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MAPPING THE LANDSCAPE OF RECENT RESEARCH ON AGRICULTURAL GEOGRAPHY (2013–2022)

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A rural village in Hualien County, Taiwan.

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ABSTRACT: Agricultural geography has developed for over a century. To review the recent development in this field, 1879 journal articles on agricultural geography published between 2013 and 2022 are analyzed using multi-leveled bibliometric methods and visualized by VOSviewer. Seven research themes are identified: »climate change and food«, »environmental sustainability«, »land and political ecology«, »water resources«, »rural geography«, »economic development«, and »spatial analysis«. Theory and practice are the two research strands, with few authors publishing extensively, indicating a lack of an active long-term research community. Geographical factors significantly influence agricultural geography research, with international collaborations showing regional patterns. China is an emerging player, developing independently from Western peers.

KEYWORDS: bibliographic coupling, citation, co-authorship, co-citation, co-word, landscape of research

Pregled najnovejših raziskav s področja agrarne geografije (2013–2022)

POVZETEK: Agrarna geografija se razvija že več kot stoletje. Da bi pregledala najnovejša dogajanja na tem področju, sta avtorja z večnivojskimi bibliometričnimi metodami analizirala 1879 znanstvenih člankov s področja agrarne geografije, objavljenih med letoma 2013 in 2022, in izsledke vizualizirala v programskem orodju VOSviewer. Določila sta sedem raziskovalnih tem: podnebne spremembe in hrana, okoljska trajnostnost, zemljišča in politična ekologija, vodni viri, geografija podeželja, gospodarski razvoj in prostorska analiza. Teorija in praksa sta glavni smeri raziskav, pri čemer malo avtorjev obsežno objavlja, kar kaže na pomanjkanje aktivne dolgoročne raziskovalne skupnosti. Geografski kazalniki pomembno vplivajo na raziskave na področju agrarne geografije, pri čemer mednarodno sodelovanje kaže regionalne vzorce. Kitajska je nov akter, ki se razvija neodvisno od Zahoda.

KLJUČNE BESEDE: bibliografsko združevanje, citiranost, soavtorstvo, socitiranost, sobesednost, raziskovalna pokrajina

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1 Introduction

Agriculture is one of the prime movers in shaping the trajectory of human civilization. The cultivation of crops and domestication of animals provided a reliable food supply that allowed populations to settle and grow in one place. The surplus production enabled the social specialization and division of labor, furthering the productivity of society and advancing civilization (Fuller and Stevens 2019). However, the conditions that enable and constrain agricultural production vary from place to place, and diverse forms of agriculture have developed and been distributed unevenly across the world. It is in this context that the geography of agriculture emerged (Grigg 1995).

Geographers have always played an important role in agricultural research (Robinson 2018a; Robinson 2018b). Before World War II, agricultural geography was a branch of economic geography under human geography. Agricultural geographers followed the core paradigm of regional geography (Johnston 1997). They collected data and categorized and summarized them according to geographical areas, and they used the concept of »region« as the basis for interpreting and explaining the geographical characteristics of each agricultural region (Liao et al. 2011). General studies have been conducted in the 1920s and 1930s: Jonasson (1925) classified European agricultural regions, Baker (1928) classified North American agricultural regions, Jones (1928) classified South American agricultural regions, and Taylor (1930) classified Australian agricultural regions. Agricultural geographers have also been interested in how natural, economic, social, and cultural factors in different regions affect the structure and distribution of crops (Robinson 2004).

In the 1960s, geography experienced the quantitative revolution. Geographers extensively used mathematical equations to explain and predict spatial phenomena (Kitchin and Tate 2000), e.g., Henshall (1967) used economic modeling to explain agricultural activities and emphasized the importance of economic regulations in controlling agricultural locations. This paradigm shift marked the development of geographic research from regional geography to spatial science (Billinge et al. 1984). Much of the agricultural geography research in the 1970s took quantification as its keynote, with more detailed quantitative analyses of the many phenomena related to agriculture (Coppock 1976a; Coppock 1976b). In addition, agricultural geography was influenced by behavioral geography, which emphasized the relationship between individual decision-making and agricultural space (Liao et al. 2011).

In the 1980s, agricultural geographers shifted their attention from a narrow sense of agricultural production to a broader framework of agricultural economy, and embedded in the complex structure of social, economic, cultural, and political aspects for discussion, which was called »political economy« (Blaikie 1985; Marsden 1988; Marsden et al. 1996). Agricultural geography expanded further in scope and content, and the research was carefully organized to cover the entire production chain of agriculture. From agricultural inputs (such as seeds, fertilizers, and machinery), to the production operations of farms, to downstream food processing, wholesale, retailing, and consumption. This change brought new research challenges and agricultural geography became an interdisciplinary study, encompassing multiple fields of social science (Bowler 1988).

In the 1990s, Morris and Evans (1999; 2004) criticized agricultural geography for focusing too much on objective factors such as production relationships, macroeconomy, and social structures and processes, ignoring the fact that farmers are living individuals; agriculture must be informed by the established culture. Therefore, the extraction of cultural characteristics is one step of research that cannot be omitted. Agricultural geographers theorized how to transform contemporary agriculture and redefine land (Robinson 2004). This shift is known as the »cultural turn in agricultural geography« (Cox 2012).

Since the 2000s, agricultural geography has gradually moved closer to the broader rural geography (Serra et al. 2014; Milbourne 2017). Responding to the challenges to agricultural geography posed by Morris and Evans (1999; 2004), geographers also approach agricultural geography issues from a broader perspective (Pacione 2014). For example: farmer identity (Lobley and Potter 2004), property relations (Ilbery et al. 2010), and civic agriculture (Poulsen 2017). Furthermore, agricultural geographers respond to global issues, such as climate change (Kelley et al. 2015; Ray et al. 2015), biodiversity (Zimmerer et al. 2018), resource depletion (Wardropper et al. 2020), globalization (Robinson 2018c), sustainable food system (McClintock 2013), urban agriculture (Tornaghi 2014), food safety (Schumilas and Scott 2016), food security (O'Connor et al. 2016), etc.

After more than a century of development, agricultural geography has been updated about every ten years, and a huge knowledge system has been established. To summarize and review the latest developments

in agricultural geography research, traditional scholars use qualitative methods to review the existing literature. For example, Marsden (1988) concluded that there are four key issues in agricultural geography: (1) uneven development; (2) geographical and historical specificity; (3) the role of family farms; (4) the role of national policy. Robinson (2018a) argues that agricultural geography has developed its own concepts and concerns over the past few decades, connecting with the broader political economy. The most recent topical concerns are food security, land grabbing, and adaptation to climate change. A similar conclusion was reached by Long et al. (2014), who pointed out that the direction and research focus of agricultural geography is mainly on global issues in the context of globalization, and that the complex impacts of globalization have led to interdisciplinary collaborative research between agricultural and physical geography, rural sociology, and even agricultural economics.

In addition, some authors focused on the development of agricultural geography in individual regions or countries. For example, Liu et al. (2011) pointed out that the recent development of agricultural geography research in China was characterized by five features: (1) close integration with rural geography; (2) rural hollowing and renovation of hollow villages; (3) construction of new rural villages; (4) regional agriculture and rural development; and (5) internationalization of the research findings. Liao et al. (2011) examined the progress of agricultural geography research in Taiwan in the decade 2001–2010. They found that Taiwan's agricultural geography research was different from Western agricultural geography research both in concepts and contents. Taiwanese geographers leaned towards empiricism and were more focused on the issues related to agricultural land use.

Although the above reviews bring readers some insights into the development of agricultural geography research, they are accused of having bias as the selection of literature is mostly based on the subjective judgment of the authors that lacks the scientific standard of replicability (Linnenluecke et al. 2019). Moreover, the number of documents involved is generally relatively small, and a small number of influential authors and works tend to be selected (Byrne 2016).

