Journal of Thai-Chinese Social Science
E-ISSN：3057-157X (Online)
https://so19.tci-thaijo.org/index.php/JTCSS/AboutJournal

# Research Landscape of Ecological Civilization: A Bibliometric Analysis

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**Abstracts:** This study explores the research landscape of ecological civilization from 2008 to 2024 through a bibliometric analysis, examining trends, collaborative networks, and thematic development. Utilizing publications sourced from major academic databases, the study applies keyword burst analysis and visual mapping tools like CiteSpace to highlight contributions at the author, institutional, and country levels. Results indicate a significant increase in publications post-2019, mirroring heightened global interest in sustainability-driven development models. Countries such as China, the United States, and the United Kingdom are identified as leading contributors, along with institutions like Tsinghua University and Harvard University, underscoring the international collaboration in this field. Core themes identified include environmental policy, urban sustainability, biodiversity conservation, and the integration of advanced technologies, such as AI and big data, to enhance ecological governance. This study underscores the importance of quantitative analysis in tracking ecological civilization's evolution, emphasizing the role of cross-disciplinary and international partnerships. Findings offer actionable insights for policymakers and researchers, supporting the advancement of ecological civilization principles in response to pressing environmental and social challenges.

**Keywords:** Ecological Civilization, Sustainability, Urban Sustainability, International Collaboration

## 1. Introduction

Ecological civilization is a holistic concept that promotes a balanced and sustainable relationship between human society and the natural environment (Ma & Guo, 2024). Unlike traditional development models, which often prioritize economic growth at the expense of ecological health, ecological civilization emphasizes the integration of environmental, social, and economic dimensions. This framework calls for systemic changes in production, consumption, governance, and cultural values to create societies that prioritize

ecological integrity and sustainability. Originally developed in China as a policy response to severe environmental challenges, ecological civilization has since gained global recognition as a model for sustainable development (Wang et al., 2023). It promotes practices such as green technology adoption, circular economy principles, resource conservation, and community-based environmental stewardship, encouraging a shift from resource-intensive, polluting activities to sustainable practices that ensure long-term ecological health and social well-being (Jain, 2024).

At its core, ecological civilization is founded on the principle of "harmony between humanity and nature (Xiao et al., 2023). This interconnected approach seeks to make ecological stability, economic viability, and social equity mutually reinforcing, addressing pressing global issues such as climate change, biodiversity loss, and pollution. Ecological civilization encompasses several interrelated dimensions that together foster sustainable development and promote harmonious coexistence between human society and nature (Zhao et al., 2024). Environmental sustainability is a central priority, focusing on biodiversity preservation, resource management, and pollution reduction to maintain ecosystem resilience for future generations (Solangi & Jianguo, 2023). Additionally, ecological civilization advocates for economic transformation aligned with ecological principles, supporting a transition from traditional resource-intensive industries to green and circular economies (Oyejobi et al., 2024). This economic focus promotes renewable energy adoption, resource efficiency, and sustainable production and consumption.

Beyond environmental and economic considerations, ecological civilization addresses social equity and well-being, aiming to reduce disparities and ensure that the benefits of sustainable development are widely shared (Li et al., 2023). This social dimension promotes inclusive policies and community-based initiatives to improve health, quality of life, and support for vulnerable populations. Equally important is the cultural and ethical shift that ecological civilization encourages, fostering values of environmental stewardship, ecological consciousness, and intergenerational responsibility (Liang & Segalas, 2024). By embedding ecological ethics within societal values, ecological civilization motivates individuals and communities to adopt sustainable behaviors (Zia et al., 2024). Finally, governance and policy innovation are essential to this framework, providing the structure for implementing sustainable practices and enforcing environmental regulations (Ni et al., 2023). Together, these dimensions offer a holistic approach to global sustainability challenges, integrating economic, social, environmental, and cultural priorities for a balanced and resilient society.

In recent years, ecological civilization has emerged as a prominent holistic framework for addressing global environmental challenges (Yan et al., 2021). It advocates for a paradigm shift from traditional development models—focused predominantly on economic growth at the expense of environmental health—toward a balanced approach that integrates ecological, social, and economic dimensions. Rooted in the principle of "harmony between humanity and nature," ecological civilization emphasizes sustainable practices that ensure both long-term ecological health and societal well-being (Zhang & Drury, 2024).

Ecological civilization also emphasizes social equity, inclusive governance, and community-based environmental stewardship, underscoring the interdependence between ecological sustainability and social development (Huang & Westman, 2021).

Initially introduced as a policy framework in China, ecological civilization has since gained global traction, influencing research, policy, and industry across diverse fields (Huang & Westman, 2021). This multidimensional approach addresses critical issues such as climate change, biodiversity loss, pollution, and resource scarcity, making it an essential model for sustainable development. Ecological civilization thus provides a guiding vision for societies that prioritize ecological integrity, social equity, and economic stability, aligning with the global goals of sustainability and environmental justice (Liu et al., 2021).

