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Review

How Agroecological Transition Frameworks Are Reshaping Agroecology: A Review

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Abstract: The "agroecological transition" has emerged as a framework that aims to explain the complex changes taking place in agrifood systems. This study offers a mapping of the emergence of this framework, and aims to demonstrate that the agroecological transition can refer to different perspectives beyond the simple combination of two concepts. We carried out a bibliometric analysis of 298 articles (2012–2023), searched using the command "agroecologic* transition*". We used *VOSviewer* software (version 1.6.20), which is able to reveal clusters of co-citations of the most cited authors and articles. This result, in turn, indicates the existence of different perspectives on the use of agroecological transitions. Four clusters were found: (i) "Techniques and Practices", represented by articles that document the agroecological transition as an expression of specific agricultural techniques and practices; (ii) "Transition Theory", which employs the emerging theory and its conceptual contributions; (iii) "Transition Criteria", which involves the use of criteria to monitor the transition; and (iv) "Political and Social", made up of articles that explore the political and social movement dimension of agroecology. Each of these clusters, and their approaches, contribute different interpretations of agroecology itself, indicating the emergence of a new framework capable of attributing new meanings to it.

Keywords: agroecology; transition; agroecological transition; transition theory; bibliometric review

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1. Introduction

Efforts to develop more sustainable agrifood systems have intensified in recent years. Building such systems may require changes in agriculture, as well as in food distribution, processing, and consumption, to make food products more equitable, fairer, and safer, while also promoting rural development and reducing environmental degradation [1–4]. In this context, among many proposals, agroecology appears to be able to address the implications of sustainability of the current agrifood systems [5–9].

Scientific literature acknowledges agroecology as an approach that can combine science, movement (social and political), and practice [10]. It emerged at the beginning of the 1900s from the combination of the principles and methods of the agronomy subject with those of ecology. As a result, it has become a suitable means to understand traditional agricultural systems' ecological tenets [11,12]. However, over time it has developed into a more comprehensive alternative that would include managing entire agrifood systems [13–19].

More recently, it has been observed that the scientific community has been resorting to the concept of agroecology in association with a 'transition' terminology in bibliographical references and publications, adopting the term 'agroecological transition'. 'Transition', from the Latin *transire*, means cross over. Dictionaries describe it as going from one shape, state, style, or place to another [20]. Ergo, it refers to a change, a process that may imply different stages over time. Rotmans et al. (2000) [20], consider transitions to be gradual and continuous processes of change that can affect large parts of society over time over one or more generations. These processes have been looked into by a theory that carries the

same name—Transition Theory—developed by such authors as Rip and Kemp (1998) [21], Smith (2003) [22], Moors, Rip and Wiskerke (2004) [23], and Seyfang [24] (2006). For authors such as Stratton, Wittman, and Blesh (2021) [25], agroecology represents the outcome of a transitional process connecting two stages: an initial stage of conventional agriculture and a final stage of agroecological production. In conventional agriculture, farmers would still employ intensive and specialized methods, relying on selected species heavily dependent on agrochemical inputs [26]. In agroecology, the final stage of this transition, farming would be more sustainable and less reliant on industrialized inputs [25,27].

Meanwhile, scientific literature suggests that the use of the 'agroecological transition' framework may take on several meanings that go well beyond merely combining the concepts of agroecology and transition. For example, it may refer to the notion of path or trajectory linking two stages: the initial stage of conventional, intensive, specialized, and industrial agriculture [25]; and the final stage of agroecological agriculture, more sustainable and less demanding in terms of industrialized inputs [25,27]. On the other hand, it may also refer to the transition that occurs in agriculture regarding both the practices and the agroecological knowledge that emerge from the farmers' own knowledge acquired from managing their farms and the agrarian system [26,28]; or, on a larger scale, it may contemplate the changes in the whole agrifood system [10,29].

The varied contexts surrounding the definition of 'agroecological transitions' suggest differing interpretations rooted in diverse theoretical perspectives and conceptual frameworks. This diversity highlights the need for a systematic review to map the range of underlying theoretical perspectives and related conceptual frameworks for 'agroecological transitions', as well as to analyze how Transition Theory is being applied to shape these frameworks in support of policies that promote agroecological transitions. Therefore, the primary aim of this article is to offer a review, based on bibliometric analysis, of 'agroecological transitions', focusing on how Transition Theory is integrated with the concept of agroecology at multiple levels and across theoretical and policy contexts, and to identify the resulting 'agroecological transition' frameworks.

A bibliometric analysis of a scientific article database on the subject has been conducted using a specific software, the *VOSviewer* (version 1.6.20). This resource allows one to visualize different data related to the publishing universe, like where the studies originate from, the most commonly used keywords, the main publications on the topic, and the authors and articles most referred to. Based on this analysis, it was possible to observe what theoretical and conceptual bases are more often employed and what contents associated with them are more relevant, thus providing information on how the most sought-after publications have evolved.

