

# Exploring Farm Household Land-Use Behavior in China: Evolution, Research Hotspots, and Emerging Trends (1996-2025)

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## Abstract

Advancing research on farm household land-use behavior is essential for understanding the implementation of the Rural Revitalization Strategy, promoting the development of an agricultural powerhouse, ensuring national food security, and achieving high-quality agricultural and rural development. Using CiteSpace bibliometric software, this study conducts a visual knowledge-mapping analysis of 564 publications on farm household land-use behavior indexed in the China National Knowledge Infrastructure (CNKI) database from 1996 to 2025. From a quantitative perspective, the study systematically examines the current research status, major hotspots, and evolutionary trends in this field, and reconstructs its developmental trajectory. The findings indicate that research on farm household land-use behavior has evolved from an initial exploratory stage to a period of rapid expansion, followed by gradual stabilization. A preliminary core group of authors and research institutions has emerged; however, overall collaboration networks remain fragmented and lack strong interconnections. Research hotspots mainly focus on two dimensions: specific land-use practices and studies concerning land-use decision-making actors. Future research should place greater emphasis on green agricultural development, ecosystem sustainability, and strengthened academic collaboration and interdisciplinary integration in alignment with national macro-policy priorities.

## Keywords

Farm Household Land-Use Behavior, CiteSpace, Literature Review, Research Hotspots

## 1. Introduction

As the most fundamental micro-level actors in rural land use, farm households

play a decisive role in shaping the structure, efficiency, and sustainability of land resource allocation. Their land-use behavior has profound implications for ensuring national food security, maintaining rural ecological security, and promoting agricultural and rural modernization. However, with the rapid advancement of urbanization and industrialization in China, large-scale rural labor out-migration has occurred, while trends such as part-time farming and rural hollowing have become increasingly prominent. These transformations have led to declining land-use efficiency, farmland abandonment, and even land degradation. Against this backdrop, gaining a deeper understanding of the formation mechanisms, influencing factors, and impacts of farm household land-use behavior has become a critical research priority for implementing the Rural Revitalization Strategy and advancing high-quality agricultural development.

In this study, farm household land-use behavior is defined as a series of choices and decision-making activities undertaken by farm households—as the micro-level decision-making entities in agricultural production and operation—regarding “whether to use land,” “how to use land,” and “how to invest production factors,” based on land contract management rights (Peng et al., 2017). It represents a complex decision-making process involving multidimensional natural, economic, and social attributes. This process is driven by internal factors such as farmers’ cognitive capacity, risk preferences (Zhang et al., 2008), and household livelihood strategies (Hu et al., 2016), while also being strongly constrained by external conditions including policy institutions (Fan et al., 2023), market environments (Tan et al., 2001), and locational characteristics (Liu et al., 2012; Wang & Cai, 2017), exhibiting significant spatial heterogeneity and dynamic temporal variation.

In contrast to this core concept, “land-use change” emphasizes the objective alteration of land cover or utilization patterns, representing the outcome state of behavior. “Land-use transition” refers to a fundamental shift in land-use morphology at a regional scale over an extended period, focusing on macro-level trends and phase changes. “Land transfer” specifically denotes the process of transferring land management rights, representing a concrete manifestation of farm household behavior. By comparison, the “farm household land-use behavior” upon which this study focuses centers on the dynamic process of “how farm households make decisions” as the behavioral subject.

Examining the research trajectory, early studies predominantly focused on specific behavioral analyses such as sustainable land use (Zhao & Ding, 1998), agricultural production decision-making (Zhu & Qu, 1999), and land transfer (Liu et al., 2008). With the advancement of interdisciplinary integration and methodological innovation, research has gradually shifted toward deeper issues including behavioral driving mechanisms, policy response processes, and comprehensive effect simulations. By integrating perspectives from geography, economics, sociology, and other disciplines, this evolution has propelled the field from “specific behavioral descriptions” toward analyses of impacts and changes under macro-

level strategies. However, systematic investigations into farm household land-use behavior and its research trajectory remain insufficient, which hinders the further deepening of knowledge in this field.

To comprehensively capture research progress, knowledge structures, and evolutionary trends, this study adopts a bibliometric approach using CiteSpace software to conduct a visual knowledge-mapping analysis of 564 core publications on farm household land-use behavior indexed in the China National Knowledge Infrastructure (CNKI) database between 1996 and 2025. By examining publication trends, author and institutional collaboration networks, keyword co-occurrence patterns, clustering structures, burst keyword detection, and timeline visualizations, this study aims to identify research hotspots, stage characteristics, and frontier directions. The findings are expected to provide theoretical insights and policy implications for deepening research on farm household behavior, optimizing land policy design, and promoting comprehensive rural revitalization.

## 2. Research Methods and Data Sources

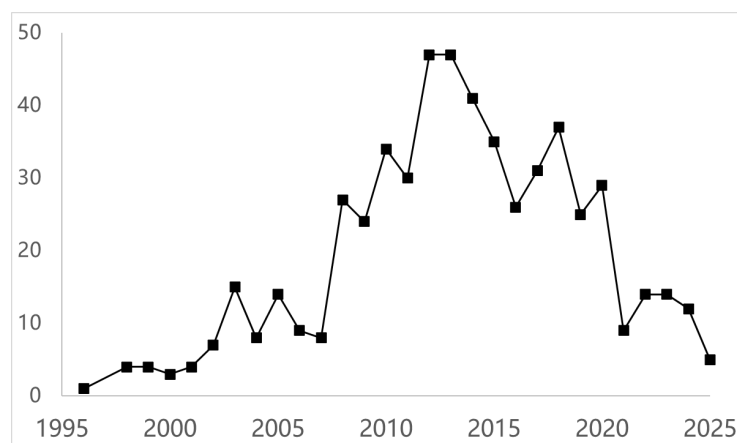
Data for this study were collected from the China National Knowledge Infrastructure (CNKI) database. To ensure comprehensive coverage and the reproducibility of the dataset construction, the specific retrieval strategy was designed as follows: the search field was set to “Topic”, and the exact search query was  $SU = \text{“farm household land use”}$ , with CNKI’s built-in synonym expansion function enabled to include related terms (e.g. farmer, agricultural land use). To ensure the quality of the dataset, only publications indexed in the Peking University Core Journal Database and the Chinese Social Sciences Citation Index (CSSCI) were included. The timespan for the search was restricted to 1996-2025. Given the dynamic nature of the database, the exact date of literature retrieval and data download was recorded as November 4, 2025. After removing non-academic or irrelevant documents—such as conference notices, newspaper articles, and news reports—a final dataset of 564 valid publications was obtained for the subsequent CiteSpace analysis.