The future of ecological civilization is expected to deepen the integration of sustainable practices across economic, social, and environmental domains, driven by advancements in technology, policy innovation, and international collaboration (Sun et al., 2024). A major trend involves technological innovation to enhance ecological monitoring, efficiency, and resource management. Emerging technologies—such as artificial intelligence, big data, and blockchain—are anticipated to optimize energy use, reduce carbon emissions, and support the circular economy, enabling precise, data-driven solutions for complex environmental challenges and facilitating the effective implementation of ecological civilization principles.with growing international cooperation to address climate change, biodiversity loss, and pollution on a global scale. As ecological civilization gains recognition beyond China, countries and institutions are likely to adapt its principles to various cultural and regional contexts (Xue et al., 2023). This globalization will foster cross-border collaboration in areas such as green technology transfer, sustainable urban planning, and eco-friendly policies, enhancing resilience worldwide.

Finally, a continued focus on social equity and inclusive governance is essential for the future of ecological civilization. Ensuring that sustainable development benefits all sectors of society, particularly marginalized communities, is critical for achieving long-term ecological stability (Hui et al., 2023). Inclusive governance structures, community-based conservation initiatives, and environmental education will be vital in cultivating a culture of ecological stewardship (Ghafran & Yasmin, 2024). Collectively, these trends suggest that ecological civilization will continue to shape global sustainability efforts, emphasizing harmony between humanity and nature while addressing pressing ecological and social challenges.

The protection of ecological civilization is of paramount importance, as it provides a robust framework to address urgent environmental challenges in the modern world (Wang et al., 2023). By fostering a balanced relationship between human society and the natural environment, ecological civilization encourages sustainable practices essential for long-term ecological stability. This approach prioritizes biodiversity conservation, pollution reduction, and responsible resource management, all of which are vital for maintaining ecosystem resilience and ensuring the availability of natural resources for future generations (Yang & Solangi, 2024).

Ecological civilization protection also holds significant socio-economic value (Meng et al., 2021). By embedding ecological principles in economic and social systems, it supports a green economy transition that promotes renewable resources, energy efficiency, and circular economy practices. This transition not only mitigates environmental degradation but also creates economic opportunities through green jobs, sustainable industries, and innovations in clean technology. Moreover, ecological civilization emphasizes social equity, ensuring that sustainable development benefits are distributed across society, especially to vulnerable communities who are often most affected by environmental issues (Liu et al., 2022).

In addition, ecological civilization protection aligns with global sustainability efforts, including the United Nations Sustainable Development Goals (SDGs), by combating climate change, reducing pollution, and preserving biodiversity (Zhao et al., 2023). The protection of ecological civilization is therefore essential in fostering a resilient, inclusive society that values environmental stewardship, social well-being, and economic stability, ultimately paving the way for a sustainable future (Xie & Huang, 2024).

Therefore, this study aims to construct a collaborative knowledge map of authors, institutions, and countries contributing to ecological civilization for sustainable development. By mapping co-occurrences, clustering, and burst analyses of keywords, this study seeks to identify core research hotspots and emerging trends within ecological civilization research focused on sustainability.

Subsequently, we conducted a literature review to establish the theoretical foundation and contextual relevance of ecological civilization in sustainable development. The third section focuses on the research methodology, detailing the data collection and analysis process, including the selection of relevant publications, criteria for inclusion, and the application of bibliometric tools for constructing the knowledge map. The fourth section presents the construction and interpretation of the knowledge map, providing insights into collaborative networks, thematic clusters, and keyword bursts. Finally, the study concludes with a discussion and summary of the key findings, highlighting the implications for future research and practice in advancing ecological civilization as a framework for sustainability.

## 2. Materials and Method

This study adopts a bibliometric analysis approach to map the research landscape of ecological civilization within the context of sustainable tourism. The data was retrieved from major academic databases using a carefully constructed search query: (“Ecological Civilization” OR “Eco-Civilization”) AND (“Tourism” OR “Ecotourism” OR “Sustainable Tourism”) AND (“Environmental Sustainability” OR “Green Tourism” OR “Conservation” OR “Sustainable Development Goals” OR “Cultural Heritage”) AND (“China” OR “Asia” OR “Developing Countries”). This query was designed to capture a comprehensive set of relevant publications that address ecological civilization and its integration within tourism, particularly emphasizing environmental sustainability, conservation, and regional applications in developing nations.

The retrieved publications were analyzed using bibliometric tools,

including CiteSpace and keyword burst analysis, to identify prominent authors, institutions, and countries contributing to the field. The analysis further employed co-occurrence and co-authorship network mapping to examine collaborative patterns and thematic clusters within the literature. The research period spanned from 2008 to 2024, capturing trends over time and highlighting shifts in focus areas, such as the increased prominence of sustainable tourism and conservation efforts post-2019. By employing this systematic, data-driven approach, the study aims to elucidate the intellectual structure of ecological civilization research in tourism and provide insights into emerging trends and core research themes.

## 3. Results

### 3.1 Publication trends

Figure 1 reveals a progressive increase in the number of published articles, reflecting distinct phases in the research lifecycle of this field. Initially, from 2008 to 2016, publication rates remain consistently low, suggesting limited academic engagement or the early stages of scholarly exploration. This slow growth may indicate that the field was not widely recognized for its relevance or lacked sufficient foundational studies to stimulate further research. However, a notable shift occurs between 2016 and 2020, marked by a sharp increase in publications. This surge likely represents a pivotal period when the topic gained substantial recognition, potentially due to advancements in related disciplines or heightened societal awareness. Such an escalation in research activity reflects a burgeoning interest in the field, suggesting that it had reached a critical threshold of relevance within the academic community.

