

Bibliometric Visualization Analysis of Ethnoecology Research: A Postprint

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Abstract

Ethnoecology is an interdisciplinary discipline that investigates indigenous peoples' perceptions of ecosystems and their relationships with the environment. To examine the current development status and research frontiers of ethnoecology, the Web of Science was utilized as the retrieval database. Papers published between 1995 and 2016 were retrieved by inputting relevant keywords related to ethnoecology, and statistical analysis of the retrieved literature information was performed using Web of Science and Hiscite to discuss publication and citation patterns across different years, countries, research institutions, authors, and journals. Citespace software was employed to conduct relevant analyses on research hotspots and frontiers and to generate knowledge maps. This study revealed that the development of ethnoecology has entered a low period in recent years; there remains a certain gap between China's ethnoecology research level and that of developed countries; and research on the sustainability of traditional indigenous ecosystems, research on the relationship between traditional indigenous ecosystems and climate change, and research on the service functions of traditional indigenous ecosystems constitute the recent research frontiers and hotspots in ethnoecology.

Full Text

Preamble

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A Bibliometric Visualization Analysis of Ethnoecology Research

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Abstract

Ethnoecology is an interdisciplinary field that investigates indigenous peoples' cognition of ecosystems and their relationships with the environment. To explore the current status and research frontiers of ethnoecology, this study utilized the Web of Science (WoS) Core Collection database as the data source. Relevant keywords related to ethnoecology were used to retrieve literature, and Hiscite was employed to conduct statistical analysis of the retrieved documents. Citespace software was then used to analyze research hotspots and frontiers and to generate knowledge maps. The findings reveal that ethnoecology development has entered a low period in recent years. China's ethnoecology research level still exhibits a certain gap compared with developed countries. The sustainability of traditional ethnoecosystems, the relationship between ethnoecosystems and climate change, and the service functions of traditional ethnoecosystems constitute the most recent research frontiers and hotspots in ethnoecology.

Keywords: Ethnoecology; Information visualization; Traditional ecological knowledge; Indigenous knowledge; Bibliometrics; Knowledge mapping

Introduction

Ethnoecology is a science that studies the cognition of ecosystems by indigenous peoples and the interrelationships between them and their environment (Ethnoecology). Its research objects primarily include ethnic groups themselves, as well as their natural and social environments [1]. As a discipline, ethnoecology represents an applied branch of ecology that has been mutually influenced and permeated by both ecology and ethnology [2-3]. Ethnoecology holds significant positive meaning for harmonious coexistence between humans and the environment, and its research results are crucial for the development of different ethnic groups and social sustainability in China. Consequently, it has attracted increasing attention from scholars in China [2, 4]. Bibliometrics is an interdisciplinary field that employs mathematical and statistical methods to analyze relevant knowledge carriers to obtain valuable information [5-6]. The development of a discipline or research field inevitably manifests in the publication and citation of relevant papers, making bibliometrics useful for describing disciplinary development status and predicting trends [7-8]. By drawing knowledge maps to visually and intuitively express results graphically, this study employs bibliometric analysis and knowledge mapping to explore and describe the overall international development and research frontiers of ethnoecology over the years, providing reference for disciplinary construction and related research in China.

1 Data Sources and Research Methods

This study selected the Web of Science (WoS) Core Collection database and its citation data from [year range] as the data source. Search terms were developed using keywords related to ethnoecology. The search query was: ((("local knowledge" OR "traditional knowledge" OR "indigenous knowledge") SAME ("forest

management" OR agroecosystem OR "grassland management" OR "natural resource management" OR "biodiversity" OR "plant resource")) OR ethnoecology OR (traditional SAME ("forest management" OR "agroecosystem" OR "grassland management" OR "natural resource management"))).

After data acquisition, comprehensive analysis and visualization were performed. WoS, Hiscite (Version 2.0), and Citespace (Version 5.0.R5 SE) are powerful data visualization tools favored for their analytical and knowledge mapping capabilities, capable of presenting non-numeric information in visual forms to facilitate better analysis and understanding [9–10].

2 Results and Analysis

2.1 Publication and Citation Volume Analysis

During the study period, the WoS database contained [number] published papers, which were cited a total of [number] times, excluding self-citations. Using the built-in statistical analysis function, the annual development trend shows that although the number of research papers published in ethnoecology fluctuated slightly, the overall trend maintained growth. In 1995, the annual publication volume was only [number], while the peak annual output reached [number] in [year]. From the perspective of total annual citations, citation counts increased progressively over time, with the rate of increase accelerating. However, analysis from the perspective of cited times reveals a different picture. While publication volume and citation counts appear to show stable development, TLCs (Total Local Citation Score) and TGCS (Total Global Citation Score) exhibit significant fluctuations rather than a consistent upward trend, with notably high levels during 2004–2010 but an overall decline in the latter period.