Based on this dataset, bibliometric analysis was conducted using CiteSpace software. Visual knowledge maps were generated to illustrate annual publication trends, author collaboration networks, institutional cooperation patterns, keyword co-occurrence relationships, keyword clustering structures, burst keyword detection, and keyword timeline evolution. These analyses collectively provide a comprehensive overview of the research status, major thematic hotspots, and future development trends in the field of farm household land-use behavior. In this study, to ensure the reproducibility of the network structure and clusters, the key parameter settings in CiteSpace were strictly defined as follows: the time slicing was set to 1 year per slice; the node selection criteria utilized both the g-index ( $k = 25$ ) and the Top N ( $N = 50$ ) thresholds; and the network pruning applied the Pathfinder algorithm alongside the “Pruning sliced networks” option to optimize the visualization.

### 3. Results

#### 3.1. Publication Trends and Evolutionary Stages

The temporal distribution of publications provides an important indicator of the development trajectory and research attention within a given field. As illustrated in **Figure 1**, the annual number of publications on farm household land-use behavior has generally exhibited an upward trend since 2007. A peak in publication output occurred during 2012-2013, followed by moderate fluctuations between 2014 and 2025, with an overall declining tendency in recent years. These patterns indicate that scholarly attention to farm household land-use behavior reached its highest level around 2012-2013 and has gradually stabilized in the subsequent period.



**Figure 1.** Annual number of publications on farm household land-use behavior research (1996-2025).

Based on the temporal distribution of publications, research on farm household land-use behavior in China can be broadly divided into three evolutionary stages.

The first stage is the initial exploratory period (approximately 1996-2005). During this stage, research output remained limited, with only 60 publications produced, averaging approximately six articles per year. Studies in this period primarily focused on influencing factors of land-use behavior (Chen, 1998), resource utilization (Liu, 1999), and sustainable land use (Zhou & Liu, 2003), reflecting an early phase characterized by conceptual introduction and exploratory investigation.

The second stage is the steady growth period (approximately 2005-2017). During this stage, publication output increased substantially, reaching a total of 359 articles, with an annual average of approximately 21.1 publications. A notable peak occurred around 2013, when 46 articles were published in a single year. This expansion coincided with the increasing national policy emphasis on agricultural, rural, and farmer-related issues. A series of major policy initiatives—including the *Administrative Measures for the Transfer of Rural Land Contractual Management Rights* issued in 2005, the *Guiding Opinions on Promoting the Orderly Transfer of Rural Land Management Rights and Developing Moderate-Scale Agricultural*

*Operations* issued in 2014, and the *Opinions on Completing the Registration and Certification of Rural Land Contractual Management Rights* issued in 2015—provided strong institutional support for research development. During this period, research topics became more systematic and diversified, shifting from general land-use issues toward more refined analyses of farm household behavioral decision-making. Meanwhile, an increasing number of scholars and research institutions entered the field.

The third stage is the deepening and transformation period (from 2018 to the present). Although the number of publications declined to 161 during this stage, this trend does not indicate a reduction in research interest. Instead, it reflects the gradual maturation of the field. Following the introduction of the Rural Revitalization Strategy in 2017, research increasingly required stronger theoretical foundations and more innovative analytical perspectives. As a result, publication cycles have lengthened and growth rates have slowed. Nevertheless, research depth and conceptual sophistication have continued to improve, indicating a transition toward more advanced and mature scholarship.

### 3.2. Author Collaboration Analysis

Author analysis provides important insights into the core contributors and intellectual structure of a research field. Identifying highly productive scholars helps reveal leading academic groups and established research traditions, enabling a clearer understanding of research frontiers and developmental trends.

An examination of publication output indicates that Zhang Fengrong from China Agricultural University is the most prolific author in this field, with a total of 22 publications. According to Price's Law, the threshold for identifying core authors can be calculated using the formula:

$$M \approx 0.749\sqrt{N_{\max}} \quad (1)$$

where  $N_{\max}$  represents the number of publications by the most productive author and  $M$  denotes the minimum publication threshold for core authors (Garfield, 1985). Based on this calculation, the minimum threshold for core authorship in this field is approximately 3.5 publications. Following standard bibliometric conventions, authors with four or more publications were therefore classified as core authors.

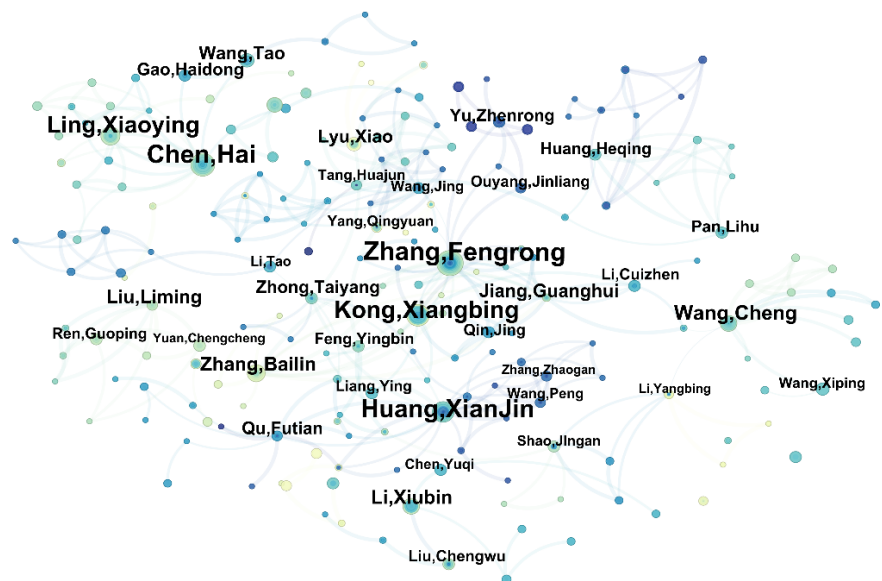
The results show that 48 core authors were identified, collectively contributing 317 publications, accounting for 56.21% of the total output. This proportion slightly exceeds the benchmark of 50% suggested by Price's Law, indicating that a relatively stable core research group has gradually formed in the field of farm household land-use behavior in China, with research productivity showing a moderate degree of concentration (Table 1).