With this in mind, this study intends to review the research field of agricultural geography by examining relevant literature using multi-level bibliometric analysis, aiming to provide readers with the landscape of recent research on agricultural geography in the last decade. The specific objectives are threefold: (1) to identify the key research themes, topics, and trends in agricultural geography; (2) to map the intellectual structure of the research field; and (3) to provide recommendations for further research.

2 Methods

2.1 Data source and retrieval

Scopus is the largest academic literature database that provides a comprehensive overview of the world's research in the fields of science, technology, medicine, social sciences, arts, and humanities, with smart tools for tracking and analyzing research. The data format is compatible with commonly used visualization softwares, making it a versatile and comprehensive database (Schotten et al. 2017). Baas et al. (2020) considered Scopus the best choice for bibliometric research.

Literature data retrieval for this study was performed on August 23th, 2023. The first query criterion was to search for the English terms »agricultur*« AND »geography« in the »Title, Abstract, and Keywords«. A total of 9043 documents were found. The second criterion was to select journal articles, while other types of literature such as conference papers, reviews, book chapters, and books were excluded, resulting in 7472 journal articles. For the third criterion, only literature from the past 10 years (i.e., 2013 to 2022) was selected, resulting in 2879 papers. Excluding duplicates and irrelevant articles, finally, 1879 articles were obtained for bibliometric analysis.

2.2 Bibliometric methods

The dataset was cleaned and calibrated for bibliometric analysis to address inconsistencies and duplicates in thesaurus terms, such as variations between American and British English usages, singular and plural nouns, full names versus initials of authors, and full titles versus abbreviations of journals. Then the following analyses were conducted to determine various aspects of the research field:

- Temporal and spatial analysis were performed to characterize the publication trends over time and space. Furthermore, international collaboration networks were identified based on co-authorship relationships (Ponomariov and Boardman 2016; Wei et al. 2022).
- Thematic analysis was conducted to identify the themes of the research field based on co-word (also co-occurrence) relationships. Co-word refers to the presence of the same keywords in two documents (Callon et al. 1983). Research themes can be deduced from the clusters, which consist of relevant and related keywords (Chen et al. 2016).
- Textual and authorial analysis were performed to explore the intellectual structure of agricultural geography research. Not only highly cited articles and prolific authors were identified, but also relationships among documents and authors were examined by co-citation analysis. Co-citation refers to the situation where two documents cite another document at the same time (Hausberg and Korreck 2021). Boyack et al. (2013) indicated that co-citation represents similarity between documents or association between authors.
- Source analysis was conducted to identify the important sources of knowledge. Prolific journals were ranked according to the number of articles. Furthermore, bibliographic coupling analysis was performed to investigate the associations among journals. Bibliographic coupling refers to the situation where two documents are cited by the same article, i.e., the reference list includes these two documents (Small and Koenig 1977). Ahlgren and Jarneving (2008) indicated that bibliographic coupling reflects the similarity in the content of the two articles.

2.3 Visualization

Network maps were produced by VOSviewer (version 1.6.18) to visualize the results of co-authorship, co-word, co-citation, and bibliographic coupling relationships. VOSviewer was chosen because of its efficient and convenient data processing and analysis capabilities, excellent and easy-to-read visualization, and user-friendly interface (van Eck and Waltman 2009).

In the network map, dots represent bibliometric items (i.e., keywords, articles, authors, journals, or countries), and their size indicates the number of items. Curved lines represent relationships between items, with the thickness of the line indicating the strength of the relationship. VOSviewer fits the position of the dots on the network map by minimizing the weighted sum of the Euclidean distances between all the dots (Kirby 2023). Items are grouped into clusters based on their degree of similarity and are represented by different colors (van Eck and Waltman 2009).

VOSviewer uses the VOS (Visualization of Similarities) clustering algorithm to partition a network into clusters by optimizing the modularity. The modularity of a partition is given by:

$$Q = \frac{1}{2m}\sum_{i,j}\left[A_{ij} - \frac{K_i K_j}{2m}\right]\delta(c_i, c_j) \quad (1)$$

where A_{ij} is the weight of the edge between nodes i and j; k_i and k_j are the sum of the weights of the edges attached to nodes i and j, respectively; m is the sum of the weights of all edges in the network; $\delta(c_i,c_j)$ is 1 if nodes i and j are in the same cluster, and 0 otherwise.

The clustering procedure involves initializing clusters, iteratively moving nodes to optimize modularity, and aggregating nodes to form higher-level clusters. This process is repeated until the modularity cannot be significantly improved.

To focus on significant associations, a threshold is applied to filter out weak associations. The outputs utilizing various association thresholds for clustering were visually examined and the best clustering result is selected based on three criteria:

- Inter-separation between clusters: Well-separated clusters are believed to reflect the unique and non-overlapping structure of the data (Bertsimas et al. 2021).
- Intra-cohesion within clusters: Dense connections between nodes, which signify significant cohesiveness between data points, indicate high-quality clusters (Bertsimas et al. 2021).
- Interpretability: High-quality clusters should include keywords that lead to meaningful themes or topics (Ohama et al. 2018).

3 Results

3.1 Temporal and spatial analysis of publications

Overall, the number of articles on agricultural geography increased in the past 10 years, but there are two stages of change (Figure 1). From 2013 to 2019, the number of articles remained fairly constant, fluctuating between 148 and 195, with an average of 168. The small fluctuations in the number of articles indicated that agricultural geography drew constant attention from researchers. After 2019, the number of articles on agricultural geography continuously increased from 194 in 2019 to 263 in 2022. Because of COVID's lockdowns, logistical disruptions made it difficult to transport grains from farms to markets, contributing to price fluctuations (Gutierrez et al. 2022). This situation may arouse the interest of researchers in agricultural geography (Nelson 2020).

137 countries published articles on agricultural geography in 2013–2022 (Figure 2). The majority of articles come from either large countries or developed regions where agriculture is well-developed. The three most productive countries the United States (462 articles), China (363 articles), and the United Kingdom (214 articles). Each of the rest countries published fewer than 100 articles.

Co-authorship analysis was performed to identify the international networks of collaboration. Taking the minimum number of eight articles as the threshold for co-authorship analysis, 50 countries were eligible and six clusters were identified (Figure 3). The red cluster consists of 13 countries and is the largest cluster, headed by the United States and the United Kingdom, plus many South American countries.

