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Review

The Relationship between Rural Sustainability and Land Use: A Bibliometric Review

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Abstract: Faced with substantial environmental, societal, and economic challenges, the matters of rural sustainability and land use have emerged as pivotal global concerns. Amidst the rapid phenomenon of urbanization, the escalating requisites for sustenance, energy, and natural resources have engendered profound pressure upon rural landscapes and ecosystems. The attainment of sustainability within rural regions assumes a paramount role, encompassing not only the advancement of these rural domains but also holding pivotal significance in addressing critical global concerns such as climate change, biodiversity depletion, and the eradication of poverty. In order to gain a thorough understanding of the implications associated with rural sustainability and land use, this study undertakes a bibliometric analysis of 1746 articles sourced from the Web of Science database. The analysis unveils a multitude of pivotal revelations. Primarily, the domain exhibits a conspicuous trajectory of expansion in publications spanning the period from 1990 to 2023, thereby alluding to a substantial reservoir of potential for subsequent advancement. Secondly, high-frequency keywords encompass sustainability, land use, agriculture, ecosystem services, and China. Thirdly, the field encompasses four primary research directions, namely the impact of rural land use and land cover changes on biodiversity, adaptive capacity, and vulnerability in rural sustainable development; the interplay between rural land use changes and rural agricultural development; and land management for rural sustainability. Fourthly, the evolution of research hotspots focuses on three main areas: rural sustainability and biodiversity conservation and ecosystem services, rural sustainability and land management and impacts, and the impacts of climate change and human activities on rural sustainability. Finally, future research should focus on sustainable multifunctional agriculture and rural land management, continue to pay attention to the social dimensions of rural sustainability, and emphasize the role of ecosystem services and natural capital in sustainable rural development. The results of this study can provide a reference for grasping the current situation, research directions, and development trends in the field of rural sustainability and land use.

Keywords: bibliometric analysis; rural sustainability; land use; urbanization

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1. Introduction

Land use stands as a crucial pillar supporting the economic advancement of human society. The alterations within it are profoundly impacting the sustainable development of the global environment [1,2]. Sustainable land use is an important foundation for sustainable development and a focus of research worldwide [3]. However, irrational development activities have produced serious negative impacts, such as rural decline and land deterioration [4]. Urbanization, as a transformative process, stands out as a major driver of global land use and land cover changes [5–7]. The transformation of rural and natural landscapes into urbanized areas is reshaping the global landscape as the rate of urban development accelerates. Cities are expanding rapidly, encroaching

upon agricultural lands, forests, and other natural habitats [8,9]. This phenomenon is propelled by population growth, rural–urban migration, and economic progress, resulting in the proliferation of infrastructure, housing, and industrial facilities. The consequences of this intricate interplay between human activities and the natural environment often exhibit long-lasting and irreversible impacts [10]. Despite the manifold benefits associated with urbanization, however, a rapidly urbanizing world is leading to the loss of valuable agricultural and ecological land, resource scarcity, and environmental degradation, and affecting biodiversity, ecosystem services, and the overall balance of ecosystems [11,12].

Sustainability is the ability to develop over the long term, ensuring that the use of resources and the protection of the environment can continue to meet current and future needs, while sustainable development emphasizes the creation of conditions for future generations to be able to continue to develop based on the satisfaction of current needs [13,14]. The sustainable development of a region requires the sustainability of its rural areas as a source of supply and resources for urbanized areas [15]. The global phenomenon of rural decline resulting from urbanization has become increasingly evident [16,17]. Problems such as population migration from rural to urban areas, rural poverty, agricultural security, and abandonment of arable land exist in all countries of the world [4,18,19]. As a result, the development capacity of rural areas is reduced, and their sustainability and resilience are threatened [20,21]. Taking China as an example, as the world's most populous nation, China has made remarkable strides in urbanization since the initiation of economic reforms, experiencing sustained and rapid economic growth over the past four decades [22,23]. By the end of 2017, China's urbanization rate had reached 58.52%, with the urban population surpassing 813 million [23,24]. The rapid progression of industrialization and urbanization has not only promoted economic growth and strengthened international competitiveness but has also had a far-reaching impact on China's rural areas. This has led to a transformation of regional urban–rural dynamics and the relationships between industry and agriculture [25,26]. Factors such as population mobility [27], technological advancements [17], poverty [28], biased policies [29], and inadequate land management [30] have contributed to the abandonment of rural areas. In 2018, the Chinese government made it clear in its No. 1 central document that the implementation of the rural revitalization strategy is a significant historic mission in achieving comprehensive societal well-being and building a modern socialist nation. Enhancing the sustainability of agriculture and rural livelihoods will contribute to expediting the harmonious development of urban and rural areas, thereby fostering the implementation of strategies for rural revitalization [31,32]. Therefore, in the context of rural revitalization and the challenges posed by global urbanization, comprehending and investigating the key issues related to rural sustainability and land use, their relationships, mechanisms, and policies are critical for adapting to changing patterns of social and economic development and responding to strategic changes.

Previous studies have examined various aspects of rural sustainability and land use. For example, Ma et al. [33] investigated the relationship between land use structure and functionality, focusing on the demand for residential land functionality in achieving rural sustainability. By establishing an indicator system, the rural residential land use function was evaluated from the perspective of supply and demand. Li et al. [34] explored and summarized the evolutionary path and development patterns of rural settlement spatial structures in the southern region of China, considering the rural revitalization strategy. Yang et al. [35] established an evaluation index system for the production–living–ecological functions of villages in the Beijing–Tianjin–Hebei region and evaluated the production–living–ecological functions of villages in the Beijing–Tianjin–Hebei region, which provided a reference for decision-making in realizing the goal of sustainable development of villages. Statuto et al. [36] utilized geographic information systems to investigate mountainous regions in southern Italy and Montenegro. They analyzed the value of rural tourism development and vernacular farm building construction, offering tools and recommendations for promoting local, sustainable development. However, the existing literature reviews on rural sustainability and land use have primarily focused on specific countries or regions,

lacking a global perspective. Moreover, these studies have predominantly addressed specific aspects, failing to provide a comprehensive overview of the field's current state or future directions. This limitation restricts researchers' capacity to examine rural sustainability and land use from diverse perspectives. What is the connection between land use and sustainable rural development? How can declining rural areas be revitalized? How can we achieve more sustainable development while increasing land productivity? How can rural structural adjustments be implemented to promote rural transformation and development? To address and answer these questions, a comprehensive and systematic review and analysis of research in this field is necessary. The research in this paper will be based on the scientific assumption that rural sustainability brings direct or indirect impacts on social, economic, and environmental aspects, which can change the functioning of the land and consequently affect land use. Conversely, land use can also, through that pathway, counteract rural sustainability (Figure 1). The relationship between the two is one of interaction.

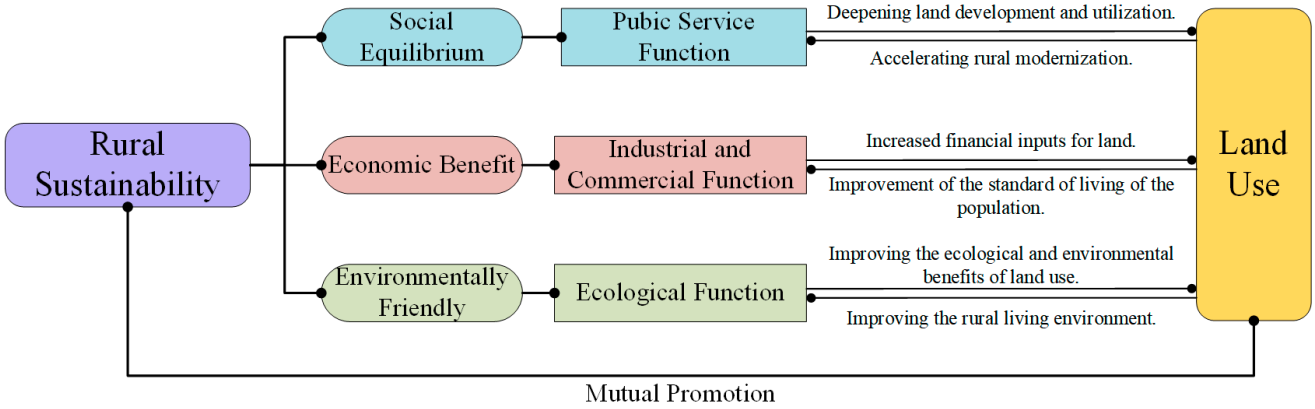

Figure 1. Interaction between rural sustainability and land use.

Bibliometrics is a powerful tool for analyzing the progress of scientific research by quantifying the information available in online scientific citation databases related to a specific research topic, including the distribution of authors, number of publications, and research institutions in the field. Additionally, bibliometrics can also identify important literature in a research field, provide keywords, institutional and national links and distributional characteristics, and quantify the current status and future trends of a research topic [37,38]. Notable bibliometric analysis tools include HistCite [39], SATI [40], and CiteSpace [41]. Bibliometrix, an open-source tool developed by Massimo Aria et al. in 2017 using R, facilitates bibliometric analysis [42]. Compared to other bibliometric software such as CITAN [43] and ScientoText, Bibliometrix allows for the import and conversion of data from various databases, including Web of Science, Scopus, Dimensions, and Lens.org. Moreover, it offers extensive features for literature information analysis and result visualization [42]. Many researchers have used this tool to quantitatively analyze the literature in the fields of agriculture and geography. For instance, Xie et al. [44] conducted data mining and quantitative analysis on research papers related to land degradation from the Web of Science core collection database spanning the years 1990 to 2019, unveiling the global research status on land degradation and assessing future research directions. Li et al. [45] used Bibliometrix to analyze the literature on food security from the Web of Science core collection database covering the period 1991 to 2021, presenting the research status and future development trends across various topics in the field. However, there remains a lack of comprehensive systematic reviews employing bibliometric analysis, specifically in the context of rural sustainability and land use.

In light of these circumstances, this study employed bibliometric methods to comprehensively analyze and evaluate the literature in the field of rural sustainability and land use by selecting relevant articles. The bibliometric analysis was conducted using the

Bibliometrix R package on literature published in the Web of Science core database from 1990 to 2023. To address the research objectives of this study, the following questions need to be answered:

(1) What are the production trends of the scientific literature on rural sustainability and land use?
(2) How have the journals, authors, research countries, and institutions focusing on rural sustainability and land use changed over time?
(3) What are the research hotspots and topics in this field, and how have they developed and evolved?
(4) What are the future research directions in the field of rural sustainability and land use?
(5) What is the relationship between rural sustainability and land use?

2. Research Methodology

2.1. Research Design and Methodology

Bibliometrics is extensively acknowledged as a proficient methodology for efficaciously accessing and analyzing information pertinent to publications [46].

In this study, the bibliometric methodology was employed through a comprehensive exploration of the Web of Science Core Collection database. This database stands as a globally esteemed and expansive academic repository, encompassing a wide spectrum of literature categories across various disciplines, encompassing natural sciences, computer science, biology, arts, and humanities. Encompassing a vast repository of more than 12,000 distinguished and influential scholarly journals, this database serves as an abundant reservoir, offering a plethora of high-caliber literature entries for retrieval [47]. The research design followed the standard steps of bibliometric analysis, including data collection and cleansing, data analysis and visualization, and data interpretation (Figure 2).

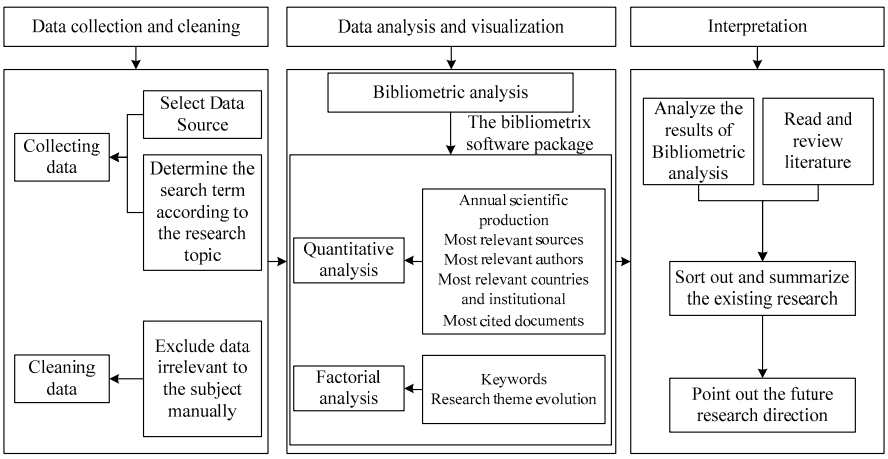

Figure 2. Research design and workflow.