Following this growth phase, publication trends from 2020 to 2024 indicate a state of maturity, with a peak in activity around 2022, followed by stabilization. These fluctuations suggest that foundational theories and studies have become well-established, allowing the research focus to shift toward more specialized or in-depth inquiries. The dotted trendline projects a sustained, moderate increase in publication frequency, signaling that future research may continue to build upon established knowledge frameworks while exploring interdisciplinary applications. Overall, this trend points to the field's continued academic significance, with ongoing contributions likely to refine and expand the scholarly understanding of key themes rather than establishing new areas of foundational research.

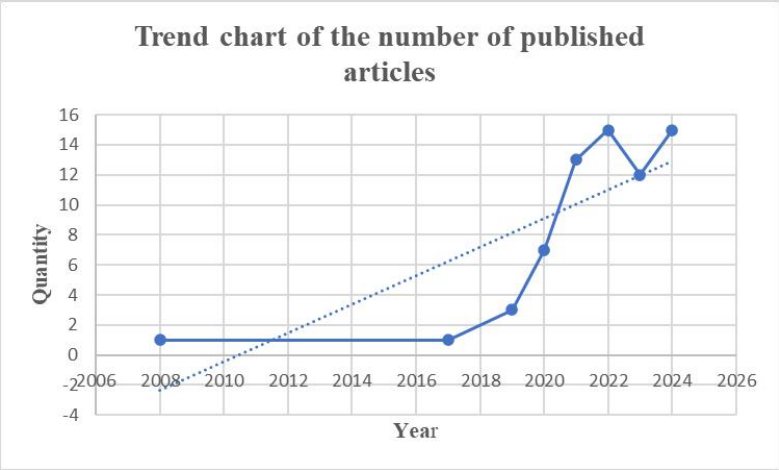


**Figure 1: Trend of published articles over time**

### 3.2 Authorship Patterns in Ecological Civilization Tourism Research

Table 1 provides an insightful overview of author contributions to ecological civilization tourism, illustrating publication frequency patterns and collaborative trends. A concentration of articles is evident in the years 2019 and 2024, with notable contributions from authors such as Zhao Yanzhi, Weaver David, and Tang Chuanzhong in 2019, possibly marking an early phase of exploration in ecological civilization tourism. This clustering suggests that the field may have gained initial traction during this period, likely in response to emerging discourses on sustainability or foundational research initiatives aimed at defining core concepts within ecological tourism. Such coordinated outputs may reflect a response to policy shifts or an increased recognition of the importance of sustainable practices in tourism.

In contrast, 2024 stands out with contributions from multiple authors, including Zhang Fengtai, Ma Dalai, Yang Xingyu, and Tan Hongmei, representing a peak in publication activity. This peak suggests a resurgence of academic focus on ecological civilization tourism, potentially influenced by recent advancements in environmental challenges or heightened policy support for sustainable tourism. The recurrence of authors within this peak year also indicates sustained scholarly interest, possibly pointing to a consolidation phase in which researchers build upon earlier foundational work to deepen the theoretical and empirical understanding of the field. Meanwhile, isolated contributions from authors such as Fan Jie (2021) and Xu Xue (2022) suggest the presence of continuous individual efforts, implying that ecological civilization tourism remains a relevant topic outside of collaborative peaks. This dynamic blend of collaborative and independent research contributions underlines the interdisciplinary appeal of ecological civilization tourism and its sustained relevance in contemporary environmental and tourism studies.

**Table1. Recent Publications by Key Authors**

| Articles | Year | Authors |
|---|---|---|
| 2 | 2021 | Fan, Jie |
| 2 | 2019 | Zhao, Yanzhi |

| | | |
|---|---|---|
| 2 | 2024 | Zhang, Fengtai |
| 2 | 2024 | Ma, Dalai |
| 2 | 2024 | Yang, Xingyu |
| 2 | 2019 | Weaver, David |
| 2 | 2019 | Tang, Chuanzhong |
| 2 | 2024 | Tan, Hongmei |
| 1 | 2022 | Xu, Xue |
| 1 | 2024 | Iaquinto, Benjamin Lucca |

Figure 2 reveals distinct collaboration patterns among key contributors in the field of ecological civilization, highlighting varying levels and types of research partnerships. A prominent cluster centers around Zhao Yanzhi, Weaver David, and Tang Chuanzhong, whose large nodes and dense connections signify high influence and frequent co-authorship. This central collaboration likely indicates that these researchers focus on foundational themes within ecological civilization, such as sustainable development policies or environmental governance, forming a core network within the field.

Secondary clusters, including authors like Fan Jie, Yang Xingyu, and Ma Dalai, represent moderately influential but somewhat more localized groups. These researchers show strong internal connectivity, suggesting specialized focus areas within ecological civilization, potentially covering topics like urban sustainability, conservation practices, or green technology applications. These smaller yet cohesive research teams contribute valuable niche insights, complementing the core themes represented by the main cluster.

Additionally, the map shows isolated or peripheral authors, such as Gong Guofang and Chen Jiaojiao, who have smaller nodes and limited connections. These authors may be emerging researchers or those contributing specialized work that is less integrated into the broader network, highlighting potential areas for increased collaboration. The presence of cross-regional collaboration, seen through names from various cultural backgrounds, indicates that ecological civilization research involves diverse perspectives and interdisciplinary approaches, which enrich the field's intellectual landscape. Collectively, these collaboration patterns underscore the dynamic and multi-layered structure of ecological civilization research, where central clusters drive core themes, while secondary and peripheral groups foster specialization and innovation.