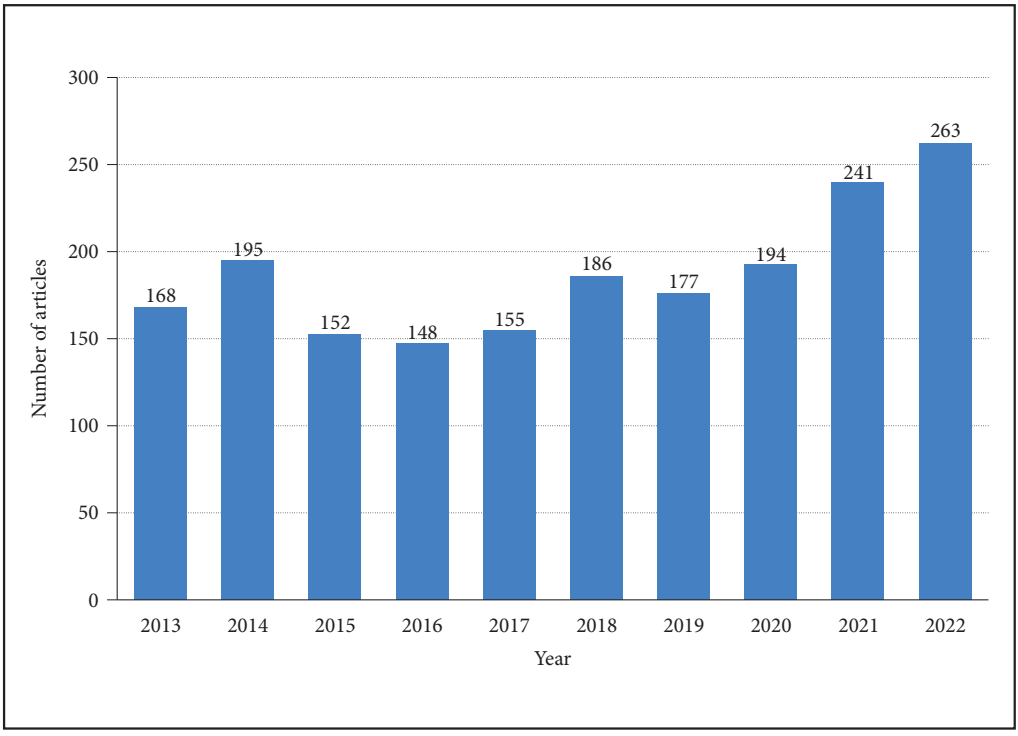
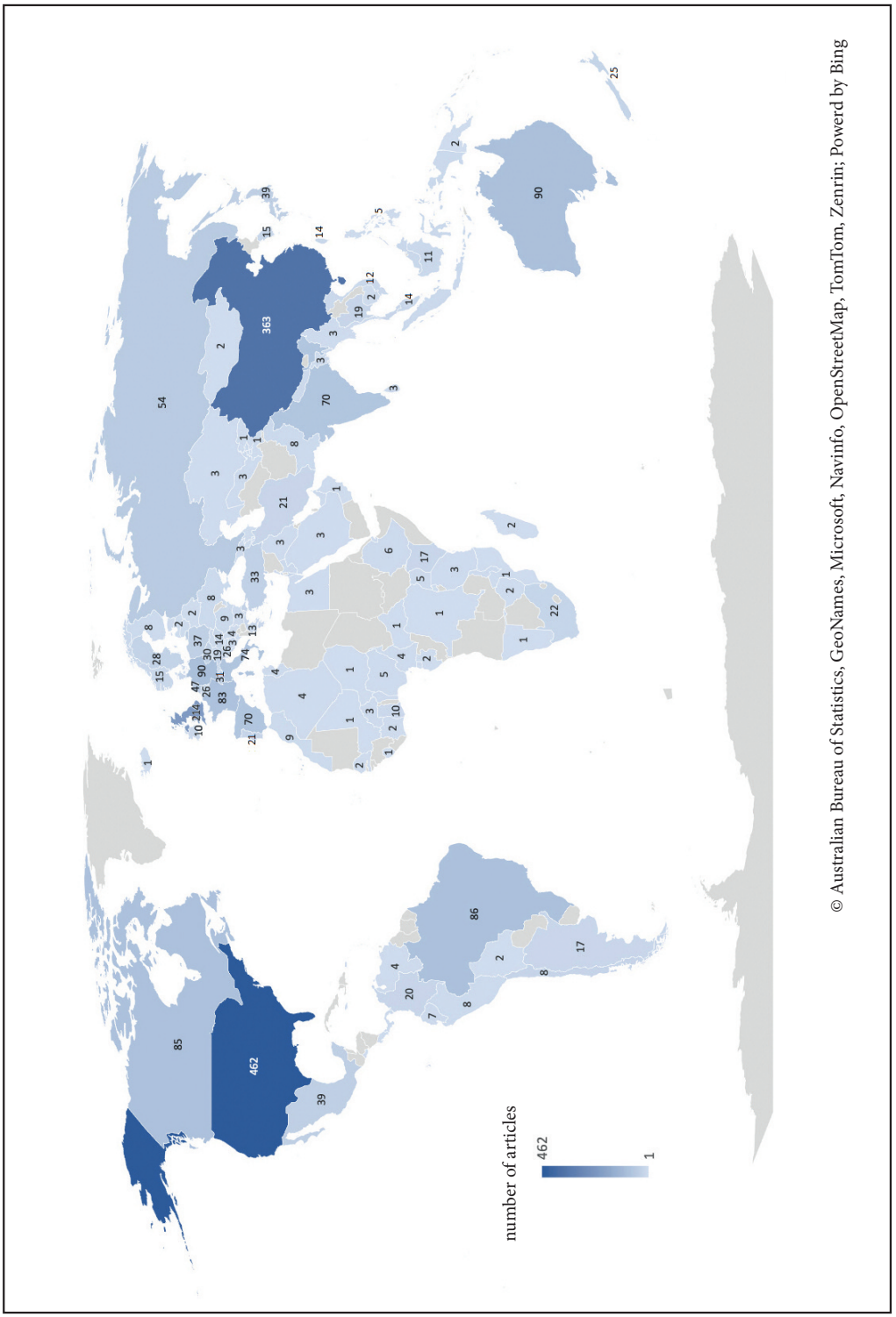


Figure 1: Numbers of articles on agricultural geography (2013–2022).

Figure 2: Global distribution of articles on agricultural geography (2013–2022). ► p. 117
Figure 3: International collaboration of countries on agricultural geography (2013–2022). ► p. 118


number of articles
462
1
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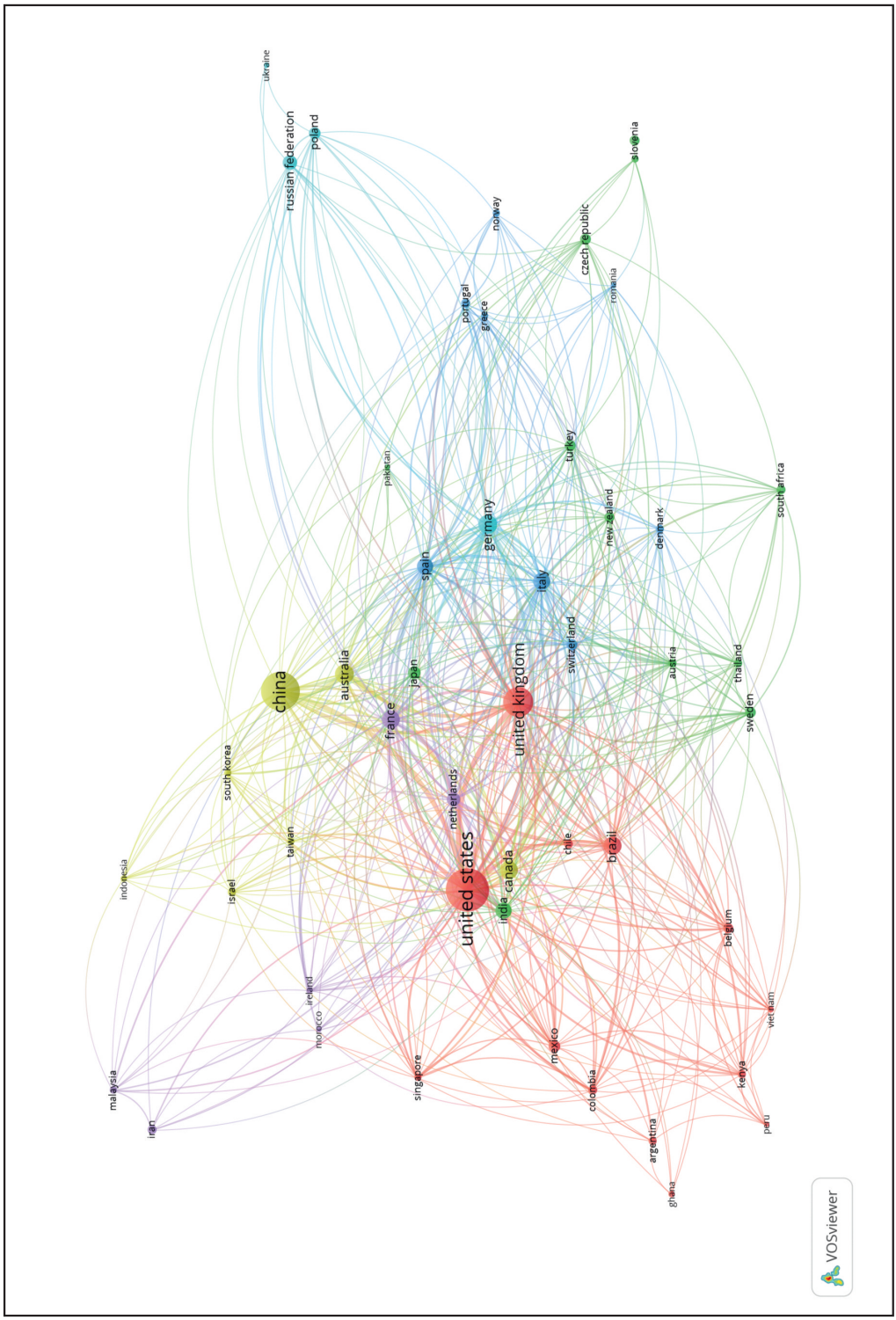
ukraine
russian federation
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slovenia
norway
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greece
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denmark
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switzerland
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australia
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france
united kingdom
sweden
south korea
netherlands
taiwan
chile
brazil
indonesia
united states
india
canada
israel
belgium
ireland
morocco
vietnam
mexico
singapore
colombia
kenya
malaysia
peru
argentina
iran
ghana
VOSviewer