The author co-occurrence network (Figure 2) consists of 554 authors and 699 collaborative links, with a network density of only 0.0046, indicating a highly fragmented structure. Although several small-scale collaboration clusters have emerged—primarily centered around key scholars such as Zhang Fengrong, Kong

Xiangbin, Huang Xianjin, Qu Futian, and Li Xiubin—most researchers remain relatively independent, and interconnections among research teams are limited. This pattern suggests that collaboration within the field remains weak overall, with only localized partnerships formed among scholars sharing similar research interests.

**Table 1.** Core authors in research related to farmers’ land use behavior.

Author	Publication Count	Author	Publication Count	Author	Publication Count
Zhang Fengrong	22	Feng Yingbin	5	Zhang Zhaogan	4
Chen Hai	20	Liu Chengwu	5	Li Tao	4
Kong Xiangbin	19	Yu Zhenrong	5	Li Yangbing	4
Huang Xianjin	18	Li Cuizhen	5	Yang Qingyuan	4
Liang Xiaoying	13	Pan Lihu	5	Liang Ying	4
Wang Cheng	13	Wang Liping	5	Chu Xuelian	4
Zhang Bailin	11	Qin Jing	5	Ouyang Jinliang	4
Li Xiubin	10	Gao Haidong	5	Wang Jing	4
Liu Hongbin	9	Huang Heqing	5	Wang Peng	4
Liu Liming	7	Yu Guofeng	4	Luo Wenbin	4
Jiang Guanghui	7	Fu Yongneng	4	Luo Fang	4
Qu Futian	7	Feng Yanfen	4	Yuan Chengcheng	4
Zhong Taiyang	7	Liu Yansui	4	Shao Jing’an	4
Lv Xiao	6	Lv Jie	4	Guo Huijun	4
Wang Tao	6	Zhou Hong	4	Chen Aiguo	4
Ren Guoping	5	Tang Huajun	4	Chen Yuqi	4

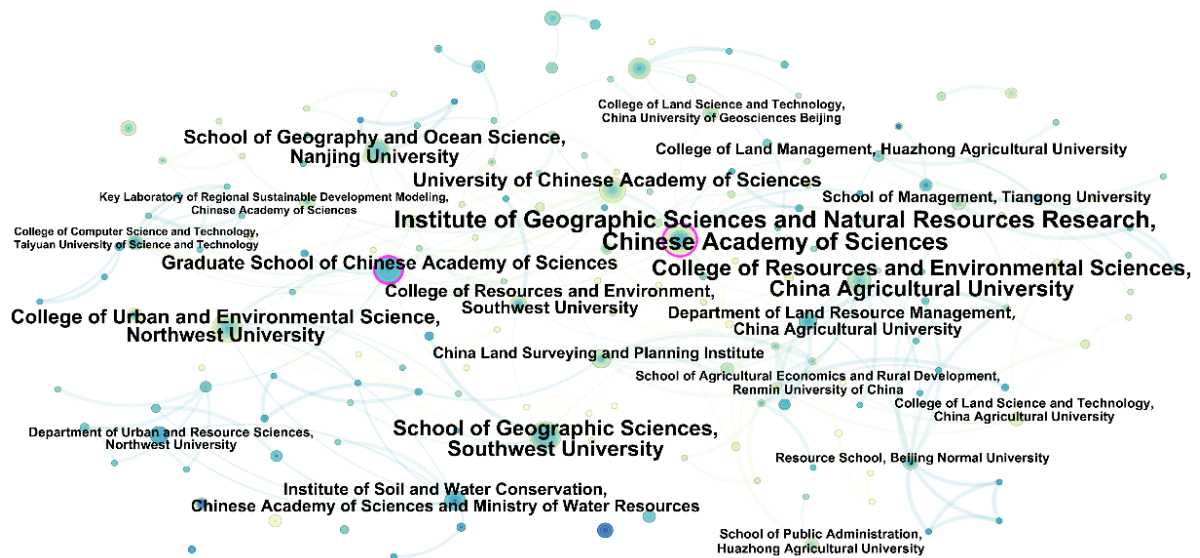


**Figure 2.** Author collaboration network in farm household land-use behavior research.

### 3.3. Institutional Collaboration Analysis

Institutional analysis using CiteSpace enables the identification of research productivity patterns and collaboration relationships among organizations within a given field. By constructing an institutional co-occurrence network, the distribution of research output across institutions and the degree of inter-institutional cooperation can be systematically examined.

As shown in **Figure 3**, a total of 377 research institutions were identified in the field of farm household land-use behavior between 1996 and 2025, with 407 collaborative links and a network density of only 0.0057, indicating relatively weak institutional connectivity. Among the top ten most productive institutions, the majority are universities, suggesting that higher education institutions play a dominant role in this research field. The three most prolific institutions are the College of Resources and Environmental Sciences at China Agricultural University (34 publications), the School of Geographical Sciences at Southwest University (24 publications), and the College of Urban and Environmental Sciences at Northwest University (23 publications). This concentration of output may be attributed to the presence of well-established research teams and abundant research resources within these institutions, as well as their sustained academic focus on land-use issues.



**Figure 3.** Institutional collaboration network in farm household land-use behavior research.

Notably, the Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences ranks first in overall publication output, reflecting strong national-level attention to research on farm household land-use behavior. A relatively large collaboration network has formed around the School of Geographical Sciences at Southwest University, which maintains cooperative relationships not only with universities such as China Agricultural University but also with governmental agencies including the China Land Surveying and Plan-



This data cleaning process enhanced the accuracy and reliability of the subsequent keyword clustering and hotspot identification. The resulting knowledge map (**Figure 4**) contains 547 nodes and 918 links, representing individual keywords and their co-occurrence relationships, respectively. In the visualization, node size and label font reflect keyword frequency, while link thickness indicates the strength of co-occurrence relationships. Larger nodes and thicker links therefore signify higher research attention and stronger thematic associations.

To provide a clearer representation of research priorities, the ten most frequently occurring keywords were identified and ranked according to their frequency and centrality values (**Table 2**). Among them, “land use” exhibits the highest frequency (147 occurrences) and the greatest centrality (0.63), followed by “farm households” (103 occurrences; centrality = 0.47). Other high-frequency keywords include “land-use change,” “farm household behavior,” and “influencing factors.”