The first step, detailed in Section 2.2, involves data collection and cleansing.

The second step is data analysis and visualization. In this study, we used Biblioshiny, an online application framework built on Bibliometrix, to analyze and visualize the data. While Bibliometrix operates through code commands, Biblioshiny employs the shiny package to encapsulate the core code of Bibliometrix. This framework provides a wide range of statistical methods and visualization charts to meet researchers' needs [42]. Leveraging Biblioshiny, we present an exposition of the prevailing landscape of research within the sphere of rural sustainability and land use. This encompasses annual publication counts, research output by country, institution, author, and journal, as well as research themes.

The third step involves data interpretation. While bibliometric software has facilitated literature review studies, it cannot replace the actual reading and analysis of the retrieved papers. Consequently, based on the bibliometric results, it is necessary to further scrutinize

and analyze the identified papers to identify existing research gaps and predict future directions in the field. This approach acknowledges the crucial role of bibliometrics as a valuable reference tool while recognizing the need for in-depth reading and analysis of the literature.

2.2. Data Collection and Cleansing

In order to amass literature related to rural sustainability and land use, a comprehensive search was conducted in the subject fields, including title, abstract, author keywords, and keywords plus. After iterative experiments and consultations with field experts, the following search formula was established: TS = ((rural sustainability) AND (land use OR land cover OR land use/cover OR lucc OR land use and land cover OR lulc)). The data retrieval was performed in June 2023. To ensure the quality of the articles, several restrictions were applied within the Web of Science database. The language was limited to English, and the document types were restricted to "article" and "review articles", excluding book chapters, editorial materials, and others. The search period spanned from 1990 to 2023, as articles published before 1990 were not available in the database. The search results were exported as complete records in a ".txt" format, including DOI, authors, title, publication year and month, journal, author contact information, abstract, and references. Manual screening using Bibliometrix was then conducted based on titles and abstracts to remove duplicates and irrelevant data. After this screening process, a final selection of 1746 publications that met the inclusion criteria was obtained. The entire process of data collection and cleansing is summarized in Figure 3.

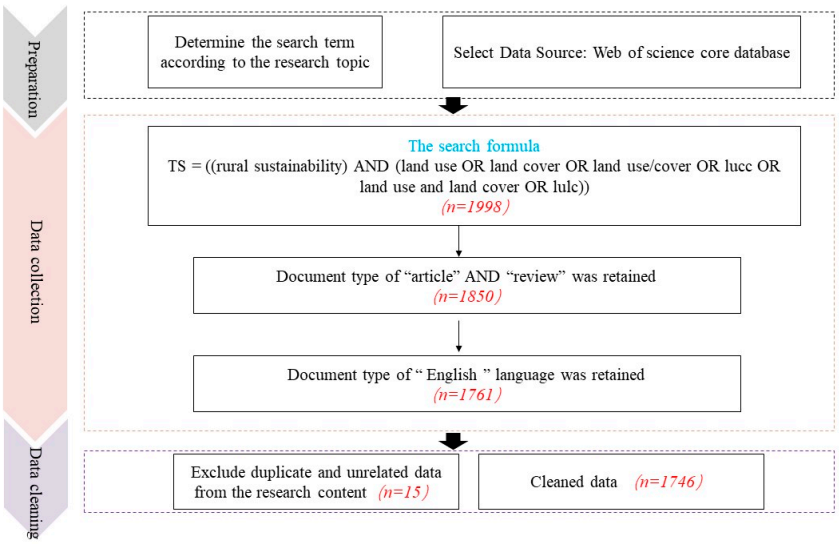

Figure 3. Data collection flow diagram.

2.3. Data Analysis and Visualization

The cleaned data were analyzed and visualized using the Bibliometrix and Biblioshiny software packages (version 4.1), along with R language (version 4.3.1), Microsoft Excel (version 2019), and VOSviewer software (version 1.6.19), to provide comprehensive insights into the field of rural sustainability and land use. The analysis and visualization focused on five main aspects:

(1) Quantitative analysis of publications and publishing journals: This analysis examined the changes in the number of publications and publishing journals over time, revealing the historical development of the field [48];

(2) Quantitative analysis of key researchers, countries, and institutions: By setting the node types as "author", "country", and "institution" in Biblioshiny, the distribution of research output among authors, countries, and institutions in the field of rural sustainability and land use was explored [49];

(3) Analysis of cited papers: This analysis identified influential and pioneering research papers in the field, contributing to the formation of a knowledge base for rural sustainability and land use [45];
(4) Keyword analysis: Keywords were used for clustering and multiple correspondence analysis, providing a concise summary of the paper's content. This analysis helped identify research topics and directions in the field [50];
(5) Analysis of research topic evolution: The field was divided into different time periods, and the evolution of research topics was explored. The "concept structure" feature in Biblioshiny generated a Sankey diagram illustrating the evolution of research topics over time, providing insights into future research directions [51].

By employing these software packages and tools, the results of the analysis were effectively visualized, enhancing the presentation and understanding of the findings.

3. Results

3.1. Analysis of the Number of Articles Issued and the Publishing Journal

3.1.1. Annual Trends in the Number of Publications

From 1990 to 2023, the number of papers issued in the field of rural sustainability and land use research generally showed a fluctuating upward trend (Figure 4). This study divided the relevant research into three phases based on the number of publications: 1990–2004, 2005–2017, and 2018–2023. The period from 1990 to 2004 can be characterized as the nascent development phase, with a low publication volume averaging below seven papers per year. Publications during these 15 years accounted for only 5.9% of the total. Scholars during this period primarily focused on assessing the agricultural landscape value to aid farmers and policymakers in better managing agricultural landscapes [52]. The period from 2005 to 2017 represented the expansion and promotion phase, with a noticeable increase in annual publication volume, averaging 52.3 papers per year. Research papers accounted for 38.95% of the total publications. The research during this period mainly focused on the impact of land use (including land use change and land management) on rural sustainable development [53–55]. The period from 2018 to the present marked the rapid development phase, with the research papers published during this period accounting for 55.15% of the total collected in this study. The number of papers published annually exceeded 170 from 2019 to 2022 alone. Research in this period focused on the analysis of the integration of "ecology-production-life" in the countryside [35,56] and the impact of policies on rural land use and sustainable development [29,33].

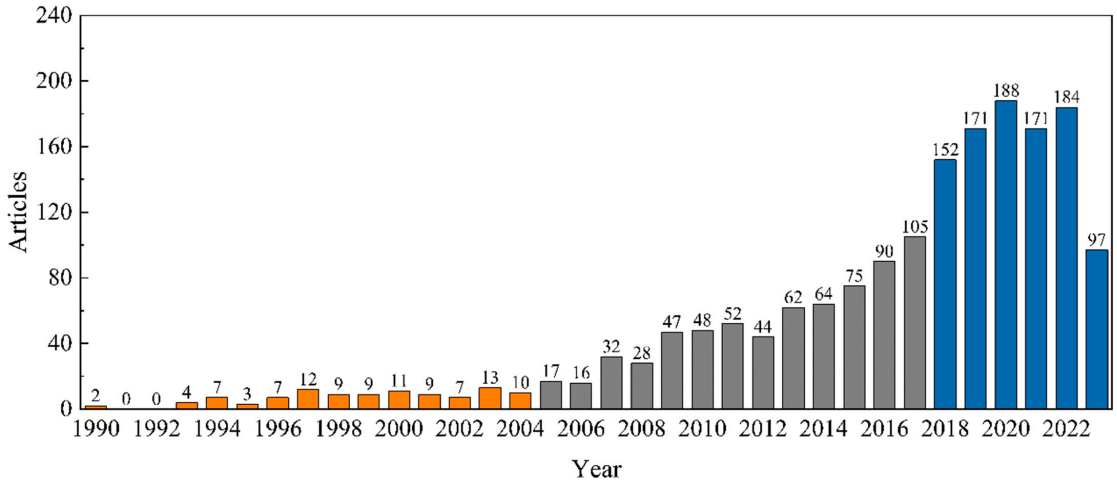

Figure 4. Annual publication trend of rural sustainability and land use from 1990 to 2023. Note: Different colors represent different phases of development.

3.1.2. Analysis of Publishing Journals

From 1990 to 2023, land use research was concentrated on forestry and agricultural policy themes. Among these journals, *Sustainability* stood out with the highest publication volume of 174 papers, followed by *Land Use Policy* with 108 papers and *Land* with 71 papers (Table 1). These journals, along with *Agriculture Ecosystems & Environment* and *Journal of Environmental Management*, demonstrated a higher H-index, suggesting their significant influence and impact within the field.

Table 1. Top 10 journals with the most publications on rural sustainability and land use from 1990 to 2023.

Sources	Articles	H-Index
Sustainability	174	23
Land Use Policy	108	35
Land	71	10
Journal of Environmental Management	32	19
Journal of Rural Studies	32	13
Agriculture Ecosystems & Environment	26	19
Ecological Indicators	24	13
Landscape and Urban Planning	24	17
Ecological Economics	23	16
Environment Development and Sustainability	23	6

Note: The H-index is a quantitative index used to characterize the number and level of academic outputs, which was proposed by American physicist Jorge E. Hirsch in 2005; the higher the value, the greater the impact of the journal in the field.

A trend analysis of the top five journals in terms of the number of publications (Figure 5) shows that *Land Use Policy* has the longest publication history, with its first article published as early as 1994. *Sustainability*, although starting later, showed a rapid increase in publication volume over time. From 1990 to 2023, all five journals exhibited a steady growth trend in terms of the number of publications. As of June 2023, *Sustainability* had published 174 papers, *Land Use Policy* had published 108 papers, and *Land* had published 71 papers.

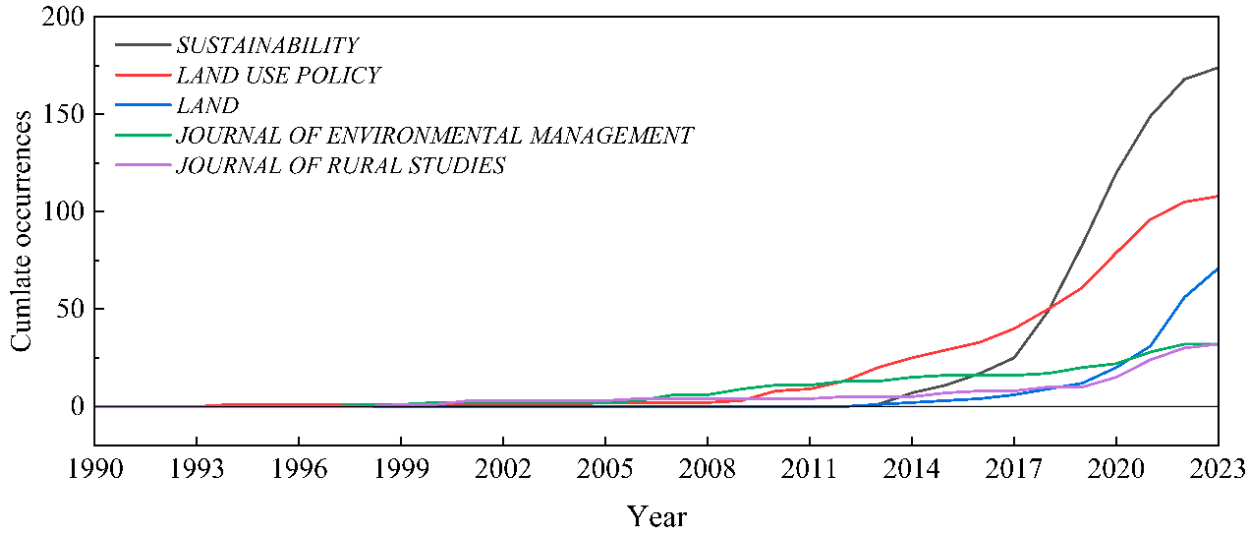

Figure 5. Growth curve of journal sources in rural sustainability and land use from 1990 to 2023.

3.2. Analysis of Key Researchers, Institutions, and Countries

3.2.1. Analysis of Key Researchers

A total of 6253 researchers have contributed to the field of rural sustainability and land use, with 25 authors having published five or more papers in this field. Most authors

(90.5%) have only published one paper, indicating that there are fewer specialists overall who have paid long-term attention to the field.