The green cluster, consisting of 12 countries, is led by India and Japan; this cluster also includes many Central European countries. There are eight countries, mainly Western European countries in the blue cluster. The yellow cluster has seven countries; these are mainly Asia-Pacific countries, led by China and Australia. The purple cluster consists of six countries, represented by France and the Netherlands. The cyan cluster consists of four countries, including Germany, Russian Federation, Poland, and Ukraine.

3.2 Keywords and thematic analysis

Among 6476 keywords in the literature on agricultural geography in 2013–2022, 40 keywords have more than 40 occurrences. The number of occurrences represents the popularity of the keyword in a field (Yuan et al. 2022). According to their literal meanings, they are categorized into eight groups (Table 1). Because keywords represent either the key contents of the papers or the interests of the authors (Zhang et al. 2012), Table 1 reflects the breadth of research on agricultural geography.

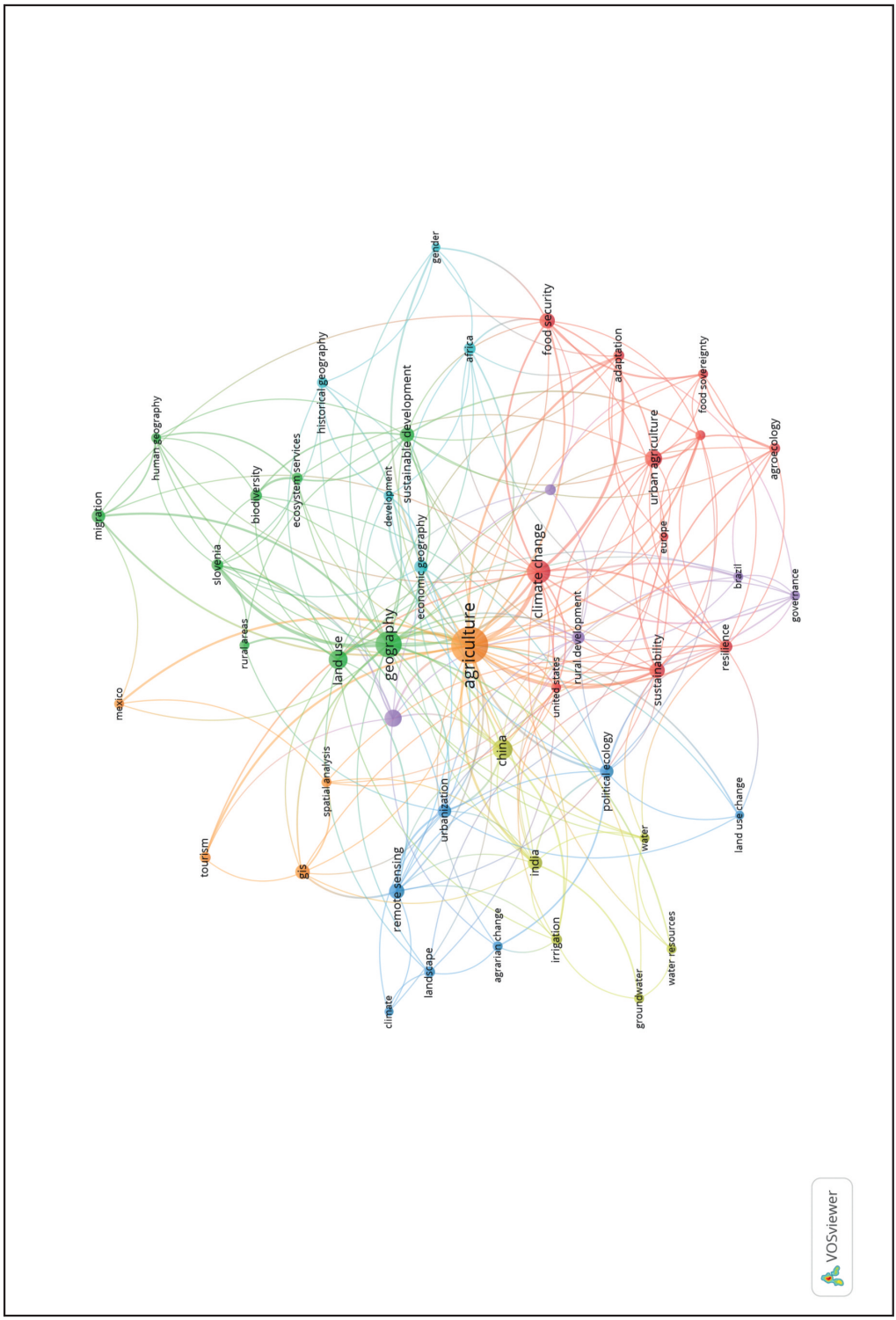
Because the literal meanings do not tell the intellectual associations between them, co-word analysis was performed to determine the relations among 48 keywords that co-occurred not less than 10 times. The results are shown in Figure 4. »Agriculture«, »geography« and »climate change« are the top three largest dots, indicating that they occur most frequently. They are located at the center of the network map, indicating that they play a pivotal role in the intellect network of agricultural geography, and other keywords are related to them to different degrees. The 48 keywords were grouped into seven clusters. Then, the themes of the clusters were identified from the respective keywords. The red cluster consists of 11 keywords. Its theme is »climate change and food«, with Europe and the United States as examples. The theme of the green cluster is »environmental sustainability«. It includes nine keywords, and Slovenia is an example. The blue cluster »land and political ecology« consists of seven keywords. The yellow cluster, consisting of six keywords, has a theme of »water resources«, and India and China are examples. The purple cluster consists of five keywords. Its theme is »rural geography«, with Brazil as an example. The cyan cluster includes five keywords. Its theme is »economic development«, and Africa is an example. Finally, the orange cluster consists of five keywords. Its theme is »spatial analysis«, and Mexico is an example.

Table 1: Grouping of keywords on agricultural geography (2013–2022) based on literal meaning.