[Figure 1: see original paper] Annual number of publications

[Figure 2: see original paper] Annual number of citing papers

[Figure 3: see original paper] Annual cited times of papers

2.2 Paper Citation Count Analysis

Hiscite analysis of the raw data reveals that LCS (Local Citation Score) indicates the number of times a paper is cited within the local dataset (all literature exported from WoS after keyword retrieval), representing its importance within the field. GCS (Global Citation Score) indicates total citation counts in the WoS database, though citing papers may not necessarily belong to the field. The data show that annual citation counts in this field do not follow the same growth pattern as paper production and citing numbers, but instead exhibit large fluctuations, with a general decline after 2010. This suggests a decrease in paper quality and influence, indicating that ethnoecology has entered a low period.

Querying original documents combined with data analysis reveals that the de-

cline in citation counts after 2004 can be attributed to: (1) Changes in main publication types: During 2004–2010, many review papers were published, representing a period focused on knowledge discovery and synthesis in ethnoecology. After 2010, review papers decreased, with most studies becoming research papers focusing on specific regions or ethnic ecosystems for ecosystem service restoration and maintenance. (2) Transfer of disciplinary hotspots: The shift toward studying biodiversity in ethnoecosystems and local community cultural diversity, including rich traditional knowledge, led to lower overall citation rates in the initial years of hotspot transfer. After 2010, research focused more on protecting and restoring ethnoecosystem service functions, with ethnoecology research transitioning from merely protecting traditional communities and knowledge to studying benefit-sharing of traditional knowledge. This shift was closely related to the research environment and trends at the time, with the Nagoya Protocol serving as an important indicator of this directional change [11–12].

2.3 Paper Citation Relationship Analysis

Notably, the paper with the highest TLCS value is *Rediscovery of traditional ecological knowledge as adaptive management* by Fikret Berkes, Johan Colding, and Carl Folke, published in *Ecological Applications* in 2000, far exceeding the second-place paper. In the citation network diagram of the top 100 papers by TLCS, each circle represents a paper (larger circles indicate higher TGCS), and arrows represent citation relationships. This paper received the most citations (183), demonstrating its crucial position in ethnoecology. Through literature review, the authors summarized how local people in different cases adaptively manage their ecological environments through traditional knowledge and practices, analyzing the underlying social mechanisms and cultural customs. This provides valuable references for modern ecological governance and restoration and offers a template for similar research [12].

The network clearly shows a polarization between left and right halves. The left nodes form a nearly closed cluster through complex citation relationships, representing the mainstream of ethnoecology research, while the right side consists mostly of isolated simple node groups representing non-mainstream and emerging research areas. Analyzing key literature in the left cluster reveals the research mainstream during [year range]. Anthony Davis' s paper *Who knows? On the importance of identifying "experts" when researching local ecological knowledge* (Human Ecology, 2003) describes systematic methodologies for identifying local traditional knowledge experts to efficiently obtain research information, calling for methodological improvements [13]. Fikret Berkes' s *Rethinking community-based conservation* (Conservation Biology, 2004) argues that traditional community conservation and development are difficult to unify, requiring more complex multidisciplinary cooperation [14].

A small cluster formed by three key nodes after 2010 represents new research content in ethnoecology: Kazuhiko Takeuchi' s *Rebuilding the relationship between people and nature: the Satoyama Initiative* (Ecological Research, 2010), Maria

Tengö et al.'s *Connecting diverse knowledge systems for enhanced ecosystem governance: the multiple evidence base approach* (AMBIO, 2014), and Sandra Díaz et al.'s *The IPBES Conceptual Framework—connecting nature and people* (Current Opinion in Environmental Sustainability, 2015). These papers are all based on ethnoecosystems and align with the sustainability and biodiversity research trends analyzed previously [15–17].

2.4 Author Analysis

In terms of author productivity, the top five most prolific authors are: Ranja y K Singh (17), Fikret Berkes (13), Victoria Reyes-García (13), Ulysses Paulino de Albuquerque (12), and Rakesh K Maikhuri (12). While Singh ranks first in publication count, Fikret Berkes has significantly higher TLCS and TGCS values, indicating greater influence in the field. Notably, Johan Colding and Carl Folke, both from Stockholm University's Department of Systems Ecology, rank in the top five for TLCS. Their contributions primarily come from collaborative work, particularly the aforementioned paper *Rediscovery of traditional ecological knowledge as adaptive management*, demonstrating its high quality and reference value and establishing their prominent academic status in the field.

Top 5 authors by publication numbers

Top 5 authors by TLCS value

2.5 Country and Institution Analysis

The retrieved papers from [year range] were published by authors from [number] countries or regions. The United States leads with 192 papers, more than double that of second-ranked Canada (192) and third-ranked [country] (179). The top five countries are primarily developed nations, indicating their leading role in ethnoecology. India is the only developing country in the top five, likely due to its long history and rich traditional knowledge, though its output remains relatively low. China published [number] papers, ranking twelfth, suggesting considerable room for improvement in ethnoecology research.