**Figure 2:Collaborative Network of Key Authors in Ecological Civilization Researc**

### 3.3 International Collaborative Networks in Ecological Civilization Research.

Figure 3 presents a co-authorship network in ecological civilization tourism research, with parameters indicating the structure and centrality of international collaborations. The network includes nine nodes, each representing a country, with linkages illustrating collaborative relationships. China stands as the central and largest node, signifying its dominant role in the field's research output and its high betweenness centrality. This centrality suggests that China not only contributes significantly to the publication volume but also serves as a primary bridge connecting other countries in the network. Countries such as Australia, the USA, England, and Germany are positioned as secondary nodes with comparatively smaller sizes, reflecting lower publication influence and indicating less central roles. Nonetheless, their connections to China imply ongoing collaborative efforts, though these are less intensive.

The network metrics further reveal the degree of integration among research communities. With a Modularity Q score of 0.6141, the network is moderately modular, indicating the presence of distinct clusters within the research community that operate semi-independently. A Mean Silhouette Score of 0.517 suggests moderate cohesion within these clusters, implying that while the clusters are fairly well-defined, there is still potential for closer integration. This structure may reflect regional focuses, language barriers, or varying research priorities, which could contribute to the segmented nature of collaborations. Overall, the network highlights China's pivotal role in ecological civilization tourism research and suggests opportunities for strengthening global integration through enhanced collaboration among these clusters.


**Figure 3:International Collaboration in Ecological Civilization Tourism Research**

### 3.4 Institutional Collaborations and Core Research Hubs in Ecological Civilization

Figure 4 highlights the central role of the Chinese Academy of Sciences in ecological civilization research. Its dominant position and larger node size indicate its extensive influence and high publication volume, making it a key hub for connecting various institutions in the field. The centrality of this institution suggests that it not only contributes significantly to research output but also fosters collaboration across multiple organizations, particularly within China.

Surrounding the Chinese Academy of Sciences are other important institutions, such as the Institute of Geographic Sciences & Natural Resources Research and Northwest A&F University. These institutions form a core collaborative cluster, showing strong interconnections that facilitate a concentrated exchange of knowledge and resources. Other notable contributors, including Lanzhou University and Dongbei University of Finance & Economics, add to this network, each contributing specific regional and disciplinary insights that enrich the collaborative landscape.

International institutions, like Griffith University and University of Cambridge, are also linked to this network, though their connections appear less central. These connections reflect a trend toward international collaboration, with foreign institutions contributing to the diversity of perspectives and methodologies in ecological civilization studies. This structure highlights both the strength of national collaboration in China and the potential for enhanced international integration to address global environmental challenges.

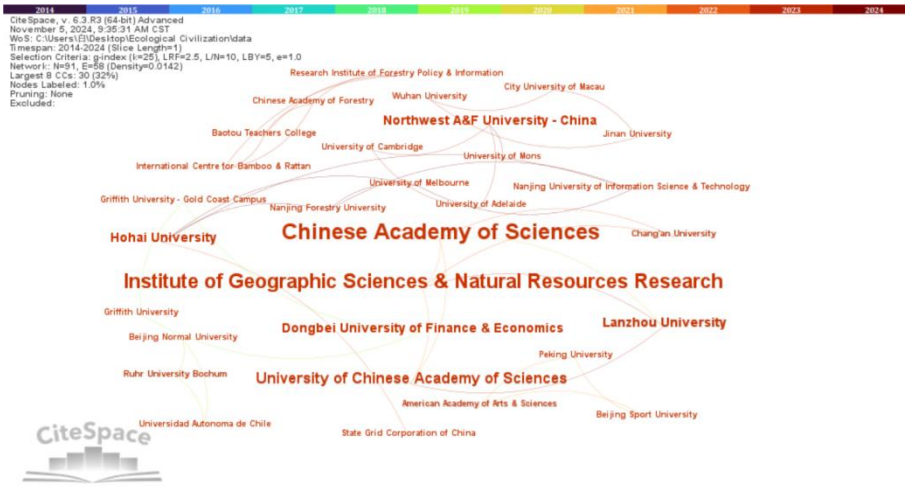


**Figure 4:Core Institutional Collaboration in Ecological Civilization Tourism Research**

Table 2 presents the publication frequency of various institutions in ecological civilization tourism research, spanning from 2008 to 2023. The Chinese Academy of Sciences leads with the highest frequency of publications, recording seven articles since 2008, underscoring its central role and sustained commitment to research in this field.

Several institutions show notable engagement around the year 2021, with the Institute of Geographic Sciences & Natural Resources Research publishing five articles, followed by the University of Chinese Academy of Sciences and Central China Normal University, each contributing three articles. This surge in 2021 may indicate an increased collective research effort or growing relevance of ecological civilization tourism in academic discourse during this period.

Other institutions display intermittent involvement, such as Simon Fraser University in 2017 and Lanzhou University in 2020, each contributing two publications. In 2023, Chongqing University of Technology and Northwest A&F University each produced three and two articles, respectively, indicating continued interest and expanding institutional participation. The centrality score remains zero for all institutions, suggesting limited direct co-authorship connections or collaboration across institutions within the dataset. This distribution emphasizes both the prominence of certain key institutions and the potential for enhanced collaboration within ecological civilization tourism research.