Groups (occurrences)	Keywords* (occurrences)
Geography (505)	geography (248), historical geography (156), economic geography (60), economics (41)
Agriculture (664)	agriculture (333), agricultural production (84), agricultural development (62), agricultural history (48), urban agriculture (46), farming system (41), agricultural robots (50)
Food production (288)	food security (48), crops (95), food production (43), crop production (50), cultivation (52)
Rural development (472)	rural area (66), rural development (59), urbanization (56), agricultural land (117), land use (106), land use change (68)
Environment (316)	sustainable development (75), sustainability (68), climate change (130), environmental protection (43)
Biodiversity (368)	Biodiversity (58), animals (135), genetics (82), physiology (52), ecosystem (41)
Spatial analysis (287)	GIS (61), remote sensing (56), spatial distribution (50), spatial analysis (71), spatiotemporal analysis (49)
Country (471)	China (233), United States (140), India (53), Brazil (45)

*Only keywords with more than 40 occurrences are listed.

Figure 4: Co-word clusters of keywords on agricultural geography (2013–2022). ► p. 120


agriculture
geography
climate change
land use
food security
sustainable development
economic geography
development
urban agriculture
agroecology
food sovereignty
adaptation
africa
gender
historical geography
human geography
migration
biodiversity
ecosystem services
slovenia
rural areas
mexico
europe
brazil
governance
resilience
sustainability
rural development
united states
china
india
political ecology
water
land use change
urbanization
spatial analysis
gis
tourism
remote sensing
landscape
climate
agrarian change
irrigation
groundwater
water resources
VOSviewer

3.3 Documents and textual analysis

Among 2879 articles on agricultural geography in 2013–2022, 29 articles have more than 100 citations. The number of citations indicates the document's impact on the body of knowledge (Waltman 2016), although these impacts may not necessarily be limited to the field of agricultural geography. Based on the nature and studied objects, these 29 articles are categorized into six groups (Table 2). The grouping of highly cited articles is similar to the literal grouping of keywords; groups of »biodiversity«, »environment«, »rural development«, »food production«, and »agriculture« can be found in both grouping results.

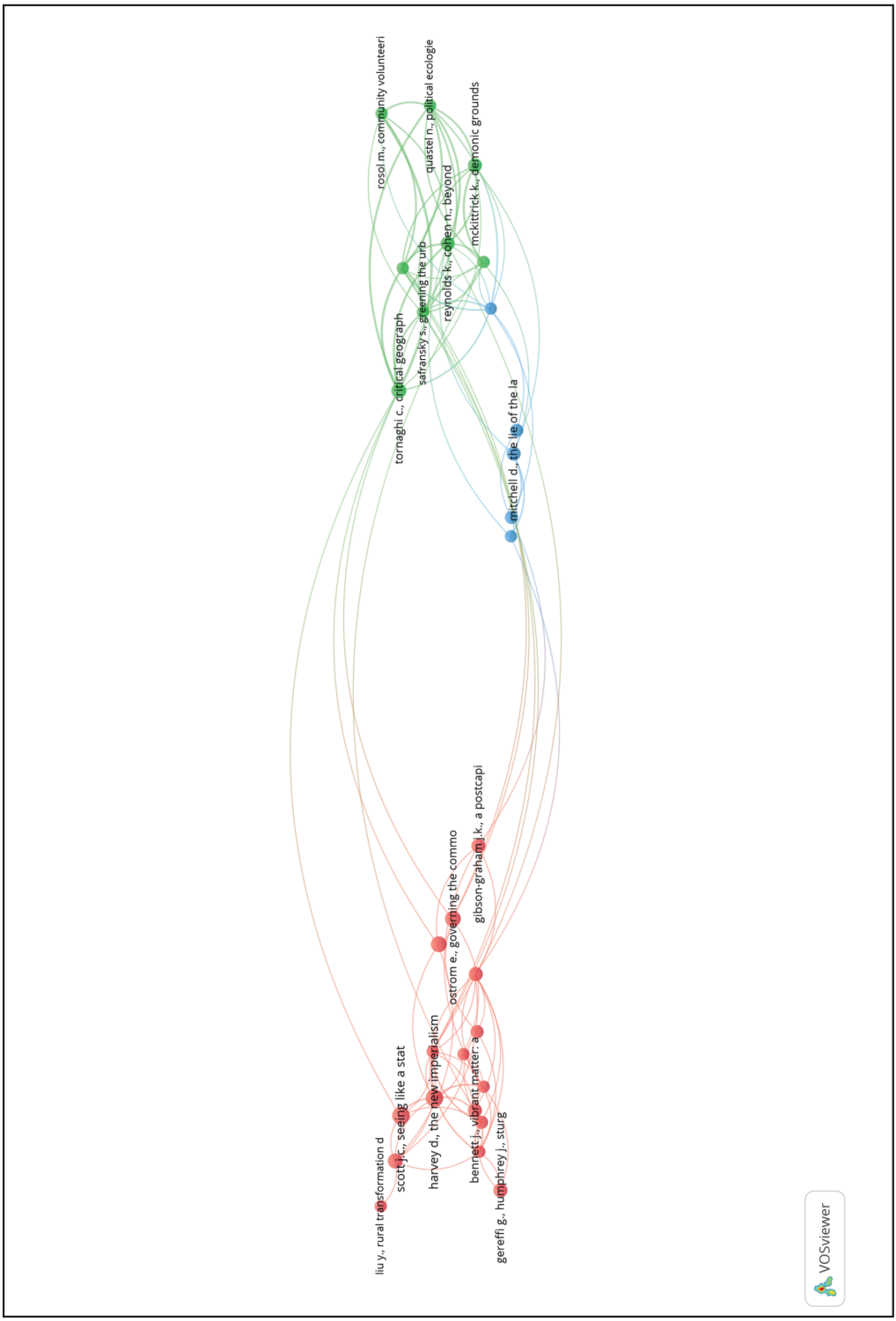
Co-citation analysis was performed to identify the intellectual associations among the articles on agricultural geography. A total of 99,726 references were cited by the 1879 articles. Taking the minimum number of citations of seven times as the threshold for co-citation analysis, 29 papers met the criteria and were categorized into three clusters (Figure 5). The red cluster, consisting of 16 documents, is the largest and is located on the left side of the graph. Documents in this cluster mostly are books on political economy, representative works include Harvey (2003), Scott (1998), Ostrom (1992), and Blaikie and Brookfield (1987). The green cluster consists of eight articles and is located on the right side of the map. The green cluster mostly focuses on global issues related to agriculture, e.g., urban agriculture, represented by McClintock (2013), Safransky (2014), Tornaghi (2014), and Reynolds and Cohen (2016). The blue cluster is an extension of the green cluster with only three papers related to land and farms, e.g., Mitchell (1996) and Guthman (2014).

Table 2: Grouping of highly cited articles (above 100 citations) on agricultural geography (2013–2022).

Groups (citations)	Articles (citations; rank*)
Climate change (2185)	Ray et al. 2015 (1222; 1st), Bassu et al. 2014 (478; 2nd), Chazdon et al. 2016 (372; 3rd), Ma et al. 2015 (113; 27th)
Rural development (1335)	Liu 2018 (317; 5th), Long et al. 2014 (301; 6th), Yang et al. 2016 (198; 13th), Fuchs et al. 2013 (148; 17th), Davis et al. 2017 (142; 19th), Messerli et al. 2014 (116; 26th), Long 2013 (113; 28th)
Food production (783)	Tamang et al. 2020 (223; 11th), Beddow et al. 2015 (182; 14th), O'Hara and Toussaint 2021 (142; 19th), McLain et al. 2013 (135; 21st), Tao et al. 2014 (101; 29th)
Biodiversity (773)	Castañeda-Álvarez et al. 2016 (339; 4th), Rozendaal et al. 2019 (263; 8th), Kwong et al. 2017 (232; 10th), Richman et al. 2015 (200; 12th), Guan et al. 2014 (172; 15th), Maas et al. 2015 (162; 16th)
Environment (674)	Tang et al. 2021 (275; 7th), Song et al. 2014 (144; 18th), Chang and Sheppard 2013 (134; 22nd), Tieskens et al. 2017 (121; 25th)
Agriculture (513)	Tornaghi 2014 (257; 9th), McArthur and McCord 2017 (130; 23rd), Henderson et al. 2018 (126; 24th)

* The ranking represents the order of the articles by number of citations across the groups from 1st to 29th.

