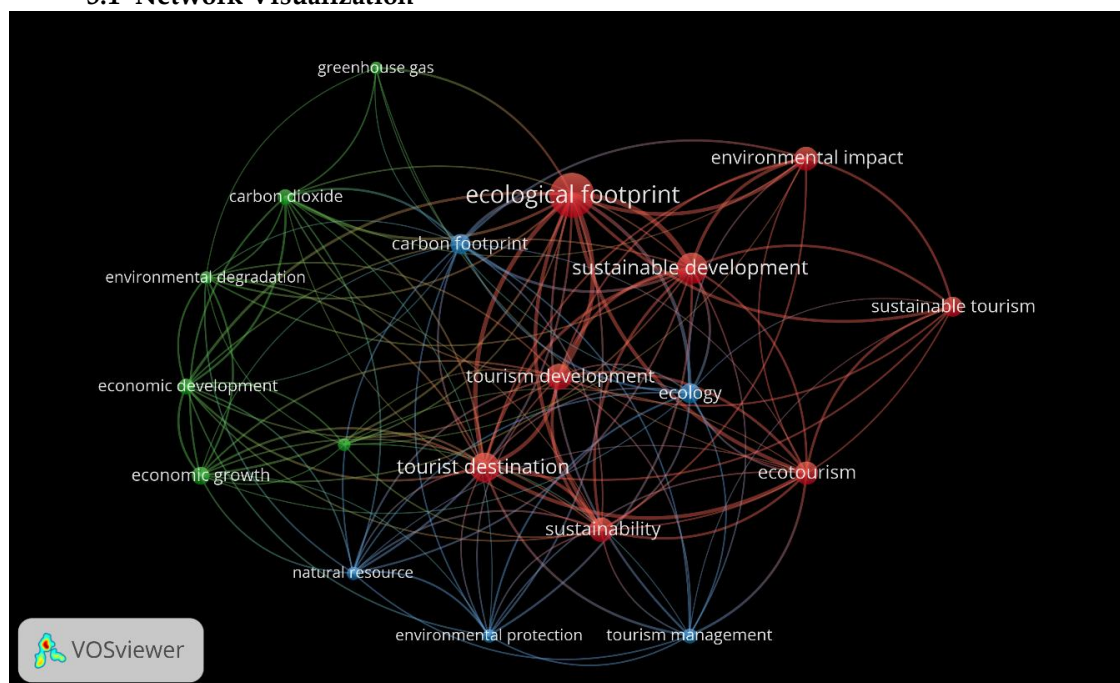### 3.1 Network Visualization

Figure 1. Network Visualization
Source: Data Analysis Result, 2025

At the heart of the visualization lies the dominant keyword "ecological footprint", which is the most interconnected term in the network. This reflects its central role as a unifying concept across sustainability, tourism, and environmental impact studies. Closely associated with it are terms such as "sustainable development", "tourism development", "tourist destination", and "sustainability", forming a red cluster that highlights the convergence between tourism expansion and the environmental metrics used to evaluate its impacts. These links suggest a strong research orientation toward assessing how tourism activities contribute to or mitigate ecological degradation. The network is composed of three primary thematic clusters:

1. The red cluster revolves around sustainability-oriented tourism research, with strong emphasis on ecotourism, sustainable tourism, environmental impact, and tourism

management. This indicates a body of work focused on eco-conscious tourism models and governance strategies aimed at reducing ecological damage.

2. The green cluster represents research concerned with emissions and economic growth, as indicated by keywords like carbon dioxide, greenhouse gas, carbon footprint, and economic development. This suggests that another segment of the literature evaluates tourism's carbon emissions and their trade-offs with economic benefits.

3. The blue cluster is positioned more toward natural resource management and environmental protection, with terms like natural resource, ecology, and tourism management. This implies an ecological science perspective exploring how tourism affects biodiversity and conservation priorities.