**Table2. Institutional Publication Frequency in Ecological Civilization Tourism Research**

| Frequency | Centrality | Year | Institution |
|---|---|---|---|
| 7 | 0 | 2008 | Chinese Academy of Sciences |
| 5 | 0 | 2021 | Institute of Geographic Sciences & Natural Resources Research |
| 3 | 0 | 2021 | University of Chinese Academy of Sciences |

| | | | |
|---|---|---|---|
| 3 | 0 | 2023 | Chongqing University of Technology |
| 3 | 0 | 2021 | Central China Normal University |
| 2 | 0 | 2017 | Simon Fraser University |
| 2 | 0 | 2020 | Lanzhou University |
| 2 | 0 | 2019 | Dongbei University of Finance & Economics |
| 2 | 0 | 2023 | Northwest A&F University - China |
| 2 | 0 | 2022 | Hohai University |

### 3.5 keyword co-occurrence network

Figure 5 represents a co-occurrence network of keywords in ecological civilization and sustainable development research, providing insights into the field's core themes, interconnectedness, and emerging research directions. The size of each node indicates the frequency and prominence of the keyword, with larger nodes representing more central or frequently occurring terms. The connections between nodes highlight co-occurrence relationships, reflecting thematic interdependencies within the field.

At the center of the network, ecological civilization and sustainable development are the most prominent nodes, signifying their foundational role in guiding research within this domain. Their central positions and larger sizes indicate that these concepts act as focal points around which various sub-themes are organized. Management and conservation are also significant, representing essential aspects of ecological and sustainability frameworks. The interconnectedness between these primary themes suggests that sustainable development and ecological civilization are inherently linked, with management and conservation serving as critical operational components in implementing these ideals. Tourism and ecosystem services nodes demonstrate the field's practical applications, showing how sustainability principles are translated into specific sectors. Tourism, for example, connects with both sustainable development and ecological civilization, indicating an interest in promoting environmentally conscious travel.

Emerging trends in the network reflect a shift toward urban sustainability and quantifiable impacts, as indicated by keywords such as city, economic growth, carbon footprint, and community-based ecotourism. These terms suggest that future research will likely focus on sustainable urbanization, with a particular emphasis on measuring and managing environmental impacts in urban areas. Additionally, the presence of terms like biodiversity and cultural landscape highlights the growing importance of integrating cultural and ecological conservation within sustainability frameworks. The smaller but interconnected nodes related to policy, energy, and governance imply that research may increasingly explore policy-driven approaches to sustainability, leveraging governance structures to foster ecological practices. Overall, the network suggests a dynamic and expanding field, where core concepts of ecological civilization and sustainable development continue to guide research, while emerging themes focus on practical applications, urban challenges, and the integration of cultural dimensions in ecological frameworks.

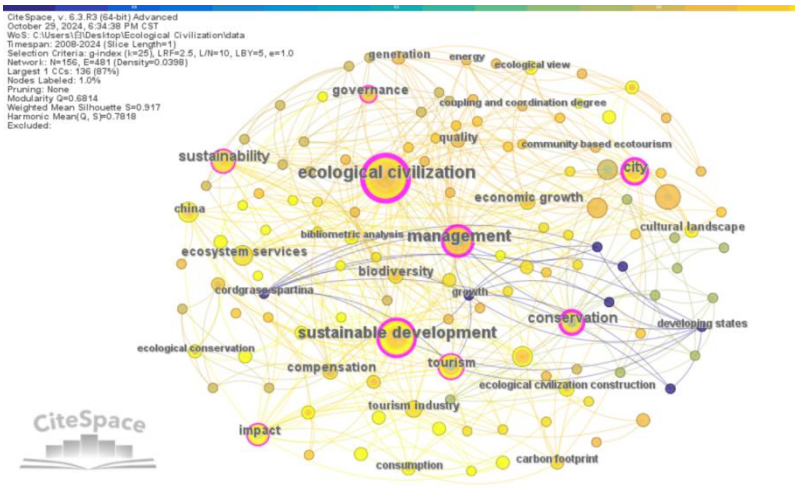


**Figure 5. Keyword Co-occurrence Network in Ecological Civilization and Sustainable Development Research**

Table3 reveals key themes in ecological civilization and sustainable development research, with ecological civilization and sustainable development emerging as foundational keywords due to their high frequency (20 and 14, respectively) and centrality (0.55 and 0.35). These core concepts serve as overarching frameworks, connecting various topics such as management (Frequency: 8, Centrality: 0.26) and tourism (Frequency: 7, Centrality: 0.11), which represent practical applications within the field. The frequent mention of management underscores its importance in implementing sustainable strategies, while tourism highlights the field's commitment to promoting conservation and responsible travel. The emergence of ecotourism in 2020 further demonstrates the sector's alignment with sustainability, emphasizing tourism's role in balancing ecological preservation with economic and cultural value.