**Table 2.** High-frequency keywords in research related to farmers’ land use behavior.

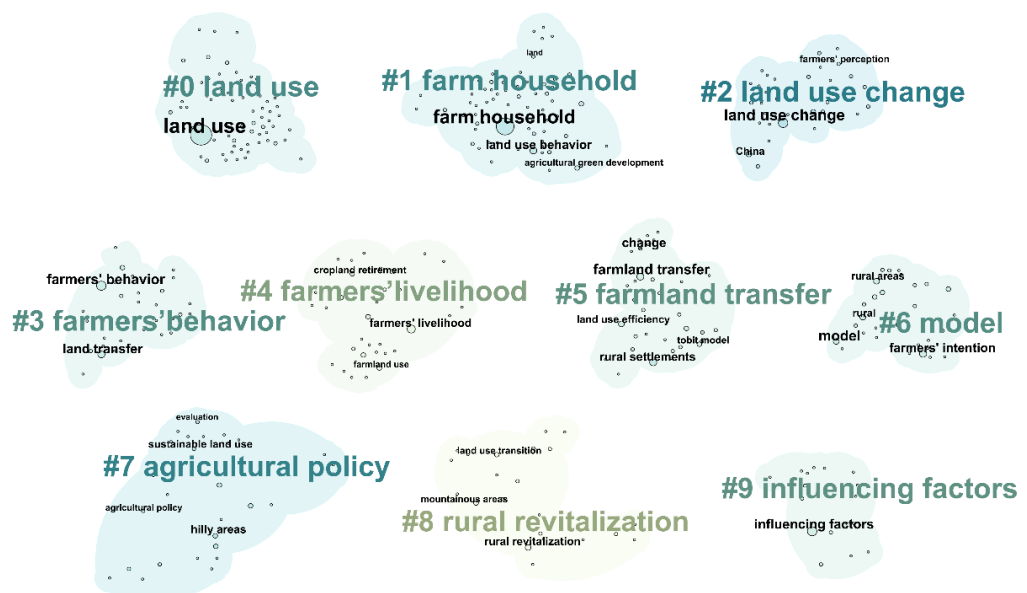
No.	Keyword	Frequency	Centrality
1	Land Use	147	0.63
2	Farmers	103	0.47
3	Land Use Change	31	0.13
4	Farmer Behavior	26	0.1
5	Influencing Factors	24	0.09
6	Farmers’ Livelihood	19	0.08
7	Land Transfer	17	0.06
8	Farmers’ Willingness	14	0.02
9	Land Use Behavior	14	0.02
10	Agricultural Land Transfer	13	0.09

Based on the combined analysis of keyword frequency, centrality, and network structure, research on farm household land-use behavior in China can be broadly categorized into two major thematic domains. The first domain focuses on specific land-use practices, including topics such as farmland transfer, land management, and the conversion of cropland to forest. The second domain centers on the characteristics and decision-making processes of land-use actors, encompassing themes such as farm household livelihoods and behavioral intentions. These findings indicate that existing research has primarily revolved around the interaction between two core elements—farm households and land resources—that is, scholars tend to analyze farm households’ land-use behavior decisions from the perspective of various individual-level influencing factors.

Furthermore, the keyword “influencing factors” demonstrates strong co-occurrence relationships with core terms such as “farm households” and “land use,” suggesting that identifying the drivers of land-use behavior has remained a central focus of scholarly attention within this field.

## 4.2. Keyword Clustering Analysis

Keyword cluster analysis calculates the co-occurrence strength between keywords and uses clustering algorithms to aggregate closely related words into different categories, thereby identifying representative knowledge subgroups within a research field to detect its hot topics. To further understand the research hotspots of farmers' land use behavior, this study used CiteSpace software to perform cluster analysis on high-frequency keywords from the sample literature, generating a keyword cluster analysis map, as shown in **Figure 5**. The log-likelihood ratio (LLR) algorithm was selected for extracting the clustering labels, and the visualization was configured to show the largest 10 clusters. In the keyword cluster map, the Q-value represents the modularity of the graph, depicting the density of connections within clusters. More internal connections result in a larger Q-value and better clustering effect. When  $Q > 0.3$ , the clustering modularity is considered significant. The S-value represents the silhouette coefficient of the graph. When  $S > 0.7$ , the clustering is considered efficient and convincing. In this study, the keyword clustering network yielded a Q-value of 0.7184 and a weighted mean silhouette S-value of 0.9206. These statistics demonstrate that the reported clusters are highly coherent and robust for substantive interpretation. The keyword cluster map contains 10 cluster labels, numbered from #0 to #9. A smaller number indicates a larger number of keywords contained in that cluster, suggesting higher importance of that cluster in this research field.



**Figure 5.** Keyword clustering network of farm household land-use behavior research.

Based on the keyword co-occurrence and clustering results, and by analyzing representative literature within each cluster's keywords, this study reviews four major hot topics in current research related to farmers' land use behavior.

First, research on types and patterns of land use behavior. This theme is the

foundation and core of farmers' land use behavior research, focusing on the specific types of behaviors farmers adopt in the land use process and their spatial patterns. Cluster labels #0 land use, #2 land use change, and #5 agricultural land transfer all reflect this theme. Research by scholars under this theme is often based on different regions. For example, Zhang et al. (2008) studied livelihood diversification and cultivated land use patterns in the eastern mountainous agro-pastoral areas of the Qinghai-Xizang Plateau, revealing local farmers' livelihood strategies and land use situations on various plots. Liu et al. (2012) focused on urban-rural fringe areas, discovering and systematically demonstrating that farmers' land use behaviors exhibit a unique spatial pattern along the urbanization gradient, profoundly revealing how micro-agent behaviors reshape macro land use patterns under rapid urbanization. Furthermore, the high-frequency keyword "land use change" contained in this theme indicates that scholars focus on exploring changes in land use methods at the farmer level. For instance, Hu et al. (2016) in their research analyzed changes in differences in the area and proportion of cultivated land, forest land, and garden land among different farmer types, aiming to reveal their changing patterns at the micro-scale.