The keyword interlinkages demonstrate a high degree of interdisciplinarity. Terms related to policy (sustainable development, environmental impact) are intricately tied to ecological science (ecology, natural resource) and socio-economic themes (economic growth, tourist destination). This interconnected structure indicates that recent scholarship is not siloed, but instead attempts to integrate environmental science with tourism planning, sustainable policy, and economic evaluation frameworks. The overlap between carbon footprint and both environmental and tourism-related keywords further emphasizes the cross-sectoral importance of emission accounting in tourism studies. Although central themes dominate the visual, less frequent but important keywords such as environmental protection, tourism management, and environmental degradation are also noteworthy. Their peripheral position may indicate emerging interest or under-researched areas. For instance, tourism management as a keyword suggests a growing concern over the governance aspect of tourism sustainability, especially in destination planning. Similarly, environmental degradation linked to economic growth presents a tension often highlighted in critiques of unregulated tourism expansion.

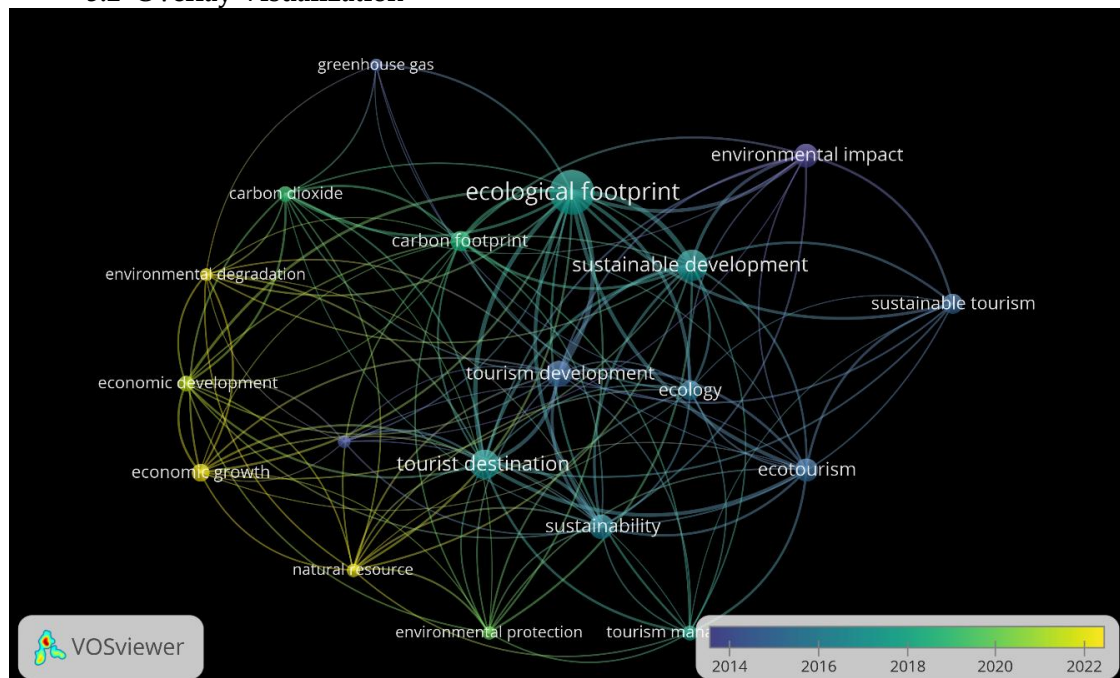### 3.2 Overlay Visualization

Figure 2. Overlay Visualization
Source: Data Analysis Result, 2025

Figure 2 represents the evolution of research interest over time in the domain of ecological footprint and trash management in tourism contexts. The color gradient—from purple (older, ~2014)

to yellow (newer, ~2022)—indicates the average publication year of documents associated with each keyword. Keywords like "economic growth", "economic development", and "natural resource" appear in yellow, suggesting that these terms have become increasingly relevant in more recent publications. This reflects a shift in scholarly focus toward balancing tourism-driven economic gains with sustainable resource management, particularly in the context of super-priority tourism destinations where such trade-offs are critical.