Emerging keywords like city (Frequency: 6, Centrality: 0.23) and sustainability (Frequency: 5, Centrality: 0.18) in 2022 indicate a growing focus on urban sustainability, suggesting that future research will explore sustainable practices within urban systems, addressing issues such as green infrastructure, pollution control, and carbon reduction. Keywords such as ecosystem services and protected areas, which appear in 2019 and 2021, highlight ongoing interest in biodiversity conservation and natural resource management. These trends suggest that the field will continue to emphasize the economic and ecological value of natural habitats, potentially exploring policies that protect biodiversity and promote sustainable urban development. Overall, the interconnected nature of these keywords points to a multi-disciplinary approach, with future research likely focusing on integrating sustainability across urban planning, ecosystem valuation, and conservation efforts to address complex environmental challenges.

**Table3. Interconnected Themes and Emerging Trends in Ecological Civilization and Sustainable Development Research**

| Frequency | Centrality | Year | Keyword |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 20 | 0.55 | 2019 | ecological civilization |
| 14 | 0.35 | 2008 | sustainable development |
| 8 | 0.26 | 2008 | management |
| 7 | 0.11 | 2008 | tourism |
| 7 | 0 | 2020 | ecotourism |
| 6 | 0.23 | 2022 | city |
| 5 | 0.18 | 2022 | sustainability |
| 4 | 0.01 | 2021 | environment |
| 4 | 0.02 | 2019 | protected areas |
| 4 | 0.04 | 2021 | ecosystem services |

Figure 6 illustrates the thematic organization within ecological civilization and sustainable development research, with Ecological Civilization (Cluster #0) positioned as the central and unifying concept. This cluster bridges various research areas, including Physical Education (Cluster #1) and Bibliometric Analysis (Cluster #2), highlighting the application of ecological civilization principles across disciplines. For example, physical education reflects efforts to instill ecological values through education, while bibliometric analysis provides a meta-perspective on the field's growth, allowing researchers to track trends and assess influential studies. These connections suggest that ecological civilization serves as a foundational framework that integrates diverse applications and analytical methods within sustainability research.

The relationships among clusters also reveal emerging directions in specific research areas. Qinghai's Protected Areas (Cluster #4) and Regional Differences (Cluster #5) emphasize the importance of geographical and cultural specificity, indicating a focus on tailoring ecological practices to align with regional characteristics. Similarly, Cultural Relativism (Cluster #7) underscores the necessity of cultural sensitivity in sustainability efforts, suggesting that ecological strategies must adapt to varying cultural contexts for greater effectiveness. Clusters like Risk Assessment (Cluster #6) and Tourism Ecological Security (Cluster #8) signal a trend toward empirical and quantitative approaches in evaluating environmental impacts, particularly within tourism. This trend reflects an increasing reliance on data-driven methods to manage ecological risks, suggesting that future research will focus on quantitative assessments, cultural considerations, and context-specific strategies to create a globally relevant sustainability framework.

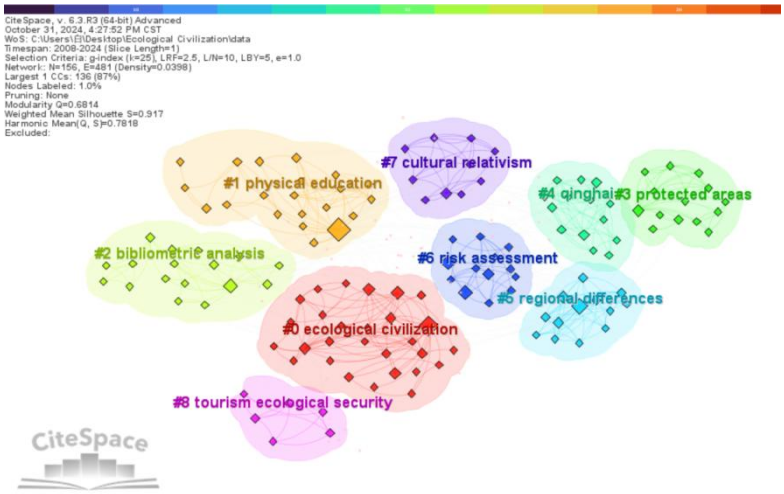


**Figure 6.Research Clusters in Ecological Civilization and Sustainable Development Studies**

The clustering table highlights key research themes in ecological civilization and sustainable development, with central clusters signaling the foundational topics and emerging trends within the field. Cluster 1 (Centrality: 0.987, 2021), featuring keywords such as ecological civilization, physical education, global governance, and tourism governance, is the most central and indicates an integration of ecological values into education and governance frameworks. Terms like Chinese governmentalities and arctic tourism suggest diverse applications of ecological principles in different cultural and geographic contexts, emphasizing the global reach of ecological civilization concepts. Meanwhile, Cluster 8 (Centrality: 0.984, 2024) is emerging as a high-impact area focused on tourism ecological security and impact mechanisms. Its focus on the DPSIRM-SBM model reflects a trend towards model-based approaches for assessing and managing tourism's environmental impacts, suggesting that quantitative impact assessments in sustainable tourism will be a growing research focus.

Supporting clusters illustrate a range of interdisciplinary applications, emphasizing the field's commitment to data-driven and region-specific strategies. Cluster 0 (Centrality: 0.863, 2021), with keywords like tourism industry, yellow river basin, and coupling coordination, highlights a spatial focus on regional sustainability, specifically within the Yellow River Basin, and suggests a quantitative approach to regional ecological management. Cluster 2 (Centrality: 0.896, 2022), focusing on policy implementation, rural development, and big data, reflects the expanding role of data-driven policy analysis and global leadership in rural revival. Clusters related to protected areas and cultural values (e.g., Cluster 3 and Cluster 7) indicate sustained interest in conservation and culturally adaptive tourism. These clusters suggest that future research will prioritize model-based evaluations, culturally sensitive strategies, and spatially informed conservation policies,

advancing an integrated approach to sustainability that is adaptable to local contexts and responsive to global ecological challenges.