Second, research on characteristics and decision-making mechanisms of land use behavior subjects. This theme focuses the research perspective on the subjects of land use—the farmers themselves—deeply analyzing the internal logic of their behavior. Cluster labels #1 farmers, #3 farmer behavior, and #4 farmers' livelihood fall into this category. Research in this theme primarily focuses on how household characteristics, livelihood strategies, subjective willingness, etc., jointly influence their land use decisions, reflecting a research shift from "land" to "people." The research by Chen et al. (2016) is exemplary of this theme. By constructing a Probit behavioral decision-making model, they empirically analyzed how land factors and farmer characteristics influence their investment and planting choices, revealing that farmers' decisions are not based on theoretical profit maximization but on "bounded rationality" and the "satisfaction principle." Such research aims to reveal the internal motivations behind "why farmers make such decisions," greatly deepening the understanding of the behavioral mechanisms of micro-agents.

Third, research on influencing factors of land use behavior. This theme aims to reveal the internal and external driving forces affecting farmers' land use behavior. Cluster label #9 influencing factors directly embodies this theme. The keyword "influencing factors" is closely linked to core keywords like "land use" and "farmers," indicating that driving mechanisms are a continuous focus in academia. Currently, academia believes that farmers' land use behavior is mainly influenced by two major factors: farmers' internal characteristics and external changes. Regarding farmers' internal factors, Peng et al. (2019), through empirical analysis, pointed out that household structure and resource conditions, such as the proportion of agricultural labor and land quality, constitute key factors influencing farmers' land use decisions. Furthermore, Liang et al. (2008) argued that the type of concurrent occupations also significantly affects farmers' choices of land use methods

and behaviors. Wang & Cai (2017) focused on the functions of cultivated land for farmers, revealing that farmers' dependence on the multiple functions of cultivated land resources—economic, social security, food, and gift-giving—is a key internal factor driving their land transfer decisions.

Regarding external factors, national policy guidelines represented by Rural Revitalization have a strong guiding effect on changes in farmers' land use behavior. Beyond policy factors, based on the context of rapid market economic development, Xiao et al. (2016) pointed out that the marketization of agricultural products also drives farmers to choose more favorable land management methods, becoming a main driver of land transfer. Additionally, research by scholars like Pan et al. (2013) indicates that external factors such as land tenure security also significantly influence changes in farmers' land use behavior.

Fourth, research on policy intervention and practical application of land use. Literature under this theme, compared to theme three, highlights a more practice-oriented approach, further focusing on how macro policies guide and regulate farmers' land use behavior. Cluster labels #7 agricultural policy and #8 rural revitalization reflect this direction. Related research often focuses on evaluating policy effects to provide decision-making references for optimizing land management practices. For example, Zou et al. (2008) empirically analyzed the impact of the agricultural tax exemption policy on farmers' land use behavior. The study found that after policy implementation, most farmers' willingness to expand land use scale and increase land investment significantly increased. In recent years, Fan et al. (2023) in their research comprehensively evaluated the impacts of various agricultural subsidy policies on food supply security, farmer income, and planting structure. They pointed out that agricultural subsidy policies can effectively stimulate farmers' input of agricultural production factors, releasing productivity. However, market support policies like minimum purchase prices may drive up agricultural product prices, which is not conducive to adjusting planting structure balance.

It is important to note that current scholarly research on these four themes is not strictly demarcated; rather, it exhibits significant characteristics of overlap and interconnection. This can be observed in the study by Tan et al. (2001), which takes micro-level farm households as its core. By classifying household types, the authors conduct an in-depth analysis of decision-making differences while simultaneously exploring the influence mechanisms affecting farm household land-use behavior. Identifying market economy factors and price policies as key external drivers of decision-making, they propose a “win-win” policy framework. This work not only underscores the practice-oriented nature of such research but also vividly illustrates the cross-cutting connectivity among these thematic areas. The academic achievements across these four themes collectively form a complete research chain—spanning phenomenon description, mechanism analysis, driver identification, and practical application—which jointly underpins the knowledge system of this field and deepens the overall understanding of the subject.

To ensure the reliability of the research findings, a robustness check was conducted by modifying the CiteSpace parameters. Specifically, the time-slice length was adjusted from 1 year to 2 years, and the keyword clustering analysis was re-run. The results yielded highly consistent major hotspots, prominently including land use, farm household behavior, influencing factors, and rural revitalization. This consistency indicates that the main bibliometric patterns and the hotspot conclusions of this study remain stable and robust against parameter variations.

### 4.3. Keyword Burst Analysis

Keyword bursts reflect the earliest appearance time of keywords, showing the research focus of scholars within a certain period, and can predict research trends in the field. Using 1996-2025 as the research period and employing CiteSpace software, a keyword burst graph for farmers' land use behavior was generated, obtaining the top 25 burst keywords in domestic literature, as shown in Figure 6.