In contrast, keywords shaded in blue to dark purple such as "environmental impact", "sustainable tourism", and "greenhouse gas" indicate themes that were more prominent in earlier research cycles (2014–2017). These early studies likely laid the foundational concerns about tourism's carbon footprint and environmental degradation. While still relevant, their relative decline in recency suggests that researchers have begun integrating these foundational ideas into broader, more complex discussions, particularly involving policy, development planning, and multi-sectoral sustainability. The keywords occupying green to light yellow tones, such as "ecological footprint", "tourist destination", and "sustainable development", show an enduring and increasing interdisciplinary presence from around 2018 onward. These terms represent a conceptual bridge connecting environmental science, economics, and tourism policy. Their central location and recent coloring imply that the current wave of research is increasingly focused on integrated approaches, such as assessing sustainability through quantitative footprint analysis in specific tourism contexts (e.g., coastal, rural, super-priority areas).

3.3 Citation Analysis

Table 1. The Most Impactful Literatures

Citations	Authors and year	Title
267	[6]	Estimating the carbon footprint of Australian tourism
261	[7]	Carbon footprint time series of the UK - results from a multi-region input-output model
225	[8]	Opportunities and challenges for near-field wireless power transfer: A review
208	[9]	Bibliometric analysis and literature review of ecotourism: Toward sustainable development
198	[10]	Sustainable tourism and the touristic ecological footprint
172	[11]	Testing the role of tourism development in ecological footprint quality: evidence from top 10 tourist destinations
144	[12]	Identifying tourists with smaller environmental footprints
139	[13]	An investigation of tourists' patterns of obligation to protect the environment
112	[14]	Concepts and tools for comprehensive sustainability assessments for tourism destinations: A comparative review
96	[15]	Horeca food waste and its ecological footprint in Lhasa, Tibet, China

Source: Scopus, 2025
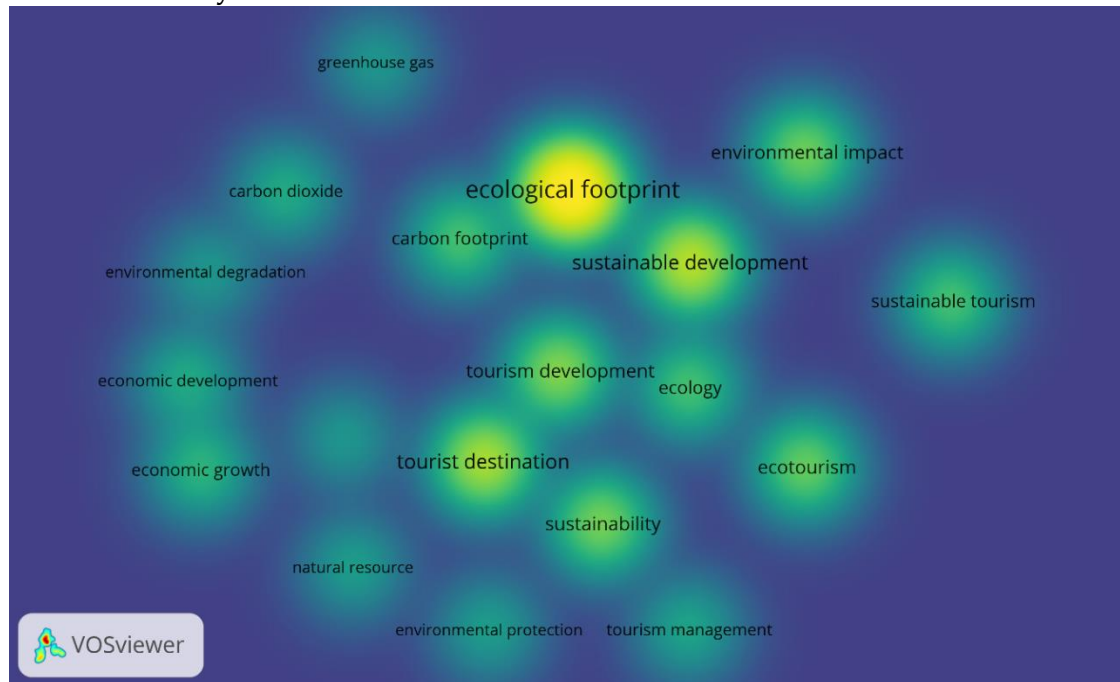
3.4 Density Visualization