Based on their contribution and influence in this field, the top 10 most influential scholars are as follows: Liu Yansui, Luca Salvati, Long Hualou, Peter H. Verburg, Joern Fischer, R.D. Garrett, Li Yurui, Yuji Murayama, Wang Jianying, and Yang Yuanyuan (Figure 6). Liu Yansui, affiliated with the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, has the highest number of publications with 12 papers. Three of his papers published in 2018 have received notable citations, indicating their impact on the field. Liu Yansui has been conducting long-term research on the relationship between rural sustainable development and land use and has actively participated in international conferences on "Land Use and Rural Sustainable Development." His paper titled "Introduction to land use and rural sustainability in China" has made a significant academic impact. Luca Salvati has published 11 papers, while Long Hualou, Peter H. Verburg, and Joern Fischer have published 9, 9, and 8 papers, respectively. Notably, Long Hualou and Li Yurui have collaborated frequently, focusing on the transformation of rural areas in China and its impact on ecosystem services [7,57]. Peter H. Verburg primarily investigates the theoretical foundations of sustainable land use development [58], while Joern Fischer pays particular attention to the role of conservation policies and strategies in rural sustainable development [59].

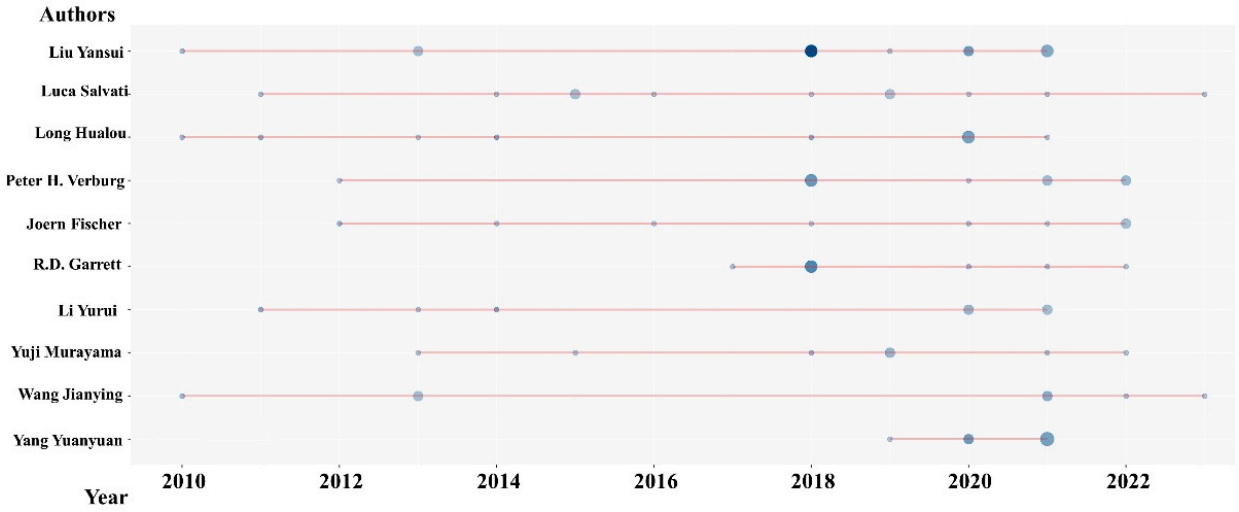

Figure 6. The author's article is on the changes in output over time in the field of rural sustainability and land use. Note: The size of the circle represents the number of documents, and the shade of the color represents the number of citations.

A total of 16 author clusters have been formed in the field of rural sustainability and land use research, each with its own distinct research focus and emphasis (Figure 7). Notably, the team represented by Liu Yansui from the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, has had a significant impact in this field. Their research encompasses various aspects of China's rural sustainable development, including land consolidation for rural development, land use and rural sustainable development in China, and urbanization and rural sustainable development. Another influential author cluster is led by Long Hualou, also from the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, which primarily focuses on the analysis of China's rural transformation and development. Additionally, the team led by Salvati Luca from the Council of Research in Agriculture primarily studies the economic and environmental sustainability of rural areas in Italy. The team led by Joern Fischer from Leuphana University Lueneburg mainly researches conservation policies for traditional agricultural landscapes. These author clusters contribute to the diverse research perspectives and expertise in the field of rural sustainability and land use.

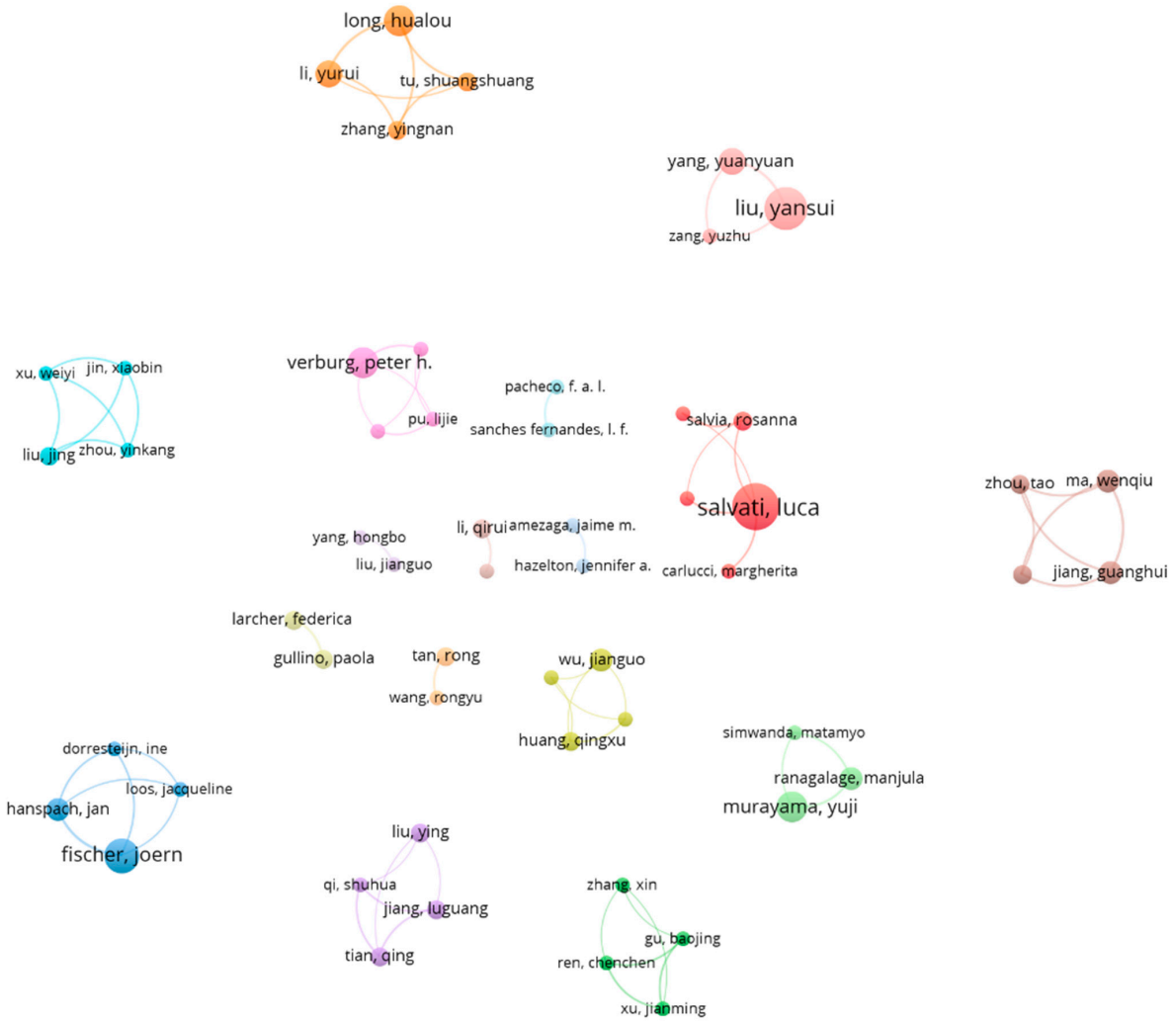

Figure 7. Author collaboration network in the field of rural sustainability and land use. Note: The same color means that these authors are in the same network.

3.2.2. Analysis of Main Research Countries and Institutions

The papers published in different countries can reflect, to some extent, the importance and influence of the country in the field of rural sustainability and land use. Since the inception of this field, 2077 institutions from 89 countries or regions have participated in research on rural sustainability and land use. Among the top 10 countries in terms of publication quantity (Table 2), there are two Asian countries (China and India), two American countries (USA and Canada), five European countries (UK, Germany, Italy, Spain, and The Netherlands), and one Oceanian country (Australia). China has the highest number of publications, with 303 articles. However, the average citation frequency is relatively low, at only 24.60, indicating that the quality of the papers still needs improvement. The country with the highest average citation frequency is the UK, with 44 citations, followed by the Netherlands and Australia, with 40.6 and 38.1 citations, respectively. This finding suggests that developed countries have strong research capabilities in the field of rural sustainability and land use. Analyzing the national collaboration network (Figure 8) reveals the most productive countries and regions. The network shows that the United States has the highest number of international collaborations, followed by the UK and the Netherlands. Although China has more publications than the United States, the United States has stronger international connections than China, indicating that Chinese scientists' work is more independent. There is frequent collaboration between the United States,

China, Canada, and Australia, while Italy, Spain, and France frequently collaborate among themselves, and Germany and the Netherlands collaborate frequently.

Table 2. Status of papers on rural sustainability and land use in main countries from 1990 to 2023.

Country	Articles	Total Citations	Average Article Citations
China	303	7440	24.6
USA	200	6216	31.1
United Kingdom	115	5062	44
Italy	96	1959	20.4
Germany	84	2680	31.9
Australia	80	3046	38.1
Spain	69	1188	17.2
India	65	1070	16.5
Canada	53	1106	20.9
Netherlands	44	1787	40.6

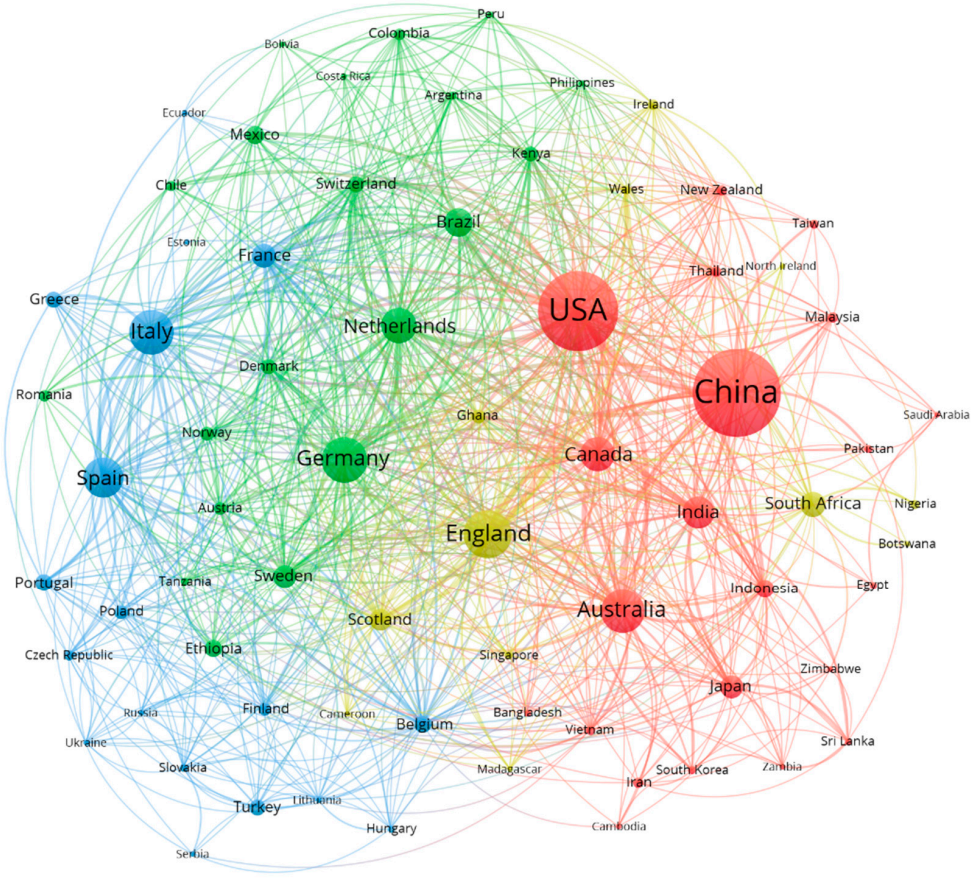

Figure 8. National cooperation network in rural sustainability and land use from 1990 to 2023. Note: The same color means that these countries are in the same cooperative network.