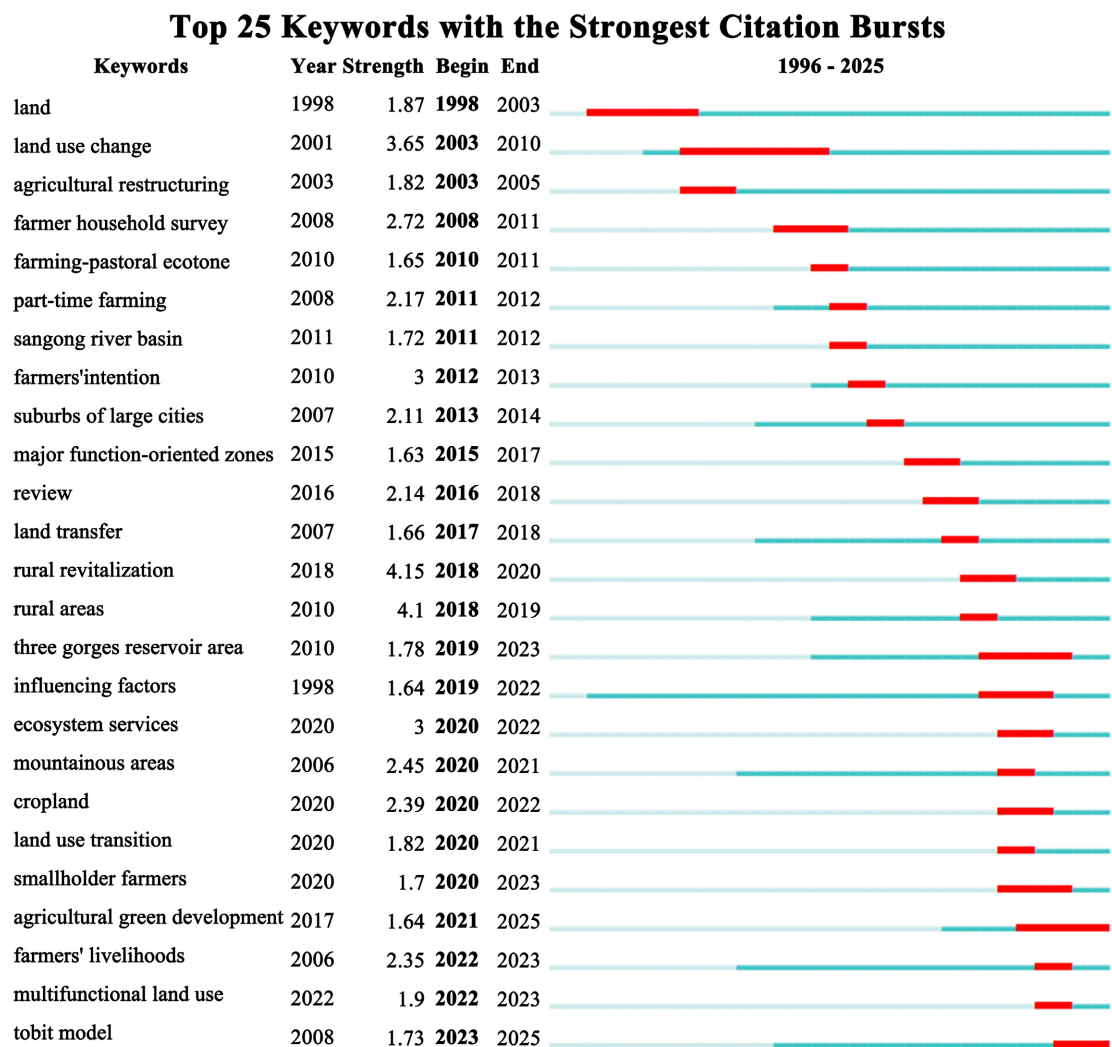


Figure 6. Keyword burst detection results in farm household land-use behavior research.

From the perspective of burst strength, “rural revitalization” ranks first with a strength of 4.15, indicating that research on farmers’ land use behavior has a strong policy orientation and plays a role in promoting rural revitalization. “Land use change” ranks third with a strength of 3.65, indicating that related changes are an effective entry point for researchers to deeply explore farmers’ utilization behavior. “Ecosystem services” ranks fourth with a strength of 3, emphasizing the positive impact of good ecosystem services on farmers’ land use behavior.

From the perspective of burst word duration, the burst word “land use change” has the longest impact cycle, over 5 years, starting its burst in 2003. This indicates that this topic is a continuously focused hotspot in the research field over many years and is also key to tracing origins and achieving breakthroughs in the exploration of farmers’ land use behavior.

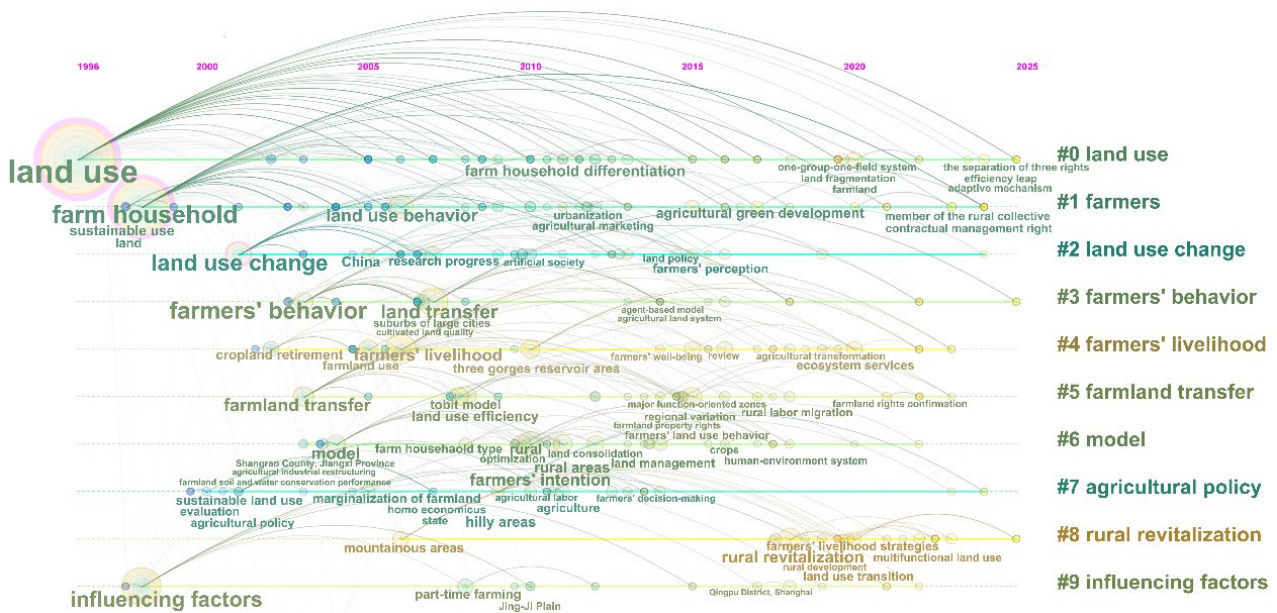
Looking at temporal sequence changes, from “land use change” and “adjustment of agricultural industrial structure” to “farmers’ concurrent occupations” and “land transfer,” and finally to bursts of “agricultural green development” and “Tobit model analysis,” research in the field of farmers’ land use behavior is gradually conducting more in-depth field investigations and deeply integrating with current policy orientations.

In summary, it is evident that influencing factors, land use change, and farmers’ livelihood were key areas of focus for early scholars, with research interest lasting for a relatively long time. The bursts of keywords like rural revitalization, ecosystem services, and land use transition in the mid-term indicate scholars’ attention to national policies during this period, aiming to assist national policies in better serving local development through research on farmers’ land use behavior. In recent years, bursts of keywords like ecosystem services and agricultural green development indicate that agricultural green development and ecosystem sustainability have become important frontier areas in current research, representing new directions emerging under the advocacy of the concept of harmonious coexistence between humans and nature.

#### 4.4. Timeline Analysis of Research Evolution

To further clarify the stage-specific research priorities and evolutionary pathways within the field of farmers’ land-use behavior, a keyword time-zone visualization combined with cluster analysis was generated using CiteSpace (Figure 7). By examining research themes from both keyword clustering and temporal evolution dimensions, the distribution of major research topics and their changes over time can be more clearly understood.