Figure 3. Density Visualization
Source: Data Analysis Result, 2025

Figure 3 above presents the intensity and frequency of keyword usage within the bibliometric landscape of research on ecological footprint and trash management in tourism destinations. The brighter the area (shifting from green to yellow), the more frequently the keyword appears in the literature and the higher its relevance to the overall research field. Clearly, "ecological footprint" and "sustainable development" emerge as the most densely cited and central themes, indicating that most studies focus on measuring environmental pressures and proposing sustainable solutions within tourism contexts. Similarly, terms like "tourist destination" and "sustainability" also appear as high-density zones, reflecting their foundational role in tourism-based sustainability discourse. In contrast, keywords like "environmental degradation," "carbon dioxide," "greenhouse gas," and "natural resource" are located in areas with lower density (green/blue), suggesting that while these terms are still part of the research network, they are less frequently the focal points. Interestingly, "tourism management" and "environmental protection" also show relatively moderate density, indicating potential gaps or opportunities for deeper exploration, especially in operationalizing sustainability strategies at the management level.

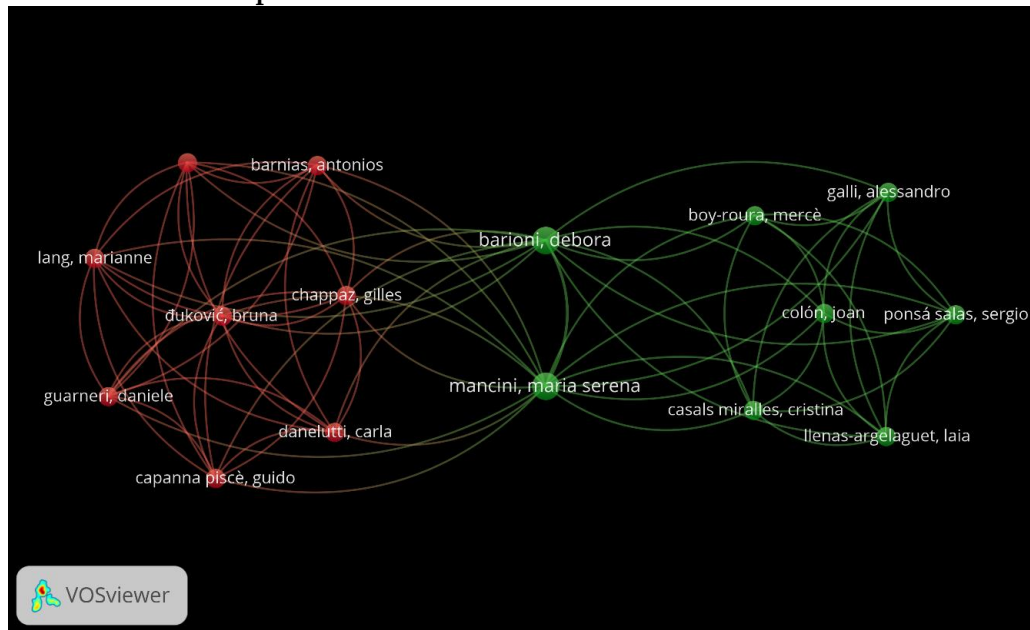### 3.5 Co-Authorship Network

Figure 4. Author Visualization
Source: Data Analysis Result, 2025