The Chinese Academy of Sciences, the Institute of Geographic Sciences and Natural Resources Research, CAS, and Wageningen University and Research are the top three institutions in terms of the number of publications (Table 3), with 114, 65, and 47 papers, respectively. In addition, Cgiar and Arizona State University-Tempe have published 42 and 35 papers, respectively. In terms of collaboration among institutions, the Chinese Academy of Sciences has the highest collaboration centrality, indicating a strong influence on the relationships within the collaboration network. This is followed by Wageningen University and Research and Beijing Normal University (Figure 9). These institutions, with high publication frequency and centrality, have been the core research centers in

this field. There is frequent collaboration between Beijing Normal University, the Chinese Academy of Sciences, and the Institute of Geographic Sciences and Natural Resources Research. Collaboration is also common between Wageningen University, the University of Oxford, and Zhejiang University, while the University of Leeds, the University of Bern, and the University of Maryland have close collaborations. These collaborative networks demonstrate the importance of partnerships and knowledge exchange among leading institutions in advancing research on rural sustainability and land use.

Table 3. Number of articles published by relevant institutions in the field of rural sustainability and land use from 1990 to 2023.

Affiliation	Articles
Chinese Academy of Sciences	114
Institute of Geographic Sciences and Natural Resources Research, CAS	65
Wageningen University and Research	47
Cgiar	42
Arizona State University-Tempe	35
Cirad	31
Inrae	31
N8 Research Partnership	30
Arizona State University	28
University of California System	28

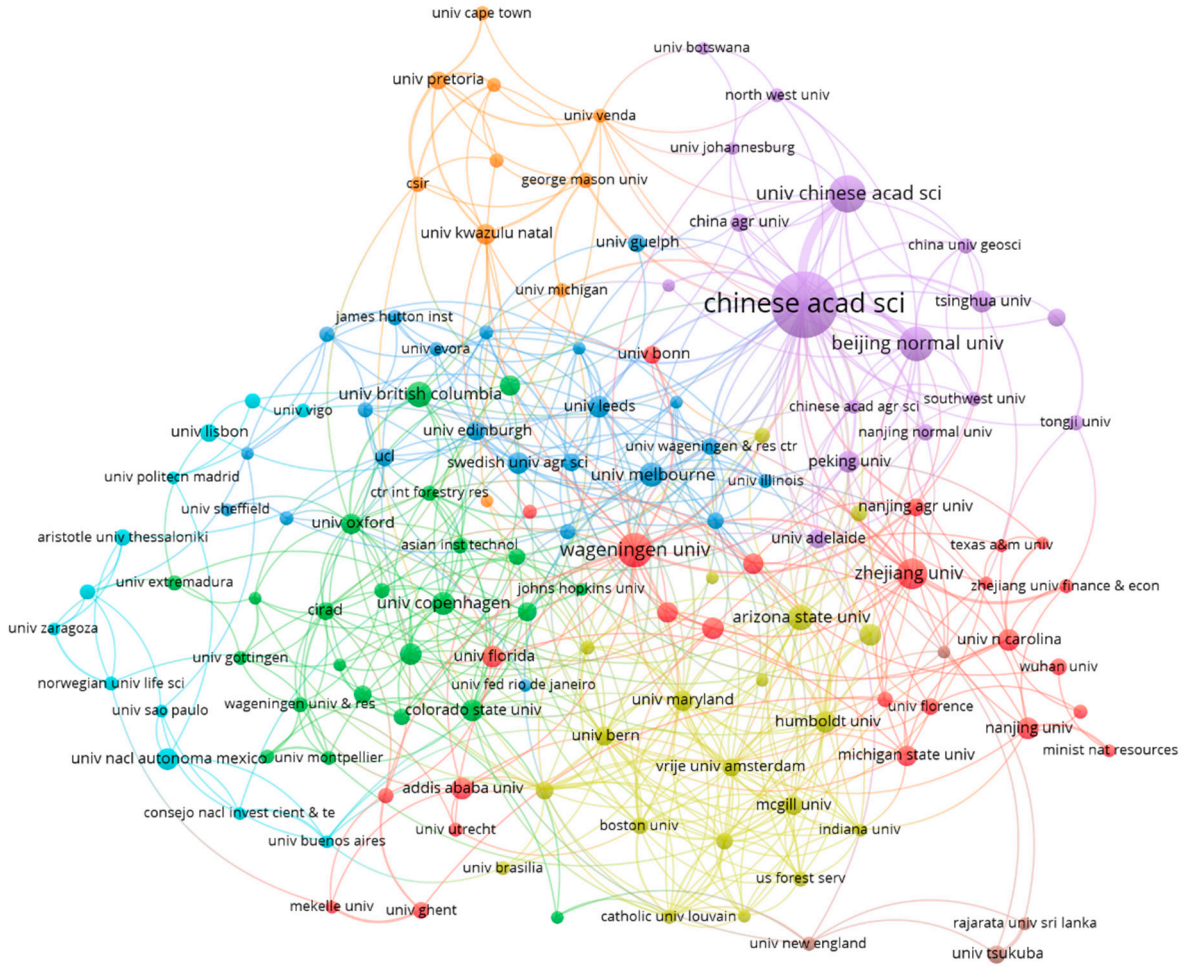

Figure 9. Institutional cooperation network in the field of rural sustainability and land use from 1990 to 2023. Note: The same color means that these institutions are in the same collaborative network.

3.3. Analysis of Cited Papers

3.3.1. Analysis of Local Highly Cited Papers

In the field of rural sustainability and land use, the papers with high local citations were mainly published in 2004–2018 (Table 4). The most highly cited paper is by Li et al. [30], published in *Land Use Policy*.

Table 4. Top ten local citation scores (LCS) of publications in rural sustainability and land use.

Reference	DOI	Year	Local Citations	Global Citations	LC/GC Ratio (%)
[30]	10.1016/j.landusepol.2017.07.003	2018	33	159	20.75
[4]	10.1016/j.landusepol.2018.01.032	2018	30	435	6.90
[29]	10.1016/j.jclepro.2017.12.273	2018	24	187	12.83
[53]	10.1073/pnas.1117622109	2012	22	532	4.14
[54]	10.1098/rstb.2007.2165	2008	21	429	4.90
[60]	10.1016/j.jrurstud.2005.08.006	2006	18	378	4.76
[61]	10.1505/ifor.6.3.317.59976	2004	15	175	8.57
[62]	10.1016/j.jenvman.2008.11.014	2009	14	311	4.50
[7]	10.1016/j.apgeog.2011.02.006	2011	14	257	5.45
[63]	10.1016/j.apgeog.2010.10.008	2011	14	223	6.28

Note: the local citations indicate the number of citations by papers in the database of this paper, and the global citations indicate the number of citations by all papers.

The study analyzes China's rural land system using a land consolidation project in a village community in Shandong Province, China, as an example. The results show that China's dualistic land system restricts the effective utilization of rural land. The authors suggest that policymakers should formulate certain policy terms and regulations to encourage the transfer of farmers' land management rights and promote large-scale land management, thus expanding the rural land market, increasing the value of farmers' homesteads, and changing the employment pattern of villagers. The second most highly cited paper is by Yansui Liu [4], titled "Introduction to land use and rural sustainability in China". This paper examines the impact of the transformation of human socio-economic activities on land use changes and related policy formulation through five aspects: "land use and sustainable development", "urbanization and farmland protection", "rural transformation and reconstruction", "urban-rural interactions in a changing society", and "land resources engineering and land use policy". The paper highlights the severe impact of rapid urbanization on rural areas, exacerbating issues such as "rural disease" and farmland loss. It emphasizes the need for further systematic research on land use sustainability and calls for more research on the challenges faced by land use and rural revitalization in China. The third most highly cited paper is by Li et al. [29], published in the *Journal of Cleaner Production*. Through a systematic literature review, the study found that the rapid development of urbanization in China has come at the expense of the countryside, resulting in a distorted urban–rural relationship and posing a variety of challenges to rural sustainability. The study proposes that urbanization should be accompanied by using small towns as a bridge to provide education, health care, administration, and other services to remote rural areas while promoting rural areas. These highly cited papers have made significant contributions to the understanding of rural sustainability and land use, highlighting the need for policy interventions and holistic approaches to address the challenges faced by rural areas in the context of urbanization.

3.3.2. Analysis of Global Highly Cited Papers

In the field of rural sustainability and land use, the highly cited papers globally were mainly published between 2010 and 2018 (Table 5). The most highly cited paper is by Bryan et al. [64], published in *Nature*. This review article examines 16 sustainable development projects implemented in China and identifies key features and potential risks of policy interventions for improving the sustainability of rural land systems in China. It provides directions for China and other countries in achieving the United Nations' 2030 Sustainable

Development Goals. The second most highly cited paper is by Creutzig et al. [65], published in *Global Change Biology*. This review study highlights the importance of rational deployment and regulation of bioenergy resources (such as cellulose feedstocks and soil carbon) for heat and power generation to promote global sustainability and help control global warming. Integrating bioenergy systems into rural agriculture and forest landscapes can improve land and water use efficiency and address environmental impacts. The third most highly cited paper is by Nobre et al. [66], published in *PNAS*. The study found that low productivity and unsustainable agricultural development in the Amazon region had led to extensive land-cover change and that loss of biodiversity and continued deforestation would lead to a high risk of irreversible changes in tropical forests. Innovative methods should be promoted to protect the sustainable development of the Amazon region by applying a combination of advanced figures, materials, and technologies.

Table 5. Top ten global citation scores (GCS) of publications in rural sustainability and land use.

Reference	DOI	Year	Total Citations	TC per Year
[64]	10.1038/s41586-018-0280-2	2018	607	101.17
[65]	10.1111/gcbb.12205	2015	397	44.11
[66]	10.1073/pnas.1605516113	2016	384	48.00
[67]	10.1016/j.agsy.2007.07.009	2008	350	21.88
[68]	10.1098/rstb.2003.1380	2003	334	15.90
[69]	10.3763/ijas.2010.0534	2010	320	22.86
[70]	10.1016/j.landusepol.2011.07.008	2012	300	25.00
[71]	10.1007/s13593-013-0143-z	2013	297	27.00
[57]	10.1016/j.habitatint.2014.10.011	2014	291	29.10
[72]	10.1111/cobi.12840	2017	284	40.57

3.3.3. Analysis of Cited Networks

In Biblioshiny, a total of 11 seminal publications have been extracted, representing pioneering research achievements in the field of rural sustainability and land use. These achievements form the basis of four co-citation networks (Figure 10). Among them, Bunker [73], Holmes [60], and Renting [62] have explored rural transformation and agricultural multifunctionality in the context of sustainable development in Australia. Xu [61] and Grosjean [74] have investigated the impact of China's reforestation projects on rural sustainable development. Liu [4,75] and Long [7] have primarily focused on the influence of land use changes on rural sustainable development in the process of China's rural transformation. Pasakarnis [76] and Li [30] have studied the role of rural land consolidation in promoting sustainable development. Within the co-citation network, Liu Yansui's research has been referenced in four articles, while Long Hualou's work has been referenced in two articles, indicating their significant influence in this field.

3.4. Keyword Analysis

3.4.1. Analysis of High-Frequency Keywords

In the field of rural sustainability and land use, the top 50 high-frequency keywords provide valuable insights into the research hotspots (Figure 11). The top 10 keywords and their frequencies are as follows: sustainability (310), land use (81), agriculture (72), ecosystem services (72), China (69), rural development (64), food security (59), sustainable development (52), urbanization (46), and climate change (45). These keywords reflect the central themes and areas of interest within the field. Scholars are particularly focused on topics related to the sustainable development of rural areas, including the management and utilization of land resources, agricultural practices, and the provision of ecosystem services. The emphasis on China as a keyword highlights the significance of research conducted in the context of China's rural development and its implications for global sustainability. Additionally, the keywords related to rural development, food security, sustainable de-

velopment, urbanization, and climate change demonstrate the interdisciplinary nature of research in this field, encompassing social, economic, and environmental dimensions.