In the timeline map, each horizontal line represents a research theme cluster. The horizontal axis indicates time, while the leftmost point of each line marks the initial appearance of that cluster. The nodes along the line denote keywords associated with the cluster, and their positions indicate the year when each keyword first appeared within the cluster. The rings surrounding nodes represent the duration across years in which the keywords remained active.



**Figure 7.** Timeline visualization of keyword clusters in farm household land-use behavior research.

Based on the timeline visualization of core concepts across different periods, together with a review of relevant literature, the development of this research field can be broadly divided into three stages.

Stage 1: Exploratory Phase (1996-2005). During this stage, research was relatively limited and mainly focused on theoretical accumulation and conceptual exploration. Keywords such as “land use”, “land-use change”, “sustainable utilization”, “influencing factors”, and “farmer behavior” dominated the field. This indicates that studies primarily concentrated on theoretical discussions of farmers’ land-use behavior and attempts to clarify the relationship between farmer decision-making and sustainable land utilization.

For example, [Zhao & Ding \(1998\)](#) analyzed factors influencing sustainable land use among farmers in China, noting the impacts of industrialization-related policies on farmers’ land-use behavior and proposing policy improvement suggestions. [Zhu & Qu \(1999\)](#) conducted empirical research on how farmer behavior affected land conservation. During this period, scholars began to recognize the role of farmer behavior in land-use outcomes, but research remained at an early developmental stage and lacked systematic frameworks.

After further development, [Tan et al. \(2001\)](#) examined how different types of farmers responded to economic policies affecting sustainable land use and were the first to clearly propose the concept of “farmers’ land-use behavior.” Overall, this stage represents an initial exploratory phase, characterized by limited research output and relatively low diversity of research topics.

Stage 2: Refinement Phase (2005-2015). With the successive introduction of major rural land policies—such as the 2005 Rural Land Contract Management Rights Transfer Measures, the 2014 policy on orderly land transfer and moderate-scale agricultural operations, and the 2015 policy on land rights registration and

certification—national attention to land-use behavior increased significantly, leading to more diversified and detailed research topics.

Keywords such as “land transfer,” “farmers’ willingness,” “livelihood,” “part-time farming,” “suburban areas,” and “Three Gorges reservoir area” became prominent. Notably, research expanded substantially during this stage, shifting from general relationships between farmers and land use toward detailed analyses of how specific farmer behaviors influenced land-use patterns.

For instance, [Liu et al. \(2008\)](#) examined the impacts of concrete farmer behaviors on land use, while [Liang et al. \(2008\)](#) analyzed multiple aspects of farmer decision-making and land-use conditions. [Zhong et al. \(2008\)](#) further introduced various analytical models into the study of farmer land-use behavior.

Overall, research in this stage became increasingly refined, broader in scope, and more closely integrated with real-world policy and socioeconomic contexts.

Stage 3: Deepening Phase (2015-2025). This stage is characterized by the emergence of many new keywords reflecting contemporary policy contexts, including “rural revitalization,” “ecosystem services,” “farmer cognition,” “green agricultural development,” “separation of three land rights,” and “agricultural transformation.” These trends indicate that research on farmers’ land-use behavior has become closely aligned with national strategies and increasingly focused on practical implications.

Within the institutional background of the “separation of three rights” reform and the emphasis on green agricultural development, recent studies—such as those by [Wu & Wang \(2024\)](#), [Niu et al. \(2025\)](#), and [Sun et al. \(2025\)](#)—have explored land-use transformation driven by farmers’ behavioral responses. Research subjects have shifted toward farmers undergoing transformation under new policy environments, with greater emphasis on policy impacts and their significance for achieving national strategies such as rural revitalization.

Although the total number of publications in this stage shows a declining trend, it remains above the long-term average. Research topics have become more diversified, and the content is increasingly aligned with macro-level policy priorities and sustainability goals.

## 5. Summary, Prospects, and Research Limitations

### 5.1. Research Conclusions

Based on the knowledge mapping and bibliometric analysis of 564 documents in the field of farmers’ land use behavior from 1996 to 2025, sourced from the China Academic Journals (CNKI) database and conducted using CiteSpace software, the following conclusions are drawn:

(1) Publication Volume and Temporal Trends: The volume of publications on farmers’ land use behavior is significantly influenced by policy and exhibits phased changes. The research in this field can be divided into three stages based on annual publication distribution: a Slow Start-up Period (circa 1996-2005), a Stable Growth Period (circa 2005-2017), and a Deepening Transformation Period (2018-pre-

sent). In the initial stage, the number of publications was small, and research themes were relatively singular. Entering the growth stage, the publication volume increased sharply, peaking in 2013, with research topics becoming more refined and diversified. In the current transformation stage, while the annual publication count has slightly declined, the overall level remains high. The depth of research themes has increased, with a growing trend towards exploring connections with national macro-strategies.

(2) Authors and Institutional Analysis: The research field on farmers' land use behavior involves a large number of scholars and institutions, and a relatively stable core academic team has been preliminarily formed. Although cooperation networks among some scholars are close, overall collaborative relationships remain relatively weak, highlighting a need to strengthen cross-team collaboration. Universities and national theoretical research institutions constitute the core force in this field. However, the density of the collaboration network among institutions is low, showing a characteristic of being "highly decentralized, with only small clusters of collaboration."

(3) Keyword Co-occurrence and Cluster Analysis: High-frequency keywords such as "land transfer," "land consolidation," "farmers' livelihoods," "farmers' behavior," and "influencing factors" are highly consistent with cluster labels. Four main research hotspots can be summarized: First, research on the types and patterns of land use behaviors. Second, research on the characteristics and decision-making mechanisms of land use actors (farmers). Third, research on the influencing factors of land use behaviors. Fourth, research on policy intervention and the practical application of land use.

Overall, current research has preliminarily established a relatively stable core team and a general framework derived from practice, achieving phased progress in theoretical application, methodological innovation, and integration with practice. Simultaneously, existing studies have fundamentally formed a basic analytical paradigm characterized by four interconnected links—"phenomenon description, mechanism analysis, driver identification, and application orientation." This paradigm takes the specific land-use behaviors of farm households as its observational starting point, proceeds to deeply analyze the decision-making mechanisms underlying these behaviors, further explores the multiple factors driving such decisions, and ultimately culminates in policy optimization and practical improvement. The formation of this paradigm marks the evolution of farm household land-use behavior research from fragmented empirical observations into a systematically interconnected body of knowledge. Finally, amid growing national attention to rural revitalization, this research field continues to advance toward greater interdisciplinary integration, more refined analytical approaches, and stronger alignment with national macro-level strategies.