Figure 4 above highlights two distinct yet interconnected clusters of researchers actively contributing to the literature on ecological footprint and sustainable tourism. The red cluster on the left features authors such as Barnías, Antonios, Lang, Marianne, and Guarneri, Daniele, indicating a tightly-knit group that collaborates frequently within their academic circle. Meanwhile, the green cluster on the right is composed of another prominent network with figures like Galli, Alessandro, Colón, Joan, and Ponsà Salas, Sergio, who are also highly collaborative and perhaps working within a European or Mediterranean academic context. Bridging the two clusters are Barioni, Debora and Mancini, Maria Serena, who serve as critical connectors, fostering interdisciplinary or cross-institutional collaboration between these research groups.
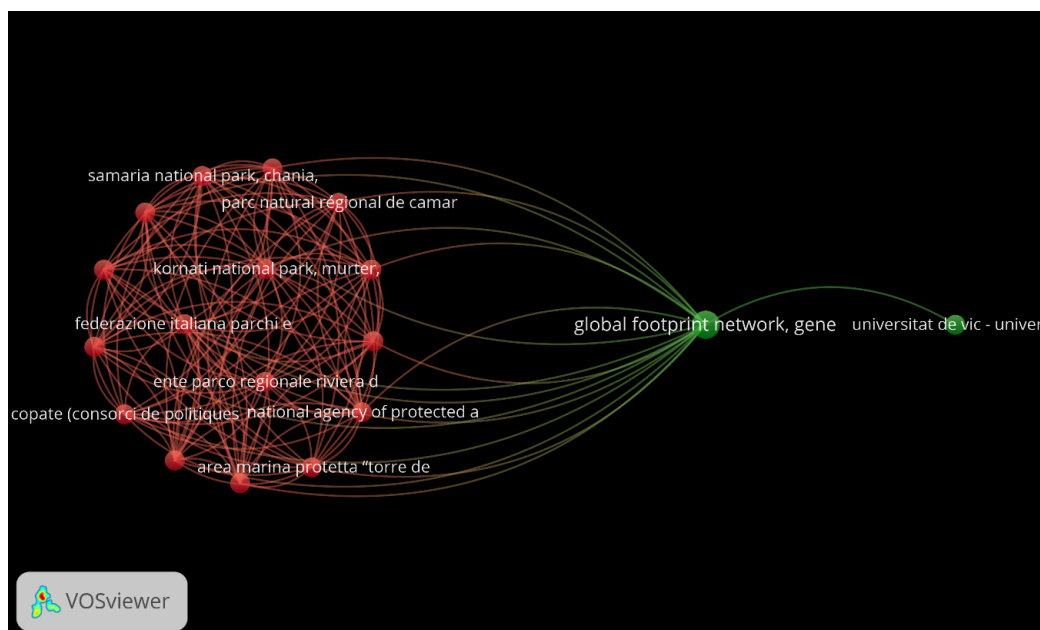

Figure 5. Affiliation Visualization
Source: Data Analysis Result, 2025

Map in figure 5 reveals two major clusters in ecological footprint and sustainability research related to protected areas and tourism destinations. The red cluster on the left consists mainly of national parks, protected area agencies, and regional conservation bodies—such as Samaria National Park, Federazione Italiana Parchi, and Kornati National Park. These institutions show dense interconnectivity, indicating strong regional or thematic collaboration in managing and studying environmental impacts within protected territories. On the other side, the green cluster is led by global and academic institutions like the Global Footprint Network and Universitat de Vic, which appear to act as central knowledge hubs that bridge scientific frameworks with practical management across diverse geographical regions. The Global Footprint Network in particular serves as a crucial intermediary node, connecting academic expertise with field-based conservation stakeholders.
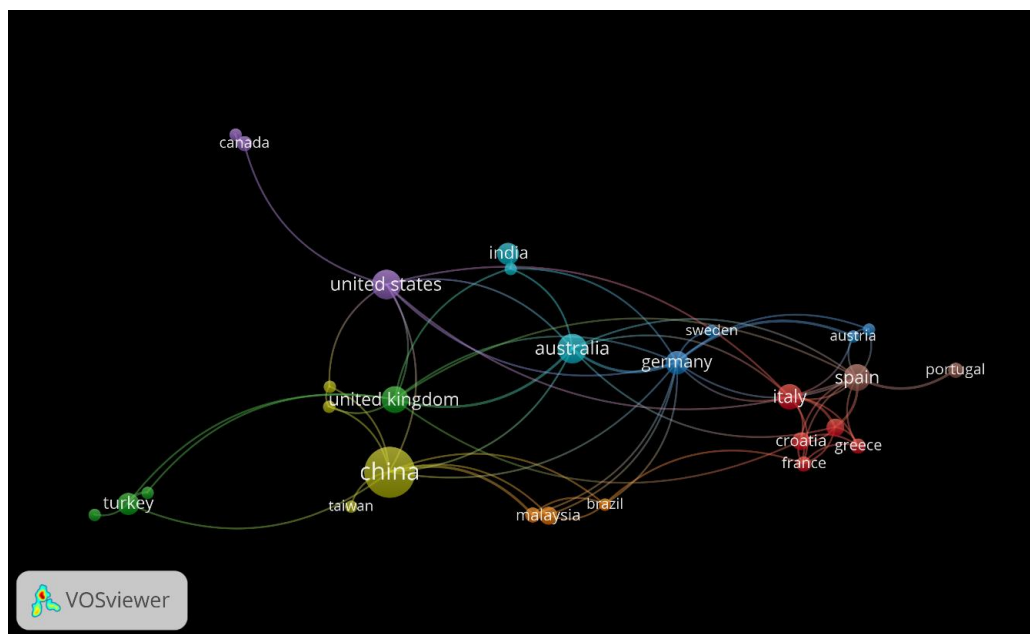