From an institutional perspective, the Chinese Academy of Sciences is the most productive institution (34 papers), making it a major research force globally and in China. This is followed by the University of British Columbia (32), National Autonomous University of Mexico (32), US Forest Service (30), and University of Manitoba (30). However, the Swedish University of Agricultural Sciences, Royal Swedish Academy of Sciences, and Stockholm University, despite lower publication counts, have substantially higher TLCS values, indicating higher paper quality and influence. Most top-ranking institutions are in developed regions, reaffirming their major contributions and highlighting the gap for developing countries.

Top 5 countries and regions by publication numbers

Top 5 institutions by publication numbers and top 3 by TLCS value

2.6 Journal Analysis

Statistics on journal publication and citation volumes reveal journal influence in the field and provide valuable references for scholars selecting target journals and references. *Forest Ecology and Management* ranks first with [number] papers, far exceeding the second-place journal, with decent TLCS values, indicating its influence in ethnoecology. However, *Ecology and Society* and *Journal of Ethnobiology and Ethnomedicine*, while ranking in the top 10, have relatively lower influence. The ratio of TLCS to publications better represents journal impact. *Biodiversity and Conservation* has the highest peer influence ratio. *Ecological Applications* and *Ecosystem* are the two most influential journals in ethnoecology, with TLCS-to-publication ratios far exceeding others. *Ecological Applications* focuses on how traditional knowledge and customs affect local communities and biodiversity, while *Ecosystem* emphasizes the use of traditional knowledge for ecosystem sustainability and resilience restoration. Both are social science journals indexed in WoS, fully reflecting ethnoecology's characteristic integration of natural and social sciences.

Top 10 journals by publication numbers in ethnoecology

Top 10 journals by cited numbers in ethnoecology

2.7 Hotspot Analysis

Visualizing disciplinary paradigms primarily involves co-citation analysis and co-word analysis. Co-citation analysis is more widely used for systematically revealing disciplinary structure, development patterns, and trends [18-19]. Ethnoecology is a highly comprehensive discipline where different subfields rarely share high-frequency keywords, making co-word analysis less effective for reflecting knowledge input-output between fields. This study selected co-citation analysis to examine ethnoecology's development hotspots and frontiers.

Citespace parameters were set with time span [range], slice length [value], node type "Cited reference," and thresholds (2,2,5; 3,2,10; 3,3,15). The resulting map contained [number] clusters, each representing a research frontier. The network had a modularity Q of 0.8424 and mean silhouette of 0.5353, indicating significant cluster structure with high confidence and meaningfulness [20]. The log-likelihood ratio algorithm extracted noun phrases from citing papers' keywords to name clusters.

The top 10 research frontiers in ethnoecology are: 1. **Sustainability of ethnoecosystems** (focus on social-ecological systems, crisis response, fisheries) 2. **Climate change adaptation** (integration of indigenous knowledge, protected areas, governance) 3. **Ecosystem services** (social-ecological resilience, natural resource management) 4. **Modern ecological techniques in traditional ethnoecosystems** (semiarid grazing systems) 5. **Ethnoecology theory and methodology** (transdisciplinarity, environmental governance) 6. **Tropical coastal ethnoecosystems** (marine protected areas, community-based conservation) 7. **Traditional knowledge and biodiversity conservation** (world-

view, religion, ecosystem management) 8. **Ethnobotany** (plant biodiversity, wild edible plants, traditional use) 9. **Traditional forest management** (community participation, sustainability indicators) 10. **Land degradation and policy** (political ecology, legal pluralism, deforestation)

Notably, ethnobotany—the science studying human-plant relationships—shows strong connections with ethnoecology. The research frontiers demonstrate the field's evolution from basic community and knowledge protection to benefit-sharing and sustainable development.

[Figure 5: see original paper] Cluster view of ethnoecology 1995–2016

[Figure 6: see original paper] Timeline view of ethnoecology 1995–2016

Cluster labels of top 10 clusters

3 Conclusion

This study employed bibliometric methods using WoS, Hiscite, and Citespace to analyze ethnoecology publications and citations from [year range]. While the field experienced better development phases around 2000 and 2004, it has entered a low period in recent years. Developed countries and their institutions remain the main research force. Although the Chinese Academy of Sciences ranks among top institutions, China lags behind in author influence and publication quality. *Ecological Applications* and *Ecosystem* are the two most influential journals in ethnoecology. Co-citation analysis and scientific mapping reveal that sustainability of traditional ethnoecosystems, climate change relationships, and ecosystem service functions are the hottest and newest research frontiers. China's ethnoecology research should leverage its rich traditional ecological knowledge, integrate advanced research concepts and technologies, and make greater contributions to ecological civilization construction and sustainable development of traditional ecosystems.

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Note: Figure translations are in progress. See original paper for figures.

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