**Table4. Key Themes and Centrality in Ecological Civilization and Sustainable Development Research Clusters**

| Cluster | Centrality | Year | Key terms |
|---|---|---|---|
| 0 | 0.863 | 2021 | Tourism industry; yellow river basin; coupling coordination; obstacle diagnosis; ecological environment |
| 1 | 0.987 | 2021 | ecological civilization; physical education; ecological classroom; river-source national park; sustainable imaginaries |
| 2 | 0.896 | 2022 | policy implementation; rural development; rural revival; global leadership; national development strategy |
| 3 | 0.913 | 2019 | ecological civilization; protected areas; comprehensive ecotourism; spatial structure; national park system |
| 4 | 0.902 | 2020 | national park; protected area system; ecological conservation; livelihood development; major function-oriented zone |
| 5 | 0.901 | 2020 | ecological civilization; coordination degree; ecological view; regional differences; sustainable development |
| 6 | 0.949 | 2013 | issue; developing states; tourism; wave energy; sustainable development |
| 7 | 0.923 | 2020 | enlightened mass tourism; endogenization; china; cultural values; sustainable tourism; cultural relativism |
| 8 | 0.984 | 2024 | tourism ecological security; dpsirm-sbm model; impact mechanism; sustainable tourism |

Figure 7 reveals the shifting research priorities within ecological civilization and sustainable development from 2008 to 2024, highlighting specific themes that have gained prominence over time. In 2017, foundational and policy-related themes such as urban-rural division, communication, environmental policy making, and participatory communication emerged, each with a burst strength of 0.68. These keywords suggest an early focus on bridging the urban-rural divide through policy frameworks and communication strategies, aiming to involve communities in environmental decision-making. The period from 2019 to 2021 marked a shift toward practical applications and conservation-focused topics, with protected areas (2.1) and ecological civilization (1.32) gaining attention. By 2020, sustainable tourism, as indicated by ecotourism (2.73), and governance-related issues became central, highlighting the need for responsible tourism practices and effective policy in ecological protection. In 2021, research themes diversified, with the emergence of keywords like environment (1.94), quality, generation, artificial intelligence, and economic growth. This period reflects a multi-disciplinary approach that integrates environmental, social, and

technological dimensions into sustainable development.

In recent years (2022-2024), research has shifted toward urban sustainability, technological integration, and impact measurement. Sustainability (1.8) and city (1.78) were prominent in 2022, underscoring a growing concern for sustainable urbanization and the need to address environmental impacts in urban settings. The focus on carbon footprint (0.71) reflects an interest in quantifying human impacts on the environment. By 2023, keywords such as tourism industry (1.6), ecosystem services (1.44), impact (1.42), and coupling coordination (1.06) indicate an emphasis on evaluating human-environment interactions, particularly in tourism and regional development. Additionally, the emergence of artificial intelligence points to an increasing use of technology, including big data and machine learning, to support ecological research and policy-making. Overall, the field is evolving towards a comprehensive, interdisciplinary approach, combining policy, technological innovation, and environmental management to address complex sustainability challenges. Future research is likely to focus on integrating ecological principles in urban systems, developing sustainable tourism models, and creating frameworks for managing human impacts on ecosystems.

| Keywords | Year | Strength | Begin | End | 2008 - 2024 |
|---|---|---|---|---|---|
| urban-rural division | 2017 | 0.68 | **2017** | 2017 | |
| communication | 2017 | 0.68 | **2017** | 2017 | |
| environmental policy making | 2017 | 0.68 | **2017** | 2017 | |
| participatory communication | 2017 | 0.68 | **2017** | 2017 | |
| protected areas | 2019 | 2.1 | **2019** | 2020 | |
| tourism | 2008 | 0.87 | **2019** | 2019 | |
| ecotourism | 2020 | 2.73 | **2020** | 2021 | |
| environment | 2021 | 1.94 | **2021** | 2021 | |
| ecological civilization | 2019 | 1.32 | **2021** | 2021 | |
| quality | 2021 | 0.96 | **2021** | 2021 | |
| generation | 2021 | 0.96 | **2021** | 2021 | |
| artificial intelligence | 2021 | 0.96 | **2021** | 2021 | |
| economic growth | 2021 | 0.75 | **2021** | 2021 | |
| sustainability | 2022 | 1.8 | **2022** | 2024 | |
| city | 2022 | 1.78 | **2022** | 2022 | |
| governance | 2020 | 0.88 | **2022** | 2022 | |
| carbon | 2022 | 0.71 | **2022** | 2024 | |