Figure 5: Co-citation clusters of documents on agricultural geography (2013–2022). ► p. 122


rosol m., community volunteeri
quastel n., political ecologie
mckittrick k., demonic grounds
reynolds k., cohen n., beyond
safransky s., greening the urb
tornaghi c., critical geograph
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VOSviewer

3.4 Authors and authorial analysis

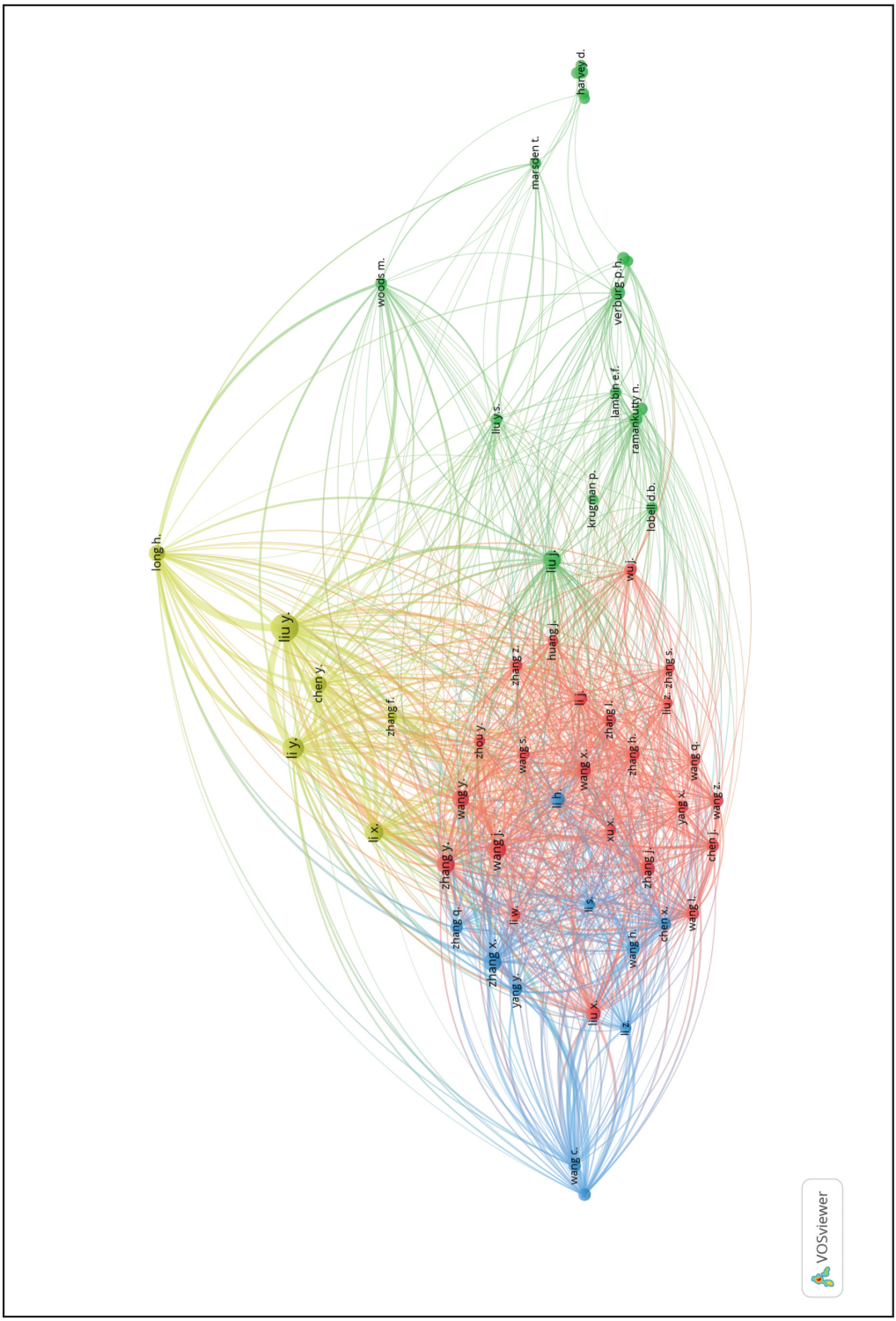
From 2013 to 2022, a total of 1857 authors published articles on agricultural geography. The number of articles contributed to the field was not high, most authors published not more than three articles. Ten authors published at least four articles on agricultural geography (Table 3). Liu Y. and Long H. ranked first and second, respectively. Both published more than 10 articles, standing out from the crowd. Interestingly, the articles on agricultural geography accounted for only a small portion of the total publications of these authors, indicating that agricultural geography is only one of their research interests, perhaps not the major interest as well. Among these ten authors, five work in China, three in Europe, and two in North America.

Taking the minimum number of seven papers as the threshold for co-citation analysis, 56 authors met the criteria and were categorized into four clusters (Figure 6). The red cluster consists of 23 authors, represented by Wang Y., Wang J., and Zhang Y., whose common point is spatial distribution. The blue cluster consists of 10 authors, represented by Wang H. and Zhang H., all of whom were working on environmental or water resources issues. The yellow cluster is small in number, consisting of six authors. It is characterized by a few prolific authors in China (e.g., Liu Y., Long H.). While the clusters red, blue, and yellow are composed of Chinese authors, Western authors are concentrated in the green cluster. There are 17 authors in the green cluster, with some prominent geographers, e.g., Harvey D. and Verburg, P. H., found on the right side. While Harvey D. is famous for critical geography (Harvey 2003), Verburg P. H. makes significant contributions to the study of land use changes (Verburg et al. 2009).

Table 3: Prolific authors who published more than 3 articles on agricultural geography (2013–2022).

Author	Affiliation/country	Number of articles on agricultural geography	Total number of publications	h-index
Liu, Yansui	Chinese Academy of Sciences, China	16	309	82
Long, Hualou	Chinese Academy of Sciences, China	11	139	53
McClintock, Nathan C.	Centre Urbanisation Culture Société, Canada	7	28	17
Li, Yurui	Chinese Academy of Sciences, China	5	114	37
Verburg, Peter H.	Vrije Universiteit Amsterdam, The Netherlands	4	428	106
Fang, Chuangling Lin	Chinese Academy of Sciences, China	4	289	59
Ramirez-Villegas, Julián	Wageningen University & Research, Netherlands	4	89	36
Wang, Jiaoe	Chinese Academy of Sciences, China	4	100	34
Reid-Musson, Emily	St. Francis Xavier University, Canada	4	19	7
Darly, Ségolène	Université Paris 8, France	4	15	6

Figure 6: Co-citation clusters of authors on agricultural geography (2013–2022). ► p. 124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chen j.
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3.5 Journals and source analysis