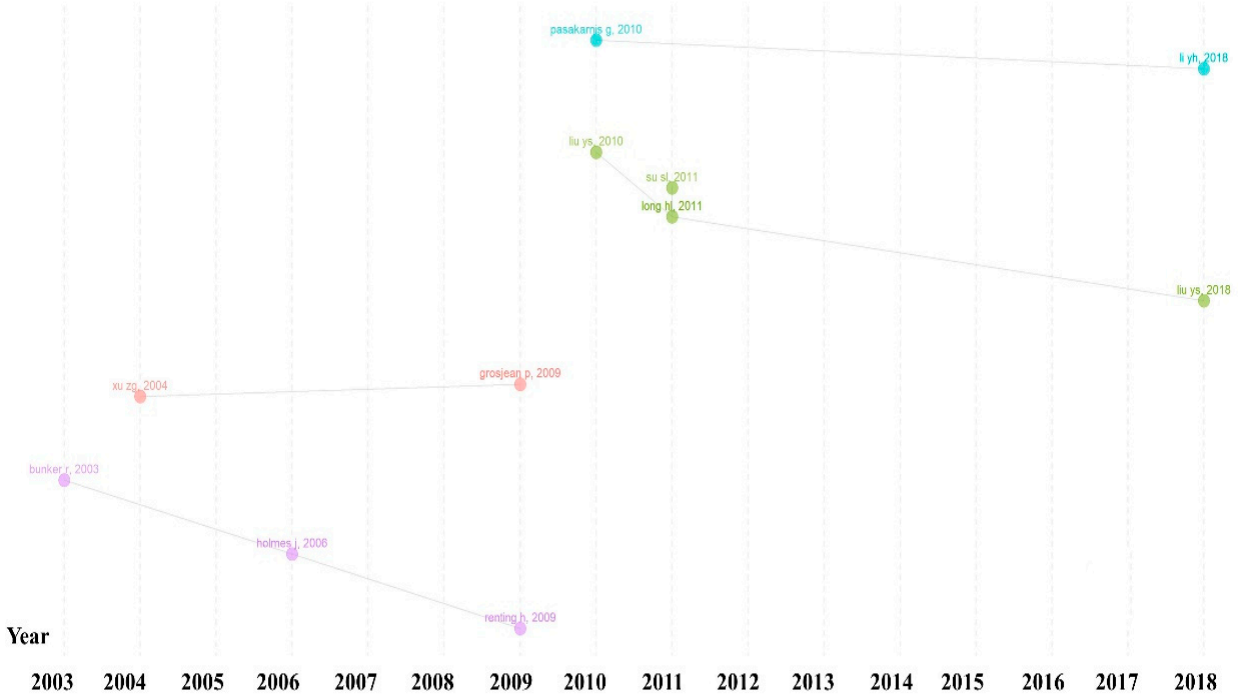

Figure 10. Historical citation network of highly cited papers in the field of rural sustainability and land use. Note: Different colors represent different co-citation networks.

Figure 11. High-frequency keywords and their occurrence frequency in the field of rural sustainability and land use.

3.4.2. Cluster Analysis and Multiple Correspondence Analysis of High-Frequency Keywords

The combination of cluster analysis and multiple correspondence analysis of high-frequency keywords can intuitively reflect the research direction and research themes of a particular research area. Cluster analysis is utilized to group keywords based on their interrelationships, revealing the level of association within the field. Subsequently, multiple correspondence analysis further explores the similarity between keywords using plane distances. Keywords positioned closer to the center point are indicative of greater prominence and heightened attention in the field [44].

Based on the cluster analysis (Figure 12) and multiple correspondence analysis (Figure 13) of high-frequency keywords, the field of rural sustainability and land use can be categorized into four main research directions.

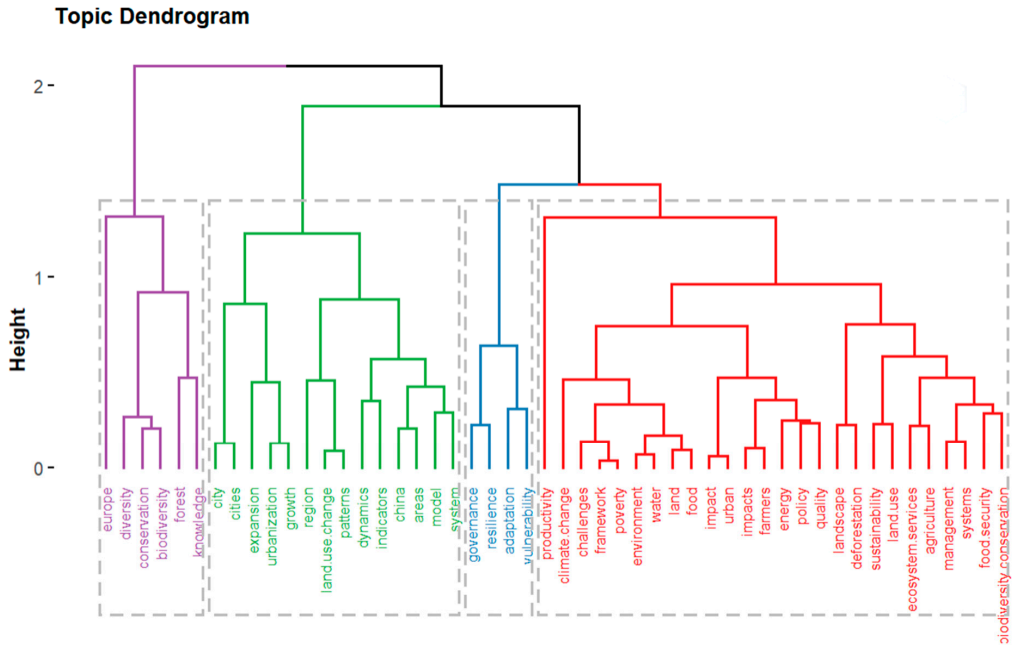

Figure 12. Hierarchical clustering analysis of high-frequency keywords in the field of rural sustainability and land use. Note: Different colors in the figure represent different clusters.

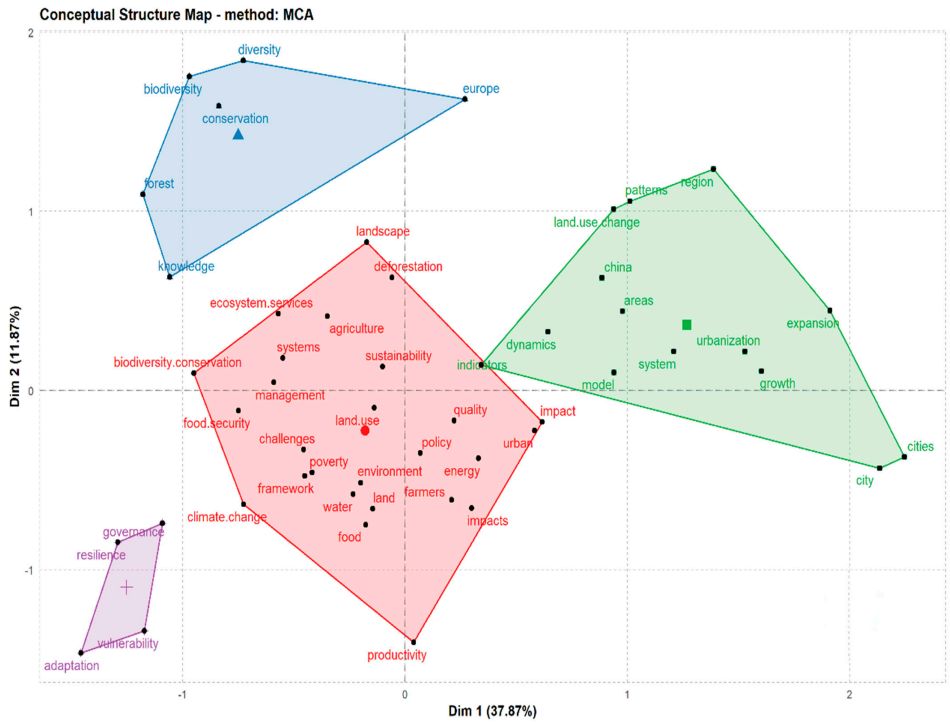

Figure 13. Multiple correspondence analysis of keywords in the field of rural sustainability and land use. Note: Different colors in the figure represent different clusters.

The first research direction is the impact of rural land use and land cover changes on biodiversity. Factors such as rural land use, land management, and grazing practices play a significant role in determining habitat suitability for species [77]. The expansion of

rural residential areas and transportation development can lead to local vegetation destruction [78]. In cases where short-term economic gains take precedence over environmental protection and rural sustainability, there is a risk of habitat destruction and biodiversity loss. However, proper land use planning and sustainable rural development can contribute to improved habitat suitability for species [79]. At the same time, improving the quality of education for people in rural areas and increasing farmers' access to ecosystem services are also key to conserving ecosystems and biodiversity [80].

The second research direction focuses on the adaptive capacity and vulnerability to external changes in the context of rural sustainable development. Environmental changes, such as climate change, and human activities, such as afforestation and mining, influence the need for adjustments in land use practices as an effective adaptation strategy for the agricultural sector. This strategy contributes to rural poverty reduction and socio-economic development [81]. Existing research suggests that sustainable development in villages has a greater potential to address climate change [82]. Additionally, the collective nature of human activities plays a vital role in promoting a circular economy and sustainable development, where local stakeholders collaborate to generate shared benefits for the community. However, challenges such as administrative and regulatory barriers, competition and conflicts in land use requirements, fiscal revenue issues, and varying educational levels can hinder rural sustainability [83–85]. Future policies should address these key issues to ensure the livelihoods and income of farmers [86].

The third research direction focuses on the interrelationship between rural land use changes and rural agricultural development. Studies have highlighted the negative impacts of agricultural land dynamics on water resources in rapidly developing urban areas, emphasizing the need for soil and water conservation measures to mitigate flood risks and maintain agricultural land productivity [87]. The conversion of agricultural land due to urban expansion has been found to result in a decrease in natural areas, indicating the importance of implementing policy measures to prevent further loss of natural regions in the context of existing farmland protection policies [88]. Additionally, the loss of rural farmland is not solely attributed to urban development but is also driven by factors such as reduced agricultural economic viability and farmers' willingness to cultivate, which undermines food self-sufficiency [89]. Understanding the dynamics and implications of rural land use changes is crucial for promoting sustainable rural agricultural development.

The fourth research direction is mainly related to land management for rural sustainability. It involves understanding the driving factors, processes, and impacts of land use changes to promote sustainable land management practices. Mutoko et al. [90] conducted a study in Western Kenya using remote sensing and survey interviews to analyze land dynamics and agricultural production over a 25-year period. The findings revealed that high population pressure does not necessarily lead to agricultural intensification, emphasizing the importance of considering the impact of non-farm income on sustainable development and policy formulation. Xu et al. [91] investigated the impact of a recent land tenure reform on organic fertilizer application in rural China. Their research demonstrated that the reform resulted in a significant increase in organic fertilizer use, indicating its positive effect on sustainable agricultural practices. The reform also addressed administrative barriers to land rights transfer, contributing to rural sustainability. By analyzing the evolutionary law and spatial-temporal pattern of land use transformation and urban–rural integrated development in China, Chen et al. [92] showed that the impact of land use transformation on urban–rural integrated development requires the realization of a rational allocation of incremental land value in urban and rural areas.

3.5. Analysis of the Evolution of Research Hotspots

Considering the trend of growth in the number of publications in the field, we use 2004 and 2017 as time points to analyze the evolution of research development in the field of rural sustainability and land use research (Figure 14). The period from 1990 to 2004 is characterized as the emergence and development phase, focusing on the challenges of

transitioning from traditional agricultural systems to sustainable agriculture. From 2005 to 2017, the field enters an expansion and promotion phase, with emphasis on the impact of land use and land cover change (LUCC) and agricultural sustainability on the ecological environment. The years 2018 to 2023 represent a phase of rapid development driven by urbanization and climate change, with particular attention to the coupling of rural areas and the multifunctionality of land use. The research evolution can be categorized into the following aspects:

(1) The research evolution in the field of rural sustainability and biodiversity conservation, as well as ecosystem services, can be categorized as follows: ① sustainability → GIS → ecosystem services; ② biodiversity → land-use → agriculture; ③ biodiversity → land-use → agroforestry; ④ biodiversity → ecosystem services; ⑤ development → ecosystem services → sustainability. The research evolution in the field of rural sustainability and biodiversity conservation, as well as ecosystem services, can be categorized as follows: (1) sustainability → GIS → ecosystem services; (2) biodiversity → land-use → agriculture; (3) biodiversity → land-use → agroforestry; (4) biodiversity → ecosystem services; (5) development → ecosystem services → sustainability. The Millennium Ecosystem Assessment has confirmed the significant ecological footprint of agriculture and the reliance of rural communities on biodiversity and ecosystem services. Future research should focus on effectively protecting wildlife biodiversity in agricultural landscapes, coordinating policies, and providing strategic support for agricultural communities and conservation efforts [54]. In China, under the pressure of rapid urbanization, land use transformation has had many negative impacts on ecosystems and the environment [70]. A study in Tianjin, China, revealed a 25.9% decrease in ecological value due to the conversion of ecological land into built-up areas between 1985 and 2010. It is crucial to protect regional ecosystem services and ensure the sustainable utilization of ecological resources during rapid urbanization to meet the demand for socio-economic development [57];

(2) In the realm of rural sustainability and land management, the research evolution can be outlined as follows: ① agriculture → sustainability → food security; ② sustainability → GIS → rural; ③ agricultural sustainability → rural development → land cover; ④ rural development → land use → agriculture. With rapid urbanization, multifunctional agriculture and the transformation of rural areas have become crucial in agricultural and rural development [62]. The transformation and development of rural areas contribute to the effective development of regional rural systems and improvements in urban–rural relationships. Coordinating urban–rural development requires attention to the strong drivers of rural transformation and consideration of multi-scale regional inequalities associated with rural transformation. Tailored rural development policies should be formulated to address different types of rural transformation [7]. Currently, the binary land system restricts the sustainable development of rural areas in China, leading to population decline, abandoned land, and inefficient land use. Urban-biased policies have distorted urban–rural relationships and contributed to the decline of rural areas [29]. Decision-makers should establish policies and regulations for rural revitalization, promote land tenure rights transfer among farmers, and facilitate large-scale land management [30];

(3) Regarding the impact of climate change and human activities on rural sustainability, the research evolution can be summarized as follows: ① agricultural sustainability → climate change → agriculture; ② farming system → biofuels. A study has demonstrated the significant potential of bioenergy deployment in mitigating climate change, but it also entails considerable risks [66]. The integration of combined heat and power, efficient biomass stoves, and small-scale electricity generation in rural areas can enhance energy access and sustainable development while reducing emissions. However, the extensive use of bioenergy feedstocks may also have adverse climate impacts and negative effects on ecosystems, biodiversity, and livelihoods. It

is crucial to integrate bioenergy systems into agricultural and forest landscapes to enhance land and water use efficiency [65].