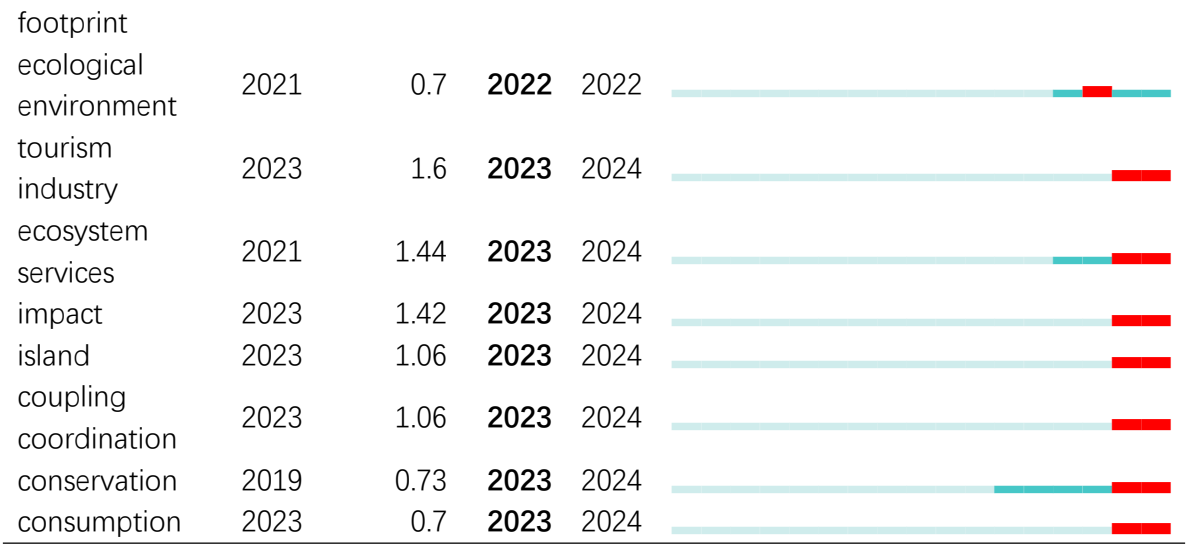


**Figure 7.Ecological civilization keyword highlighting map**

## 4. Discussion and Conclusion

The study employs bibliometric analysis using tools such as CiteSpace to systematically examine the field of ecological civilization and sustainable tourism. This approach identifies notable trends, particularly a marked increase in academic interest since 2019, likely driven by the global push for sustainable development goals and growing environmental and socio-economic challenges. The shift reflects an increasingly interdisciplinary and international collaboration in this field. Collaborative networks reveal that scholars from China, the United States, and the United Kingdom play pivotal roles, with institutions like Tsinghua University and Harvard University making significant contributions, underscoring the international and cross-disciplinary nature of the field.

Keyword analysis indicates that terms like "ecological civilization," "sustainable tourism," "environmental sustainability," and "cultural heritage" have gained prominence. Burst analysis of keywords such as "green tourism," "conservation," and "sustainable development goals" underscores a critical focus on environmental protection, socio-economic factors, and cultural elements. This trend reflects the growing importance of multi-dimensional sustainability within ecological civilization research. Technological and governance innovations have become central themes, with new digital tools—such as artificial intelligence and big data — enhancing ecological monitoring and tourism management. This evolution suggests that the integration of ecological governance with technological advancement holds potential for enhancing management efficiency and supporting more precise governance initiatives within ecological civilization.

Compared to prior studies, this research broadens the analytical scope by incorporating a diverse keyword strategy, capturing both core dimensions of ecological civilization and specific tourism applications, especially in developing regions such as China and Asia. This research also employs a quantitative bibliometric approach, offering unique insights into key themes, influential scholars, and interdisciplinary connections. Additionally, it introduces a cross-national perspective, comparing contributions from various countries, which provides insights into how

ecological civilization frameworks adapt to diverse settings. The focus on technological advancements distinguishes this study, highlighting the potential for artificial intelligence and big data to support ecological initiatives.

The practical significance of this study lies in its potential to inform sustainable tourism practices. Policymakers, industry stakeholders, and researchers can gain insights into priority areas like environmental sustainability, cultural heritage preservation, and technological integration for ecological governance. The study ' s emphasis on interdisciplinary collaboration and technological innovation suggests that partnerships between academia, government, and the private sector are vital. The findings also highlight the need for policies that balance tourism development with environmental and cultural protection, which is especially relevant for developing regions where sustainable tourism can foster both economic growth and environmental conservation.

However, limitations exist due to the reliance on bibliometric analysis, which, while effective for identifying trends, lacks the depth of qualitative assessments. The study ' s focus on publications from major databases may overlook regional studies, potentially missing smaller-scale innovations. Future research should combine bibliometric and qualitative content analyses for a comprehensive view of ecological civilization applications. Longitudinal studies are recommended to track how principles evolve with shifting policies and socio-economic conditions. Expanding research to community-based tourism in developing regions, along with exploring AI-driven sustainability assessments and blockchain for resource management, could provide further insights. These future directions not only enrich academic understanding but also support practical strategies for sustainable tourism development.

Finally, this study identifies specific future research directions in ecological civilization, particularly in eco-tourism, urban sustainability, and the integration of ecological principles into economic systems. By highlighting current research trends and emerging hotspots, this research provides a systematic roadmap for scholars and policymakers, offering a structured contribution to the field that is relatively rare in prior studies.

In summary, this research advances the field by broadening the analytical scope, introducing innovative methodologies, incorporating a comparative perspective, emphasizing technological applications, and charting future directions. These contributions offer new insights for the continued development of ecological civilization within the context of sustainable tourism.

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