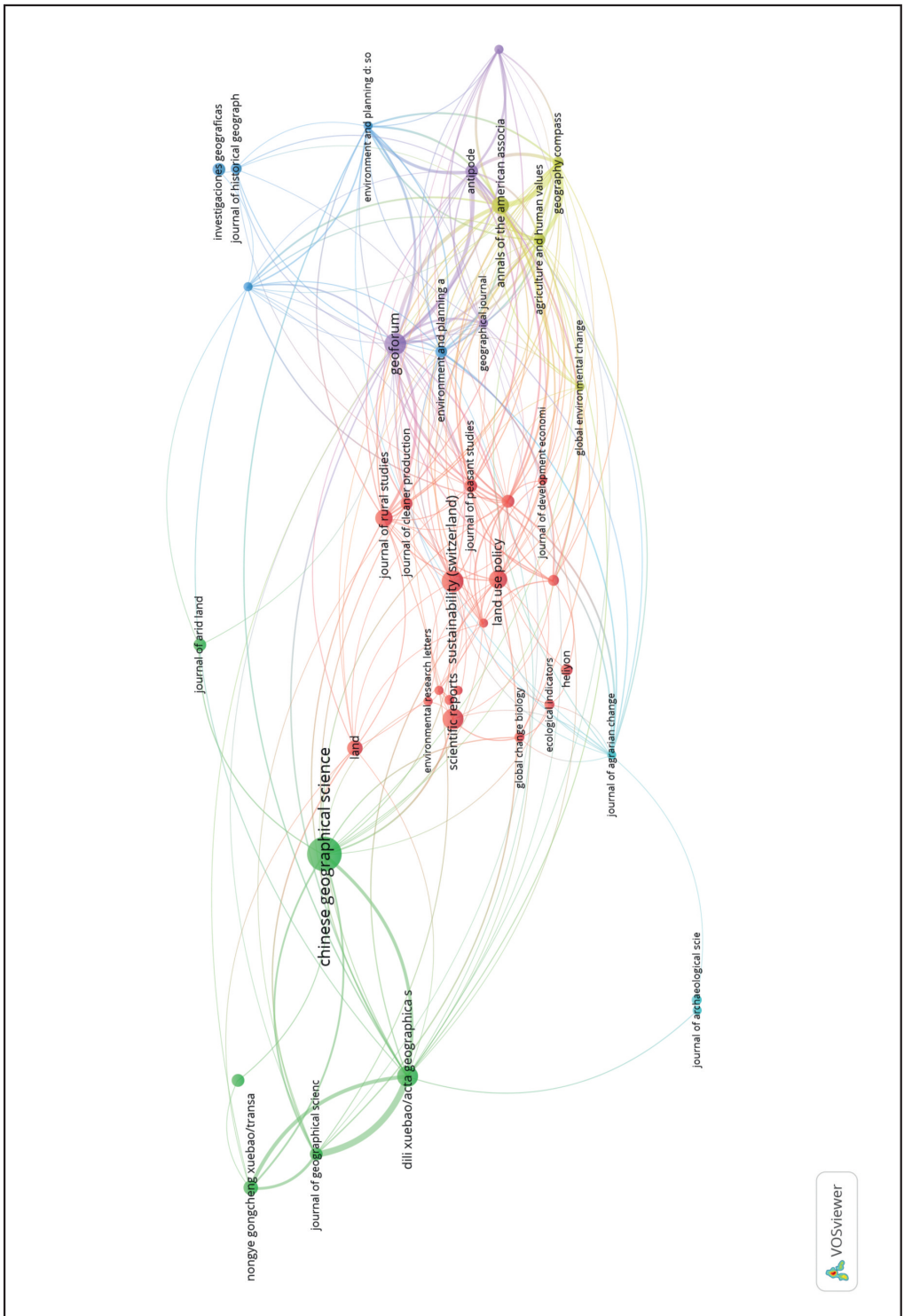
Among 841 journals on agricultural geography in 2013–2022, 21 journals published at least 10 articles on agricultural geography. Based on the aims and scopes, these 21 journals are categorized into six groups (Table 4). Apart from the largest group »geography« which has nine journals, other groups consist of not more than three journals. Interestingly, the most cited articles on agricultural geography (i.e., those listed in Table 2) are not published in these prolific journals.

To examine the intellectual associations among the journals on agricultural geography, bibliographic coupling analysis was performed to analyze 40 journals that published at least seven articles on agricultural geography, and six clusters were identified (Figure 7). The red cluster consists of 18 journals that provide outlets for a wide variety of research topics (e.g., land use, development, rural studies, clean production, etc.) that agricultural geographers can take part. Because of a good mix of journals, the red cluster represents the bulk journals on the agricultural geography. Occupying the center location of the network map, the red cluster extends outwards to form four small clusters (i.e., blue, yellow, purple, and cyan). While these three clusters mainly consist of geographical journals, they may have their own emphasis or perspectives, i.e., the blue cluster focuses on environment, the yellow cluster has a global outlook, the purple cluster encourages dialogues, and the cyan cluster related to certain specific issues related to land, respectively. The green cluster is located on the left side of the network map and is separated from the other clusters. This cluster consists of six journals, all of which are Chinese journals.

Table 4: Grouping of prolific journals with more than 10 articles on agricultural geography (2013–2022).

Groups (articles)	Journals (articles; rank)
Geography (237)	Chinese Geographical Science (86; 1st), Geoforum (35; 2nd), Annals of The American Association of Geographers (21; 7th), Investigaciones Geograficas (13; 11th), World Development (13; 11th), Antipode (13; 11th), Acta Geographica Sinica (31; 5th), Journal of Geographical Sciences (13; 11th), Journal of Arid Land (12; 16th)
Agriculture (25)	Transactions of The Chinese Society of Agricultural Engineering (15; 10th), Agriculture and Human Values (10; 20th)
Land (43)	Land Use Policy (25; 6th), Land (18; 9th)
Environment (34)	Environment and Planning A (11; 18th), Journal of Cleaner Production (10; 20th), Shengtai Xuebao (13; 11th)
Rural studies (33)	Journal of Rural Studies (21; 7th), Journal of Peasant Studies (12; 16th)
Multi-disciplinary (79)	Sustainability (Switzerland) (35; 2nd), Scientific Reports (33; 4th), Heliyon (11; 18th)

Figure 7: Bibliographical coupling clusters of journals on agricultural geography (2013–2022). ► p. 125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journal of cleaner production
journal of peasant studies
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sustainability (switzerland)
land use policy
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4 Discussion

4.1 The geography of agricultural geography

The analysis of publications from 137 countries over the past decade underscores the global interest in agricultural geography. However, the geographical distribution of research efforts is uneven. The »global north« countries, such as the United States and European nations, dominate the field, while the »global south« countries contribute less. This disparity can be attributed to several factors. Developed countries generally have better research infrastructure and more funding available for academic pursuits, including agricultural geography (Mohrman et al. 2008). This enables more extensive and higher-quality research output. Additionally, countries with well-developed agricultural sectors, such as the United States and China, have a vested interest in advancing agricultural research to support their economies (Cantwell and Mathies 2012). Grain-exporting countries require robust agricultural research to maintain and improve their export capabilities, driving more research and publications in agricultural geography (Khosla 2018).

The co-authorship analysis reveals six distinct clusters of international collaboration, which largely align with geographic regions. Generally speaking, countries in the same region share similar climates, livelihoods, and cultures, and may need to work together to face similar agricultural problems, thus leading to research collaboration. In addition, proximity implies low transaction costs for academic exchanges and has a positive effect on academic collaboration (Ng 2022).