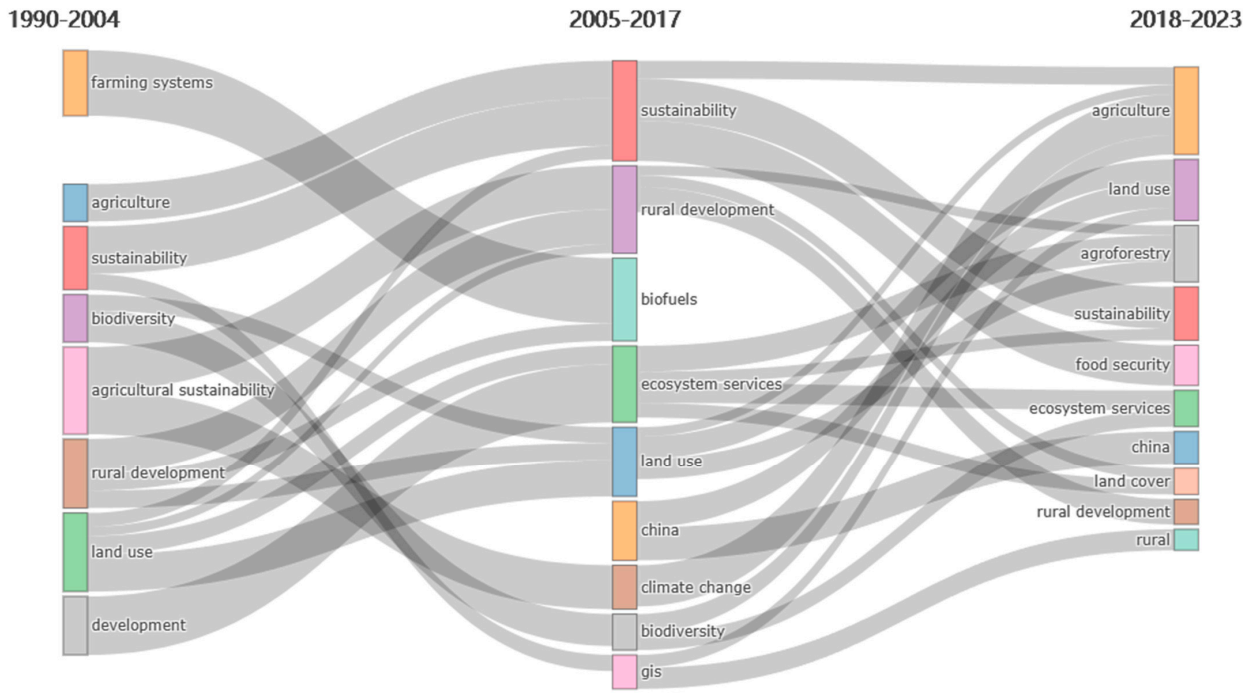

Figure 14. Theme evolution in the field of rural sustainability and land use from 1990 to 2023.

4. Discussion

4.1. Driving Factors for Rural Sustainability

In recent years, the field of rural sustainable development research has seen tremendous growth. Among them, research on the driving factors of rural sustainable development has grown significantly, which is related to the surge of interest in rural revitalization and rural sustainable development in China over the past decade or so. Nelson et al. [14] showed that, from 2003, Australia and Canada became the early leaders in research on rural sustainable development, but during the period of 2007–2021, nearly 30% of the research conducted on China was conducted, and China became the leading country for related research, which is also largely consistent with the findings of this paper. China is representative of the serious urbanization problems it currently faces, and the rapid pace of industrialization and urbanization has not only boosted its economic development but also had a profound impact on China's rural areas. Factors such as human mobility, poverty, biased policies, and inadequate land management [17,27–30] hinder rural sustainability. Rural sustainability has become a complex and multidimensional issue.

Many studies have explored the impact of one or more drivers on rural sustainability. Generally, these drivers can be categorized into two main groups: basic drivers and intervening factors. Fundamental drivers are various forms of available resources and capital that directly or indirectly affect changes in rural sustainability [93]. Intervening factors are human activities that directly affect rural sustainability [94]. The impact of interventions on rural sustainability is what most of the current studies focus on. Combining the existing studies, interventions can be categorized into policies (government-led programs), other actions (where there are actions taken by individuals or groups), and land use changes (caused by human activities) [14]. These interventions cover a wide range of aspects, such as agricultural policies and programs, land management strategies, and technology applications, and most of them generally have a positive impact on the sustainability of rural areas. The most representative ones are the Common Agricultural Policy (CAP) in Europe, the Green Grain and Slope Farming Land Conversion Programs in China, and

the CRVDP in Korea. Among them, the CAP is a policy of the European Union that aims to support the rural economy by supporting agriculture and agro-industry [95]. There are elements of the CAP that focus on rural development policies, which have a positive impact on rural sustainability. Granvik et al. [96] found that the second pillar of the CAP contributes to better protection of the natural land cover and helps to sustain agriculture and rural populations.

4.2. Relationship between Rural Sustainability and Land Use

The epochal, strategic, and systemic nature of sustainable land use and rural development issues makes this field a hot spot of international academic research and a focus of attention for all sectors of society, and it is of great significance to strengthen the research on land use and rural sustainability issues in the context of global change and economic transformation [4]. As a systemic issue, rural sustainable development is closely related to the interactions among people, rural land use, and the external environment [33]. First of all, promoting the optimal allocation of rural land resources can protect the natural ecosystem and avoid the destruction of the ecological environment, thus ensuring the sustainable development of the countryside. Scientific land use planning can prevent over-exploitation, protect water sources, vegetation, soil, and other resources, and it also helps optimize the layout of farmland and agricultural structure, improve crop yield and quality, and thus maintain food security. Secondly, the rational use of land can promote the diversified development of the rural economy. For example, the development of rural tourism, eco-agriculture, and other industries will increase farmers' sources of income and enhance the sustainability of the rural economy. In addition, scientific land use planning can improve the living environment of rural residents, provide better living conditions, health facilities, and community facilities, improve the quality of life of rural residents, and thus promote the sustainable development of the countryside.

In the process of developing new urbanization, different stages of economic and social development correspond to different regional land use patterns and stages of land use transformation, which inevitably bring about specific land use transformation processes. Rural revitalization is the link between land use transformation and sustainable rural development [17]. In the process of rural revitalization, land use patterns are optimized by means of economic leverage, engineering technology, and policy system, and the transformation of land use patterns, in turn, plays a role in the practice of rural revitalization, which is of great significance to the sustainable development of the countryside.

4.3. Future Research Directions in the Field of Rural Sustainability and Land Use

Based on the results of the bibliometric analysis, we believe that research in the field of rural sustainability and land use remains a hot topic for future research. In recent years, this field has attracted the attention of many scholars for its key role in addressing global challenges such as food security, climate change, and sustainable development. To advance knowledge in this field, future research should prioritize breakthroughs in the following key areas:

(1) Further in-depth research should be conducted on sustainable multifunctional agriculture and rural land management.

With the growing recognition of the environmental impacts of traditional agriculture and land use, there is an urgent need to explore and promote new sustainable agricultural technologies. It is essential to explore and promote new agricultural technologies that prioritize sustainability. Future research should focus on the study of sustainable multifunctionality in agriculture and land management to address the complex challenges and opportunities presented by modern agricultural systems. Multifunctionality refers to the ability of rural landscapes and agricultural activities to provide multiple benefits beyond food production. Traditional agricultural practices often prioritize productivity at the expense of environmental and social considerations. Sustainable multifunctionality aims to integrate biodiversity conservation, water resource management, climate change mitiga-

tion, and rural livelihoods, among other functions. To advance this research field, scholars and practitioners need to delve into the development and implementation of innovative policies, practices, and governance frameworks that support multifunctional landscapes. Researchers should explore the trade-offs and synergies among different functions, identify best practices for sustainable land management, and assess the economic, social, and ecological impacts of multifunctional approaches. Interdisciplinary collaboration and participatory approaches are crucial to ensure that research on sustainable multifunctionality is grounded in local knowledge, addresses specific contextual challenges, and meets the needs of diverse stakeholders. By deepening our understanding of sustainable multifunctionality, we can pave the way for reforms in agricultural and rural land management systems that prioritize environmental stewardship, social welfare, and long-term sustainability.

(2) Research on the social aspects of rural sustainability will remain a key focus.

Researchers should recognize that social factors play a crucial role in shaping the success and long-term viability of sustainable rural development initiatives. To advance this field, future research should focus on comprehending the complex interactions between social factors and rural sustainability, providing strategic recommendations to policymakers for inclusive and participatory governance models that empower local communities and stakeholders in decision-making processes. Furthermore, research should explore avenues to promote social equity and enhance the well-being of rural communities, with particular attention to marginalized and vulnerable groups. This necessitates investigating innovative approaches that generate livelihood opportunities, support rural entrepreneurship, and strengthen social networks and cohesion. In addition, the study should analyze the social impacts of rural–urban interactions, migration, and changes in land-use patterns, seeking to balance the demands of urban development with the preservation of rural identities and traditional practices. Understanding the social dimensions of rural sustainability also entails exploring the cultural values of rural landscapes and the potential for social innovation to drive positive change. By focusing on the social dimension, research can contribute to the creation of sustainable rural communities that are resilient, inclusive, and socially just.

(3) Future research on rural sustainability and land use should increasingly emphasize the role of ecosystem services and natural capital.

Future research on rural sustainability and land use should increasingly emphasize the importance of maintaining and restoring ecological integrity for sustainable rural development. The research will focus on ecosystem-based approaches to land-use planning, biodiversity conservation, and restoration, as well as in-depth quantification and mapping of ecosystem services and assessment of their spatial distribution and dynamics. Moreover, researchers will explore the potential of nature-based solutions, such as green infrastructure, sustainable forestry, and watershed management, which rely on the preservation and enhancement of natural capital. These approaches aim to enhance the sustainability and resilience of rural areas in the face of environmental challenges, including climate change and habitat loss. By highlighting the importance of ecosystem services and natural capital, future research in the field of rural sustainability and land use can provide critical insights and tools to ensure the long-term resilience and well-being of rural landscapes and communities. This focus is particularly important given the increasing environmental pressures and the need to address challenges such as climate change, habitat loss, and resource depletion in rural areas.

5. Conclusions

With the accelerating processes of urbanization, desertification, and climate change driven by human activities, the research on rural sustainability and land use has gained increasing attention from scholars worldwide. This study uses bibliometric analysis to provide a comprehensive overview of 1746 papers related to the field in the Web of Science Core Collection database for the period 1990–2023, identifies trends in publications and

major published journals in the field, determines the collaborative networks of major research authors, countries, and institutions, and analyzes the most influential articles and high-frequency keywords. Subsequently, the evolution of research themes in the field over time is analyzed, and future research directions and trends are discussed.