Figure 6. Country Visualization
Source: Data Analysis Result, 2025

Figure 6 visualizes the global research landscape on ecological footprint and sustainability in tourism, highlighting clusters of international scholarly partnerships. Notably, China appears as the largest and most interconnected node, signaling its dominant role in research output and collaboration, especially with the United Kingdom, United States, Germany, and Australia. The red cluster centered around Italy, Spain, France, and Greece reflects strong regional partnerships in Europe, likely focusing on Mediterranean sustainability and tourism studies. Meanwhile, countries like Canada, India, Malaysia, and Brazil are somewhat peripheral but still maintain key links with central actors.

Practical Implication
This study provides valuable insights for policymakers, tourism planners, and environmental managers, particularly those involved in Indonesia's Super-Priority Tourism Destinations (SPTD). By mapping the global literature on ecological footprint and trash management in tourism contexts, it becomes evident that sustainable tourism cannot be achieved without coordinated strategies that include waste governance, environmental impact measurement, and local stakeholder engagement. The identification of research hotspots such as sustainable development, carbon footprint, and tourism management

can help local governments prioritize policy frameworks that align with global standards. Furthermore, the strong presence of collaborations between protected area authorities and academic institutions suggests the potential for replicating such models in Indonesia's SPTDs, fostering joint research, community-based monitoring, and adaptive waste management strategies tailored to the ecological sensitivities of each destination.

Theoretical Contribution

Theoretically, this study enriches the intersection of tourism studies, environmental sustainability, and bibliometric science. It contributes by synthesizing fragmented research on trash management and ecological footprint into a coherent knowledge map, revealing thematic clusters, research trends, and emerging areas for scholarly exploration. The bibliometric visualizations using VOSviewer demonstrate that ecological footprint is a conceptual bridge between environmental science and tourism development, validating its role as a core metric in sustainability assessments. This study also highlights the growing shift toward interdisciplinary approaches, with sustainability no longer being treated as a siloed issue but as an integrated component of economic development, environmental conservation, and policy innovation. By identifying key authors, institutions, and countries, the study lays the foundation for future meta-analyses and systematic reviews in this domain.

Limitation

Despite its contributions, this study has certain limitations. First, the analysis is limited to the Scopus database, which, although comprehensive, may omit relevant publications indexed elsewhere, such as Web of Science or regional journals not indexed in Scopus. Second, the use of bibliometric methods emphasizes quantitative patterns over qualitative depth—which means the actual content, methods, or context of the studies are not critically reviewed. Third, the keyword-based analysis may underrepresent emerging topics that are described using varying terminology. Lastly, while the findings provide generalizable insights for global and national tourism policy, the contextual application to specific super-priority destinations in Indonesia would benefit from complementary field-based case studies or mixed-method research to validate these bibliometric trends in practice.