4.2 Agricultural geography and legacy of human geography

The evolution of agricultural geography is closely tied to the broader field of human geography. Each significant advancement in human geography has spurred corresponding developments in agricultural geography. Co-word analysis identified seven research themes in agricultural geography in the last 10 years, which are rooted in a certain period in the history of human geography (Figure 8). The themes »climate

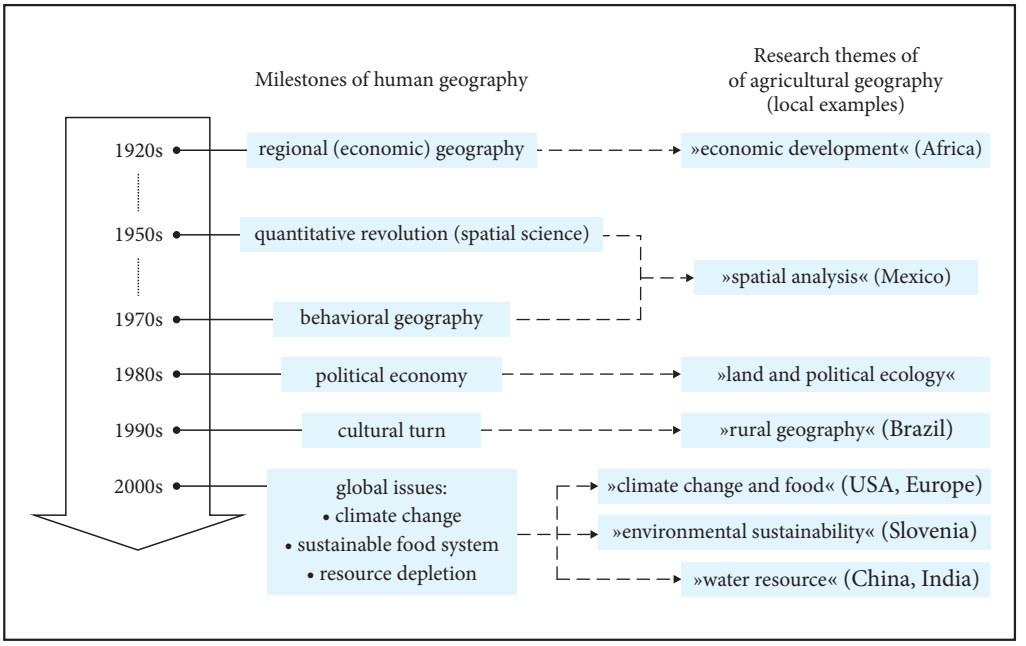

Figure 8: Development of human geography and seven research themes of agricultural geography.

change and food«, »environmental sustainability«, and »water resources« emerge from global issues and are popular topics of interest today. The theme »economic development« originates from regional (economic) geography in the early 20th century. The theme »spatial analysis« originates from the quantitative revolution in the 1960s and behavioral geography in the 1970s. The theme »land and political ecology« has its origins in the political economy in the 1980s, and the theme »rural geography« originates from the cultural turn in the 1990s.

On the other hand, because the natural environment, economy, society, and culture are different across the world, the research focus on agricultural geography may vary in different regions or countries. For example, the United States and the European countries are developed economies, and they are more interested in »climate change and food« (Petersen-Rockney 2022); on the contrary, the economy is generally backward in Africa, hence its agricultural geography focuses on »economic development« (Andrianarimanana and Pu 2021); Slovenia emphasizes the importance of agricultural sustainability (Razpotnik Visković and Komac 2018); China and India have large populations and are large agricultural countries, and »water resource« is an overriding issue (Fang et al. 2020); and »rural geography« is a popular topic in Brazil because of the rapid urbanization of the countryside (Santos et al. 2017).

4.3 Intellectual structure of agricultural geography

The textual analysis of documents reveals two main strands of research within agricultural geography: theoretical and practical. The theoretical strand is heavily influenced by foundational works in human geography, such as Blaikie and Brookfield (1987), Ostrom (1992), Scott (1998), and Harvey (2003). These works provide theoretical and analytical frameworks that are applied to agricultural geography research (Marsden et al. 1996). For instance, Ostrom's (1992) seminal work on common-pool resources has provided a foundation for addressing challenges in land and water management. This approach is increasingly recognized as a potential solution to the dual issues of land abandonment and agricultural intensification (Renes et al. 2023). The growing discourse on commons and collective action in Europe underscores this trend, as evidenced by a recent special issue in Acta geographica Slovenica (Urbanc et al. 2023). The practical strand focuses on empirical issues, addressing real-world challenges in agricultural geography. For example, studies on urban agriculture (McClintock 2013; Tornaghi 2014) and food security (O'Connor 2016) provide practical solutions to pressing global issues. The distinction between these strands highlights the dual nature of agricultural geography as both a theoretical and applied discipline. The integration of theoretical frameworks with empirical research enriches the field and enhances its relevance to contemporary issues.

The authorial analysis indicated that most of the authors published only very few articles on agricultural geography, hence their impact is very limited and piecemeal. The low number of articles per author implies a low level of participation in agricultural geography research, or that there is no active research team carrying out agricultural geography research on a sustained basis.

4.4 Agricultural geography and China

China's prominence in agricultural geography is evident from its high publication output and influential authors. The separation of Chinese research from Western counterparts, as indicated by various bibliometric analyses, can be attributed to several factors. Chinese agricultural geography research often differs from Western approaches in terms of concepts and content (Liao et al. 2011). This divergence reflects the unique socio-economic and cultural context of China (Liu et al. 2011). The predominance of English in academic publishing creates a barrier for Chinese researchers, leading to a more insular research community (Lund et al. 2023).

Chinese researchers primarily collaborate with other Asia-Pacific countries, reflecting regional proximity and shared agricultural challenges. This regional collaboration is partly due to the language issue but also due to the geographical distance between China and other countries that are active in agricultural geography (e.g., the United States and the United Kingdom). Despite these differences, China's contributions to agricultural geography are significant, and its influence is growing. The integration of Chinese perspectives into the global discourse can enrich the field and foster more comprehensive and diverse research.

4.5 Theoretical and practical implications

This study has two theoretical implications. First, this study underscores the importance of contextual factors in the production of geographical knowledge. The uneven distribution of research efforts and the diversity of research focuses highlight the influence of geographical, socio-economic, and cultural contexts on agricultural geography. For example, there has been an increase in both research interest and also publication output on agricultural geography since 2019 due to the pandemic outbreak of COVID-19. The influences of geography on the development of agricultural geography are evident in the uneven distribution of research efforts on agricultural geography globally and the diversity of research focuses in different regions or countries.

Second, this study demonstrates that the research themes of agricultural geography recapitulate the development of human geography. Every advance in human geography can be understood as the development of a new paradigm that subsequently guides the research on agricultural geography, echoing Kuhn's structure of »scientific revolution« that disciplines evolve through paradigms (Livingstone and Withers 2007). This study challenges the traditional view of geography as a unified and objective discipline. As Harvey (2000) indicated, geography is not a monolithic body of knowledge but rather a diverse and evolving field with multiple internal factions and contested perspectives, and this is particularly evident in agricultural geography.

This study also offers a couple of practical insights. First, understanding the development and intellectual structure of the field can help identify gaps and challenges, informing future research agendas. Two critical issues are the lack of a sustainable community of agricultural geographers and the independence of oriental and Western researchers.

Second, exploring the diversity of geographical knowledge can enhance public engagement and geographical literacy. Understanding the research field of agricultural geography can foster a deeper appreciation for the complexities of our world and encourage participation in debates related to agriculture, food, environment, and other geographical issues.

5 Conclusion

Geographers have long participated in the research of agricultural development. Despite the rapid development of agricultural geography in the 21st century, our knowledge about its recent development is very limited. This study analyzes 1879 papers obtained from Scopus to determine the landscape of the recent development in this field. This study identifies 7 research themes: »climate change and food«, »environmental sustainability«, »land and political ecology«, »water resources«, »rural geography«, »economic development«, and »spatial analysis«, and two strands: theory and practice. Geographical factors greatly affect research initiatives and international collaborations among agricultural geographers. The above findings can guide readers to acquaint themselves with the diversity of knowledge in this research field.

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