Over the past three decades, the field of rural sustainability and land use has witnessed exponential growth in scholarly publications. This growth can be classified into three distinct stages: the budding stage (1990–2004), the expansion and promotion stage (2005–2017), and the rapid development stage (2018–present). Notably, prominent journals such as *Sustainability*, *Land Use Policy*, and *Agriculture Ecosystems & Environment* have played a pivotal role in shaping the research landscape in this field. Key contributors to this body of knowledge include countries like China, the United States, and the United Kingdom, with research institutions such as the University of the Chinese Academy of Sciences, the Institute of Geographic Sciences and Natural Resources Research (CAS), and Wageningen University and Research leading the way. In terms of high-frequency keywords, sustainability, land use, agriculture, ecosystem services, and China have emerged as prominent themes in the field. Research in this domain can be broadly categorized into four main directions: exploring the impact of rural land use and land cover change on biodiversity; investigating the adaptability and vulnerability of rural areas during sustainable development; examining the interrelationship between rural land use change and rural agricultural development; and emphasizing the importance of land management for rural sustainability. The evolution of research hotspots has revolved around three key aspects: the conservation of biodiversity and ecosystem services in the context of rural sustainability, the influence of land management practices on rural sustainability, and the implications of climate change and human activities on rural sustainability. Looking ahead, future research should prioritize investigations into sustainable multifunctional agriculture and effective rural land management practices. Furthermore, the social aspects of rural sustainability should continue to be a focus, with a particular emphasis on inclusive and participatory governance models and the well-being of rural communities. Finally, the role of ecosystem services and natural capital should be further emphasized, emphasizing their importance for sustainable rural development. By prioritizing these research directions, scholars and practitioners can contribute to the advancement of knowledge and the implementation of sustainable practices in rural areas, thereby addressing pressing global challenges and fostering long-term rural sustainability.

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References

1. Pereira, H.M.; Leadley, P.W.; Proença, V.; Alkemade, R.; Scharlemann, J.P.; Fernandez-Manjarrés, J.F.; Araújo, M.B.; Balvanera, P.; Biggs, R.; Cheung, W.W. Scenarios for global biodiversity in the 21st century. *Science* **2010**, *330*, 1496–1501. [CrossRef] [PubMed]
2. Lambin, E.F.; Meyfroidt, P. Global land use change, economic globalization, and the looming land scarcity. *Proc. Natl. Acad. Sci. USA* **2011**, *108*, 3465–3472. [CrossRef] [PubMed]
3. Robinson, G.M.; Carson, D.A. *Handbook on the Globalisation of Agriculture*; Edward Elgar Publishing: Cheltenham, UK, 2015.
4. Liu, Y. Introduction to land use and rural sustainability in China. *Land Use Policy* **2018**, *74*, 1–4. [CrossRef]
5. Chen, R.; Ye, C.; Cai, Y.; Xing, X.; Chen, Q. The impact of rural out-migration on land use transition in China: Past, present and trend. *Land Use Policy* **2014**, *40*, 101–110. [CrossRef]

6. Liu, Y.; Fang, F.; Li, Y. Key issues of land use in China and implications for policy making. *Land Use Policy* **2014**, *40*, 6–12. [CrossRef]
7. Long, H.; Zou, J.; Pykett, J.; Li, Y. Analysis of rural transformation development in China since the turn of the new millennium. *Appl. Geogr.* **2011**, *31*, 1094–1105. [CrossRef]
8. Xuemei, B.; Peijun, S.; Yansui, L. Realizing China's urban dream. *Nature* **2014**, *509*, 158–160.
9. He, C.; Okada, N.; Zhang, Q.; Shi, P.; Li, J. Modelling dynamic urban expansion processes incorporating a potential model with cellular automata. *Landsc. Urban Plan.* **2008**, *86*, 79–91. [CrossRef]
10. Tu, S.; Long, H.; Li, T.; Ge, D. The mechanism and models of villages and towns construction and rural development in China. *Econ. Geogr.* **2015**, *35*, 141–147.
11. Liao, G.; He, P.; Gao, X.; Deng, L.; Zhang, H.; Feng, N.; Zhou, W.; Deng, O. The production–living–ecological land classification system and its characteristics in the hilly area of Sichuan province, southwest China based on identification of the main functions. *Sustainability* **2019**, *11*, 1600. [CrossRef]
12. Huang, J.; Lin, H.; Qi, X. A literature review on optimization of spatial development pattern based on ecological-production-living space. *Prog. Geogr* **2017**, *36*, 378–391.
13. Winther, A.M. Community sustainability: A holistic approach to measuring the sustainability of rural communities in Scotland. *Int. J. Sustain. Dev. World Ecol.* **2017**, *24*, 338–351. [CrossRef]
14. Nelson, K.S.; Nguyen, T.D.; Francois, J.R.; Ojha, S. Rural sustainability methods, drivers, and outcomes: A systematic review. *Sustain. Dev.* **2023**, *31*, 1226–1249. [CrossRef]
15. Widomski, M.K.; Musz-Pomorska, A. Sustainable Development of Rural Areas in Poland since 2004 in the Light of Sustainability Indicators. *Land* **2023**, *12*, 508. [CrossRef]
16. Gomez-Limon, J.A.; Arriaza, M. What does society demand from rural areas? Evidence from Southern Spain. *New Medit* **2013**, *12*, 2–12.
17. Liu, Y.; Li, Y. Revitalize the world's countryside. *Nature* **2017**, *548*, 275–277. [CrossRef] [PubMed]
18. Hassanzadehkermanshahi, K.; Shirowzhan, S. Measuring Urban Sustainability over Time at National and Regional Scale for Addressing United Nations Sustainable Development Goal (SDG) 11: Iran and Tehran as Case Studies. *Sustainability* **2022**, *14*, 7402. [CrossRef]
19. Johnson, K.M.; Lichter, D.T. Metropolitan Reclassification and the Urbanization of Rural America. *Demography* **2020**, *57*, 1929–1950. [CrossRef]
20. Daur, N.; Adam, Y.O.; Pretzsch, J. A historical political ecology of forest access and use in Sudan: Implications for sustainable rural livelihoods. *Land Use Policy* **2016**, *58*, 95–101. [CrossRef]
21. Willemen, L.; Hein, L.; van Mensvoort, M.E.; Verburg, P.H. Space for people, plants, and livestock? Quantifying interactions among multiple landscape functions in a Dutch rural region. *Ecol. Indic.* **2010**, *10*, 62–73. [CrossRef]
22. Li, Y.; Chen, C.; Wang, Y.; Liu, Y. Urban-rural transformation and farmland conversion in China: The application of the environmental Kuznets Curve. *J. Rural Stud.* **2014**, *36*, 311–317. [CrossRef]
23. Li, Y.; Li, Y.; Westlund, H.; Liu, Y. Urban–rural transformation in relation to cultivated land conversion in China: Implications for optimizing land use and balanced regional development. *Land Use Policy* **2015**, *47*, 218–224. [CrossRef]
24. Long, H. Land consolidation: An indispensable way of spatial restructuring in rural China. *J. Geogr. Sci.* **2014**, *24*, 211–225. [CrossRef]
25. Liu, Y.; Lu, S.; Chen, Y. Spatio-temporal change of urban–rural equalized development patterns in China and its driving factors. *J. Rural Stud.* **2013**, *32*, 320–330. [CrossRef]
26. Li, Y.; Du, G.; Liu, Y. Transforming the loess plateau of china. *Front. Agric. Sci. Eng.* **2016**, *3*, 181–185. [CrossRef]
27. Miranda, D.; Crecente, R.; Alvarez, M.F. Land consolidation in inland rural Galicia, NW Spain, since 1950: An example of the formulation and use of questions, criteria and indicators for evaluation of rural development policies. *Land Use Policy* **2006**, *23*, 511–520. [CrossRef]
28. Long, H.; Liu, Y.; Li, X.; Chen, Y. Building new countryside in China: A geographical perspective. *Land Use Policy* **2010**, *27*, 457–470. [CrossRef]
29. Li, Y.; Jia, L.; Wu, W.; Yan, J.; Liu, Y. Urbanization for rural sustainability–Rethinking China's urbanization strategy. *J. Clean. Prod.* **2018**, *178*, 580–586. [CrossRef]
30. Li, Y.; Wu, W.; Liu, Y. Land consolidation for rural sustainability in China: Practical reflections and policy implications. *Land Use Policy* **2018**, *74*, 137–141. [CrossRef]
31. Zhang, Y.; Long, H.; Ma, L.; Tu, S.; Chen, K. Research progress of urban-rural relations and its implications for rural revitalization. *Geogr. Res* **2019**, *38*, 578–594.
32. Wang, P.; Qi, M.; Liang, Y.; Ling, X.; Song, Y. Examining the relationship between environmentally friendly land use and rural revitalization using a coupling analysis: A case study of Hainan province, China. *Sustainability* **2019**, *11*, 6266. [CrossRef]
33. Ma, W.; Jiang, G.; Li, W.; Zhou, T.; Zhang, R. Multifunctionality assessment of the land use system in rural residential areas: Confronting land use supply with rural sustainability demand. *J. Environ. Manag.* **2019**, *231*, 73–85. [CrossRef] [PubMed]
34. Li, H.; Yuan, Y.; Zhang, X.; Li, Z.; Wang, Y.; Hu, X. Evolution and transformation mechanism of the spatial structure of rural settlements from the perspective of long-term economic and social change: A case study of the Sunan region, China. *J. Rural Stud.* **2022**, *93*, 234–243. [CrossRef]