CONCLUSION

This study offers a comprehensive bibliometric analysis of the scholarly landscape surrounding trash management and ecological footprint in the context of tourism, with particular relevance to Indonesia's Super-Priority Tourism Destinations (SPTD). The findings reveal that research in this domain is heavily centered on themes such as sustainable development, ecological footprint, tourist destinations, and carbon emissions, indicating a strong global focus on measuring and mitigating tourism's environmental impact. Through co-authorship and institutional collaboration maps, the study also uncovers key academic networks and institutional actors that drive the field, suggesting opportunities for transnational collaboration and knowledge exchange. Importantly, the temporal and density visualizations show a shift toward integrative and interdisciplinary approaches in recent years, reflecting the urgency of embedding sustainability into tourism planning. These insights not only support evidence-based policymaking but also offer a roadmap for future research to address existing gaps and enhance the environmental resilience of tourism destinations, particularly those under rapid development pressure such as Indonesia's SPTDs.

REFERENCES

[1]   A. Paiano, T. Crovella, and G. Lagioia, "Managing sustainable practices in cruise tourism: The assessment of carbon footprint and waste of water and beverage packaging," *Tour. Manag.*, vol. 77, p. 104016, 2020.

[2]   C. Campos *et al.*, "Towards more sustainable tourism under a carbon footprint approach: The Camino Lebaniego case

study," *J. Clean. Prod.*, vol. 369, p. 133222, 2022.

[3]   R. M. I. R. Susilorini *et al.*, "Tourism village carbon footprint after COVID-19 pandemic: A challenge to sustainability," *Sustainability*, vol. 14, no. 4, p. 2400, 2022.

[4]   L. Wang, X. Ni, Y. Li, J. Li, and S. Cheng, "Framework proposal for estimating tourist food waste and its carbon footprint in China: Sampling from four main tourist destinations," *Resour. Conserv. Recycl.*, vol. 197, p. 107107, 2023.

[5]   N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *J. Bus. Res.*, vol. 133, pp. 285–296, 2021.

[6]   L. Dwyer, P. Forsyth, R. Spurr, and S. Hoque, "Estimating the carbon footprint of Australian tourism," *J. Sustain. Tour.*, vol. 18, no. 3, pp. 355–376, 2010.

[7]   T. Wiedmann, R. Wood, J. C. Minx, M. Lenzen, D. Guan, and R. Harris, "A carbon footprint time series of the UK–results from a multi-region input–output model," *Econ. Syst. Res.*, vol. 22, no. 1, pp. 19–42, 2010.

[8]   A. M. Jawad, R. Nordin, S. K. Gharghan, H. M. Jawad, and M. Ismail, "Opportunities and challenges for near-field wireless power transfer: A review," *Energies*, vol. 10, no. 7, p. 1022, 2017.

[9]   S. Khanra, A. Dhir, P. Kaur, and M. Mäntymäki, "Bibliometric analysis and literature review of ecotourism: Toward sustainable development," *Tour. Manag. Perspect.*, vol. 37, p. 100777, 2021.

[10]   C. Hunter, "Sustainable tourism and the touristic ecological footprint," *Environ. Dev. Sustain.*, vol. 4, no. 1, pp. 7–20, 2002.

[11]   S. Katircioglu, K. K. Gokmenoglu, and B. M. Eren, "Testing the role of tourism development in ecological footprint quality: evidence from top 10 tourist destinations," *Environ. Sci. Pollut. Res.*, vol. 25, no. 33, pp. 33611–33619, 2018.

[12]   S. Dolnicar, "Identifying tourists with smaller environmental footprints," *J. Sustain. Tour.*, vol. 18, no. 6, pp. 717–734, 2010.

[13]   S. Dolnicar and F. Leisch, "An investigation of tourists' patterns of obligation to protect the environment," *J. Travel Res.*, vol. 46, no. 4, pp. 381–391, 2008.

[14]   K. Schianetz, L. Kavanagh, and D. Lockington, "Concepts and tools for comprehensive sustainability assessments for tourism destinations: A comparative review," *J. Sustain. Tour.*, vol. 15, no. 4, pp. 369–389, 2007.

[15]   L. Wang, L. Xue, Y. Li, X. Liu, S. Cheng, and G. Liu, "Horeca food waste and its ecological footprint in Lhasa, Tibet, China," *Resour. Conserv. Recycl.*, vol. 136, pp. 1–8, 2018.