## 5.2. Future Prospects

While current research on farmers' land use behavior has initially formed a core

research team, established a basic research framework, and achieved phased results in areas such as behavioral characteristics, influencing factors, and policy responses, challenges remain. These include a lack of clear, standardized definitions for core concepts, loose research collaboration networks, a degree of research homogenization, insufficient depth in integrating with national macro-policy practice, and inadequate interdisciplinary research integration. Future exploration and practice should be strengthened in the following areas, closely aligning with the era's requirements for agricultural green development and ecosystem sustainability, and fitting the orientation of national macro-policies such as rural revitalization and building a strong agricultural nation, to open new prospects in the study of farmers' land use behavior.

First, deepen systematic research on the theoretical system of farmers' land use behavior. 1) Strengthen the standardization and theorization of core concepts. Clear, standardized dissection and definition of core concepts such as farmers' land use behavior, agricultural land transfer, farmers' livelihoods, land use transition, and agricultural green development are needed at the theoretical level. Clarifying the connotations, extensions, and logical connections between different concepts, and distinguishing their relationships, is essential to avoid hindering the in-depth development of research due to conceptual confusion, equivalence, or misuse, thereby solidifying the theoretical foundation of the field. 2) Conduct multi-angled theoretical research. Farmers' land use behavior is a complex system involving natural, economic, and social factors, requiring not only a macro-level overall grasp but also specific micro-level exploration. Therefore, future research should strengthen micro-level studies on the basis of macro research. This involves systematically exploring the intrinsic connections between farmers' land use behavior and national macro-strategies like rural revitalization, agricultural powerhouse, food security, and ecological protection at the macro level, deepening the understanding of the evolution laws of farmers' land use behavior and the transmission paths of policy intervention. At the micro level, it requires continuous in-depth analysis of the spatial heterogeneity and stage differences in farmers' land use behavior from perspectives such as farmers' cognition, risk preferences, and household livelihood strategies, based on different regions and farmer types. Proposing feasible countermeasures according to new situations and problems faced in the development of farmers' land use behavior can help avoid issues of insufficient research refinement and high homogenization, while also providing theoretical support at the practical level for optimizing land policy design and improving land use efficiency, thereby promoting high-quality agricultural and rural development.

Second, innovate research methods and technical means for studying farmers' land use behavior. 1) Enhance the depth and breadth of empirical research, promoting deep synergy between qualitative and quantitative studies. Although existing research has employed econometric methods like Tobit and Probit models and visualization tools like CiteSpace, the dimensions and means of empirical re-

search can be further enriched. Future efforts should comprehensively utilize field research methods such as general surveys, sample surveys, case studies, and field investigations, combined with quantitative analysis tools like spatial analysis, panel data models, and machine learning. This multi-angle, multi-level approach aims to uncover the driving forces and decision-making mechanisms behind farmers' land use behavior. Simultaneously, qualitative research methods like participatory observation and in-depth interviews should be used to compensate for the shortcomings of quantitative research, accurately explaining the internal logic of farmers' land use behavior. This will provide reliable data support and practical evidence for relevant policy formulation.

Third, strengthen academic collaboration and interdisciplinary cross-integration research. 1) Improve academic collaboration mechanisms to address the current issue of loose research collaboration. The current author and institutional collaboration networks in farmers' land use behavior research are fragmented, exhibiting characteristics of "atomization" and being "highly decentralized with only small clusters." Whether from the perspective of perfecting the theoretical system's integrity or the practical need to serve agricultural and rural development, collaboration and exchange among different scholars, research teams, and institutions should be enhanced. Therefore, platforms for academic exchange and collaboration should be established, cooperation mechanisms improved, and the sharing of resources and information promoted to consolidate research efforts and elevate the overall level of research. 2) Promote interdisciplinary and cross-integration research to break down disciplinary barriers. Farmers' land use behavior is a complex process influenced by multiple factors including natural, economic, social, cultural, and technological elements. The complexity and comprehensiveness of its research determine that a single disciplinary perspective is insufficient for a comprehensive, in-depth analysis. Although existing research incorporates foundational perspectives from geography, economics, and sociology, the depth and breadth of interdisciplinary integration need further expansion. Future efforts should further break down disciplinary boundaries and promote deep dialogue and methodological integration among multiple disciplines. This includes exploring the psychological motivations and formation logic of behavioral preferences in farmers' land use decision-making from the perspectives of psychology and behavioral economics; investigating the embedding of local culture and the constraining mechanisms of village regulations and folk conventions on farmers' land use behavior from the perspective of folklore studies; and exploring optimization paths for policy regulation and operational management of farmers' land use behavior from a management perspective. Through multi-dimensional, three-dimensional analysis and research on farmers' land use behavior, it is possible not only to solve the problems of singular research perspectives and content homogenization in the field but also to enrich the research system, promoting deeper and broader development and better aligning research outcomes with the practical needs of national macro-policies and agricultural/rural development.

### 5.3. Research Limitations

Although this study systematically reviews research related to farmers' land use behavior from 1996 to 2025 using CiteSpace software, the following limitations remain:

First, limitations in data sources. The sample for this study is drawn solely from the Peking University Core (PKU Core) and CSSCI databases within CNKI. While this reflects the mainstream of Chinese-language research, it does not cover studies on Chinese farmers in foreign language databases such as Web of Science, nor does it include dissertations, monographs, and other literature types. This may result in an insufficient global perspective in the analysis and an inability to fully reflect the interaction and differences between domestic and international research.

Second, limited analytical depth due to software constraints. CiteSpace primarily conducts visual analysis based on the co-occurrence of literature keywords, authors, and institutions, focusing on presenting and describing macro-structures. In-depth interpretation of specific literature content still requires supplementation with qualitative research methods.

Third, potential deviations in timeliness and predictability. Although the study spans up to 2025, some recently published or newly accepted frontier literature may not yet be fully included in the databases. Furthermore, while burst word detection can predict future trends, it is susceptible to short-term policy hotspots. The accuracy of predicting the deep evolution patterns of farmers' land use behavior in future multidisciplinary contexts still requires further validation through practice.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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