35. Yang, Y.; Bao, W.; Liu, Y. Coupling coordination analysis of rural production-living-ecological space in the Beijing-Tianjin-Hebei region. *Ecol. Indic.* **2020**, *117*, 106512. [CrossRef]
36. Statuto, D.; Picuno, P. Valorisation of vernacular farm buildings for the sustainable development of rural tourism in mountain areas of the Adriatic-Ionian macro-region. *J. Agric. Eng.* **2017**, *48*, 21–26. [CrossRef]
37. Rousseau, D.M. *The Oxford Handbook of Evidence-Based Management*; Oxford University Press: Oxford, UK, 2012.
38. Crane, D. *Invisible Colleges: Diffusion of Knowledge in Scientific Communities*; The University of Chicago Press: Chicago, IL, USA, 1972.
39. Garfield, E. From the science of science to Scientometrics visualizing the history of science with HistCite software. *J. Informetr.* **2009**, *3*, 173–179. [CrossRef]
40. Zhuang, J.; Nie, Q.; Man, W.; You, C. Visualization Applications of the Bibliometric Software SATI and Histcite. In Proceedings of the 2022 2nd International Conference on Business Administration and Data Science (BADS 2022), Xinjiang, China, 28–30 October 2022.
41. Wang, W.; Lu, C. Visualization analysis of big data research based on Citespace. *Soft Comput.* **2020**, *24*, 8173–8186. [CrossRef]
42. Aria, M.; Cuccurullo, C. bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Informetr.* **2017**, *11*, 959–975. [CrossRef]
43. Gagolewski, M. Bibliometric impact assessment with R and the CITAN package. *J. Informetr.* **2011**, *5*, 678–692. [CrossRef]
44. Xie, H.; Zhang, Y.; Wu, Z.; Lv, T. A bibliometric analysis on land degradation: Current status, development, and future directions. *Land* **2020**, *9*, 28. [CrossRef]
45. Li, J.; Song, W. Food security review based on bibliometrics from 1991 to 2021. *Foods* **2022**, *11*, 3915. [CrossRef]
46. Liang, Y.; Song, W. Ecological and Environmental Effects of Land Use and Cover Changes on the Qinghai-Tibetan Plateau: A Bibliometric Review. *Land* **2022**, *11*, 2163. [CrossRef]
47. Liu, B.; Song, W.; Meng, Z.; Liu, X. Review of Land Use Change Detection—A Method Combining Machine Learning and Bibliometric Analysis. *Land* **2023**, *12*, 1050. [CrossRef]
48. Liu, B.; Song, W.; Sun, Q. Status, Trend, and Prospect of Global Farmland Abandonment Research: A Bibliometric Analysis. *Int. J. Environ. Res. Public Health* **2022**, *19*, 16007. [CrossRef]
49. Liu, L.; Zou, G.; Zuo, Q.; Li, S.; Bao, Z.; Jin, T.; Liu, D.; Du, L. It is still too early to promote biodegradable mulch film on a large scale: A bibliometric analysis. *Environ. Technol. Innov.* **2022**, *27*, 102487. [CrossRef]
50. Tripathi, M.; Kumar, S.; Sonker, S.; Babbar, P. Occurrence of author keywords and keywords plus in social sciences and humanities research: A preliminary study. *COLLNET J. Scientometr. Inf. Manag.* **2018**, *12*, 215–232. [CrossRef]
51. Rodríguez-Soler, R.; Uribe-Toril, J.; Valenciano, J.D.P. Worldwide trends in the scientific production on rural depopulation, a bibliometric analysis using bibliometrix R-tool. *Land Use Policy* **2020**, *97*, 104787. [CrossRef]
52. Van Mansvelt, J. An interdisciplinary approach to integrate a range of agro-landscape values as proposed by representatives of various disciplines. *Agric. Ecosyst. Environ.* **1997**, *63*, 233–250. [CrossRef]
53. Seto, K.C.; Reenberg, A.; Boone, C.G.; Fragkias, M.; Haase, D.; Langanke, T.; Marcotullio, P.; Munroe, D.K.; Olah, B.; Simon, D. Urban land teleconnections and sustainability. *Proc. Natl. Acad. Sci. USA* **2012**, *109*, 7687–7692. [CrossRef]
54. Scherr, S.J.; McNeely, J.A. Biodiversity conservation and agricultural sustainability: Towards a new paradigm of 'ecoagriculture'landscapes. *Philos. Trans. R. Soc. B Biol. Sci.* **2008**, *363*, 477–494. [CrossRef]
55. Xie, H.; Wang, P.; Yao, G. Exploring the dynamic mechanisms of farmland abandonment based on a spatially explicit economic model for environmental sustainability: A case study in Jiangxi Province, China. *Sustainability* **2014**, *6*, 1260–1282. [CrossRef]
56. Zou, L.; Liu, Y.; Wang, J.; Yang, Y. An analysis of land use conflict potentials based on ecological-production-living function in the southeast coastal area of China. *Ecol. Indic.* **2021**, *122*, 107297. [CrossRef]
57. Long, H.; Liu, Y.; Hou, X.; Li, T.; Li, Y. Effects of land use transitions due to rapid urbanization on ecosystem services: Implications for urban planning in the new developing area of China. *Habitat Int.* **2014**, *44*, 536–544. [CrossRef]
58. Meyfroidt, P.; Chowdhury, R.R.; de Bremond, A.; Ellis, E.C.; Erb, K.-H.; Filatova, T.; Garrett, R.; Grove, J.M.; Heinimann, A.; Kuemmerle, T. Middle-range theories of land system change. *Glob. Environ. Chang.* **2018**, *53*, 52–67. [CrossRef]
59. Fischer, J.; Hartel, T.; Kuemmerle, T. Conservation policy in traditional farming landscapes. *Conserv. Lett.* **2012**, *5*, 167–175. [CrossRef]
60. Holmes, J. Impulses towards a multifunctional transition in rural Australia: Gaps in the research agenda. *J. Rural Stud.* **2006**, *22*, 142–160. [CrossRef]
61. Xu, Z.; Bennett, M.T.; Tao, R.; Xu, J. China's Sloping Land Conversion Program four years on: Current situation and pending issues. *Int. For. Rev.* **2004**, *6*, 317–326. [CrossRef]
62. Renting, H.; Rossing, W.A.; Groot, J.C.; Van der Ploeg, J.D.; Laurent, C.; Perraud, D.; Stobbelaar, D.J.; Van Ittersum, M.K. Exploring multifunctional agriculture. A review of conceptual approaches and prospects for an integrative transitional framework. *J. Environ. Manag.* **2009**, *90*, S112–S123. [CrossRef]
63. Su, S.; Jiang, Z.; Zhang, Q.; Zhang, Y. Transformation of agricultural landscapes under rapid urbanization: A threat to sustainability in Hang-Jia-Hu region, China. *Appl. Geogr.* **2011**, *31*, 439–449. [CrossRef]
64. Bryan, B.A.; Gao, L.; Ye, Y.; Sun, X.; Connor, J.D.; Crossman, N.D.; Stafford-Smith, M.; Wu, J.; He, C.; Yu, D. China's response to a national land-system sustainability emergency. *Nature* **2018**, *559*, 193–204. [CrossRef]

65. Creutzig, F.; Ravindranath, N.H.; Berndes, G.; Bolwig, S.; Bright, R.; Cherubini, F.; Chum, H.; Corbera, E.; Delucchi, M.; Faaij, A. Bioenergy and climate change mitigation: An assessment. *GCB Bioenergy* **2015**, *7*, 916–944. [CrossRef]
66. Nobre, C.A.; Sampaio, G.; Borma, L.S.; Castilla-Rubio, J.C.; Silva, J.S.; Cardoso, M. Land-use and climate change risks in the Amazon and the need of a novel sustainable development paradigm. *Proc. Natl. Acad. Sci. USA* **2016**, *113*, 10759–10768. [CrossRef] [PubMed]
67. Van Ittersum, M.K.; Ewert, F.; Heckelei, T.; Wery, J.; Olsson, J.A.; Andersen, E.; Bezlepkina, I.; Brouwer, F.; Donatelli, M.; Flichman, G. Integrated assessment of agricultural systems–A component-based framework for the European Union (SEAMLESS). *Agric. Syst.* **2008**, *96*, 150–165. [CrossRef]
68. Foster, S.; Chilton, P. Groundwater: The processes and global significance of aquifer degradation. *Philos. Trans. R. Soc. Lond. Ser. B Biol. Sci.* **2003**, *358*, 1957–1972. [CrossRef]
69. Pretty, J.; Sutherland, W.J.; Ashby, J.; Auburn, J.; Baulcombe, D.; Bell, M.; Bentley, J.; Bickersteth, S.; Brown, K.; Burke, J. The top 100 questions of importance to the future of global agriculture. *Int. J. Agric. Sustain.* **2010**, *8*, 219–236. [CrossRef]
70. Kroll, F.; Müller, F.; Haase, D.; Fohrer, N. Rural–urban gradient analysis of ecosystem services supply and demand dynamics. *Land Use Policy* **2012**, *29*, 521–535. [CrossRef]
71. Orsini, F.; Kahane, R.; Nono-Womdim, R.; Gianquinto, G. Urban agriculture in the developing world: A review. *Agron. Sustain. Dev.* **2013**, *33*, 695–720. [CrossRef]
72. Hall, D.M.; Camilo, G.R.; Tonietto, R.K.; Ollerton, J.; Ahrné, K.; Arduser, M.; Ascher, J.S.; Baldock, K.C.; Fowler, R.; Frankie, G. The city as a refuge for insect pollinators. *Conserv. Biol.* **2017**, *31*, 24–29. [CrossRef]
73. Bunker, R.; Houston, P. Prospects for the rural-urban fringe in Australia: Observations from a brief history of the landscapes around Sydney and Adelaide. *Aust. Geogr. Stud.* **2003**, *41*, 303–323. [CrossRef]
74. Grosjean, P.; Kontoleon, A. How sustainable are sustainable development programs? The case of the Sloping Land Conversion Program in China. *World Dev.* **2009**, *37*, 268–285. [CrossRef]
75. Liu, Y.; Wang, J.; Long, H. Analysis of arable land loss and its impact on rural sustainability in Southern Jiangsu Province of China. *J. Environ. Manag.* **2010**, *91*, 646–653. [CrossRef] [PubMed]
76. Pašakarnis, G.; Maliene, V. Towards sustainable rural development in Central and Eastern Europe: Applying land consolidation. *Land Use Policy* **2010**, *27*, 545–549. [CrossRef]
77. Sorice, M.G.; Kreuter, U.P.; Wilcox, B.P.; Fox, W.E., III. Classifying land-ownership motivations in central, Texas, USA: A first step in understanding drivers of large-scale land cover change. *J. Arid Environ.* **2012**, *80*, 56–64. [CrossRef]
78. Coetzer, K.L.; Erasmus, B.F.; Witkowski, E.T.; Reyers, B. The race for space: Tracking land-cover transformation in a socio-ecological landscape, South Africa. *Environ. Manag.* **2013**, *52*, 595–611. [CrossRef] [PubMed]
79. Mateo-Tomás, P.; Olea, P.P. Livestock-driven land use change to model species distributions: Egyptian vulture as a case study. *Ecol. Indic.* **2015**, *57*, 331–340. [CrossRef]
80. Yuan, Y.; Liu, Y.; Hu, Y.n.; Chen, X.; Peng, J. Identification of non-economic influencing factors affecting farmer's participation in the paddy land-to-dry land program in Chicheng County, China. *Sustainability* **2017**, *9*, 366. [CrossRef]
81. Lei, Y.; Yue, Y.; Yin, Y.; Sheng, Z. How adjustments in land use patterns contribute to drought risk adaptation in a changing climate—A case study in China. *Land Use Policy* **2014**, *36*, 577–584. [CrossRef]
82. Thompson, W.J.; Blaser-Hart, W.J.; Joerin, J.; Krütli, P.; Dawoe, E.; Kopainsky, B.; Chavez, E.; Garrett, R.D.; Six, J. Can sustainability certification enhance the climate resilience of smallholder farmers? The case of Ghanaian cocoa. *J. Land Use Sci.* **2022**, *17*, 407–428.
83. Swagemakers, P.; Dominguez Garcia, M.D.; Wiskerke, J.S. Socially-inclusive development and value creation: How a composting project in Galicia (Spain)'hit the rocks'. *Sustainability* **2018**, *10*, 2040. [CrossRef]
84. Ullah, A.; Zeb, A.; Saqib, S.E.; Kächele, H. Landscape co-management and livelihood sustainability: Lessons learned from the billion trees afforestation project in Pakistan. *Land Use Policy* **2022**, *115*, 106034. [CrossRef]
85. Rosyida, I.; Ullah, W.; Helmi, A.; Sasaoka, M. Adapting livelihoods to the impacts of tin mining in Indonesia: Options and constraints. *Extr. Ind. Soc.* **2019**, *6*, 1302–1313. [CrossRef]
86. Winkel, T.; Bommel, P.; Chevarría-Lazo, M.; Cortes, G.; Del Castillo, C.; Gasselin, P.; Léger, F.; Nina-Laura, J.-P.; Rambal, S.; Tichit, M. Panarchy of an indigenous agroecosystem in the globalized market: The quinoa production in the Bolivian Altiplano. *Glob. Environ. Chang.* **2016**, *39*, 195–204. [CrossRef]
87. Pribadi, D.O.; Vollmer, D.; Pauleit, S. Impact of peri-urban agriculture on runoff and soil erosion in the rapidly developing metropolitan area of Jakarta, Indonesia. *Reg. Environ. Chang.* **2018**, *18*, 2129–2143. [CrossRef]
88. Wang, Y.; van Vliet, J.; Debonne, N.; Pu, L.; Verburg, P.H. Settlement changes after peak population: Land system projections for China until 2050. *Landsc. Urban Plan.* **2021**, *209*, 104045. [CrossRef]
89. Zhou, B.-B.; Aggarwal, R.; Wu, J.; Lv, L. Urbanization-associated farmland loss: A macro-micro comparative study in China. *Land Use Policy* **2021**, *101*, 105228. [CrossRef]
90. Mutoko, M.C.; Hein, L.; Bartholomeus, H. Integrated analysis of land use changes and their impacts on agrarian livelihoods in the western highlands of Kenya. *Agric. Syst.* **2014**, *128*, 1–12. [CrossRef]
91. Xu, Y.; Huang, X.; Bao, H.X.; Ju, X.; Zhong, T.; Chen, Z.; Zhou, Y. Rural land rights reform and agro-environmental sustainability: Empirical evidence from China. *Land Use Policy* **2018**, *74*, 73–87. [CrossRef]
92. Chen, K.; Long, H.; Liao, L.; Tu, S.; Li, T. Land use transitions and urban-rural integrated development: Theoretical framework and China's evidence. *Land Use Policy* **2020**, *92*, 104465. [CrossRef]

93. Plieninger, T.; Draux, H.; Fagerholm, N.; Bieling, C.; Bürgi, M.; Kizos, T.; Kuemmerle, T.; Primdahl, J.; Verburg, P.H. The driving forces of landscape change in Europe: A systematic review of the evidence. *Land Use Policy* **2016**, *57*, 204–214. [CrossRef]
94. Tscherning, K.; Helming, K.; Krippner, B.; Sieber, S.; Paloma, S.G.y. Does research applying the DPSIR framework support decision making? *Land Use Policy* **2012**, *29*, 102–110. [CrossRef]
95. Balezentis, T.; Ribasauskiene, E.; Morkunas, M.; Volkov, A.; Streimikiene, D.; Toma, P. Young farmers' support under the Common Agricultural Policy and sustainability of rural regions: Evidence from Lithuania. *Land Use Policy* **2020**, *94*, 104542. [CrossRef]
96. Granvik, M.; Lindberg, G.; Stigzelius, K.-A.; Fahlbeck, E.; Surry, Y. Prospects of multifunctional agriculture as a facilitator of sustainable rural development: Swedish experience of Pillar 2 of the Common Agricultural Policy (CAP). *Nor. Geogr. Tidsskr.-Nor. J. Geogr.* **2012**, *66*, 155–166. [CrossRef]