This article is organized as follows: after the introduction, Section 2 describes the methodology used following a selection of articles and the construction of a database to support the bibliometric analysis (Materials and Methods). Section 3 presents the 'Results and Discussion', taking into consideration the articles selected and the analyses conducted. Finally, Section 4 presents the final remarks based on the interpretation of the relationships between the published materials' theoretical and conceptual references.

2. Materials and Methods

Bibliometric analysis is a tool to systematically review the literature, which includes a set of mathematical and statistical methods that can evaluate bibliometric data. It is widely used to study and examine great volumes of scientific data. As a resource of a quantitative nature, it offers several tools that allow for the identification of the main scientific sources of a given topic [30], such as the most relevant keywords, authors, and publications, as well as the main countries where studies originate from. This way, it is possible to systematize the 'state of the art' of a given topic [31] and trace its evolution over time [32]. The 1.6.20 version of *VOSviewer* software uses the systematization of publications and shows them through several bibliometric maps [33,34].

The first stage consists of defining the databases to locate the materials to be analyzed. For this study, we selected Scopus® and Web of Science™, as these databases support a systematic search for peer-reviewed articles. We then defined the keywords, terminologies, and indexing expressions of interest. We used the term 'agroecologic* transition*' as a search command to identify all the documents published on the subject. This search returned 526 documents—262 from Scopus® and 264 from Web of Science™. After refining the results to include only scientific articles and removing duplicates, 298 documents remained, covering publications from 2012 to 2023.

The 298 publications were subject to a bibliometric analysis highlighting such details as the year of publication, its geographic location, keywords more often used, the main periodicals publishing on the topic, and the authors more frequently cited. Note that, as regards keywords, the criterium used was that of co-occurrence, by which we selected only words that appeared at least five times, while for authors we used the co-citation criterium, selecting those who were referred to 10 or more times. Regarding the magazines, we chose those that registered at least 25 cocitations within the 298 publication universe. The analysis was intended to extract the theoretical and conceptual influences from agroecological transitions in order to identify likely redefinitions of agroecology.

3. Results and Discussion

In this section, for the sake of clarity, we present the results of the aforementioned analyses and discuss them at the same time.

First of all, it is important to remark how topical this subject is in today's scientific communications: the first articles to ever use the expression 'agroecological transition' date back from 2012 [35–37]. Only in 2018 did the issue become relevant upon the publication of 20 documents. The year 2022 registered the highest number of publications on agroecological transition with 74 articles.

3.1. Geographic Dispersion Analysis

Another aspect to consider regards the origin of the most frequently cited publications. Figure 1 highlights the continents and countries where the most representative studies have emerged, showing, therefore, where the references on the subject more often used originate from.

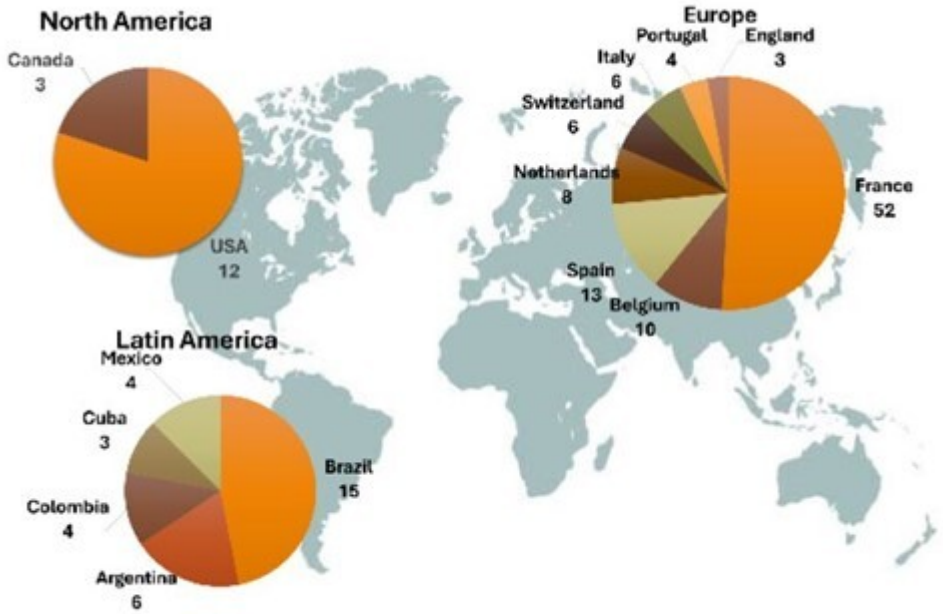

Figure 1. Continents and countries where the most cited studies originate from own findings based on the *VOSviewer* software (Version 1.6.20) results. Source: Authors'.

The subject started in Europe, especially in France, and in American countries, namely Latin American ones, particularly in Brazil, setting the tone for the type of reflections that have shaped the 'agroecological transition' theoretical and conceptual references.

3.2. Keyword Analysis

The keywords more frequently used in the publication universe up to the fifth occurrence are presented in Figure 2.

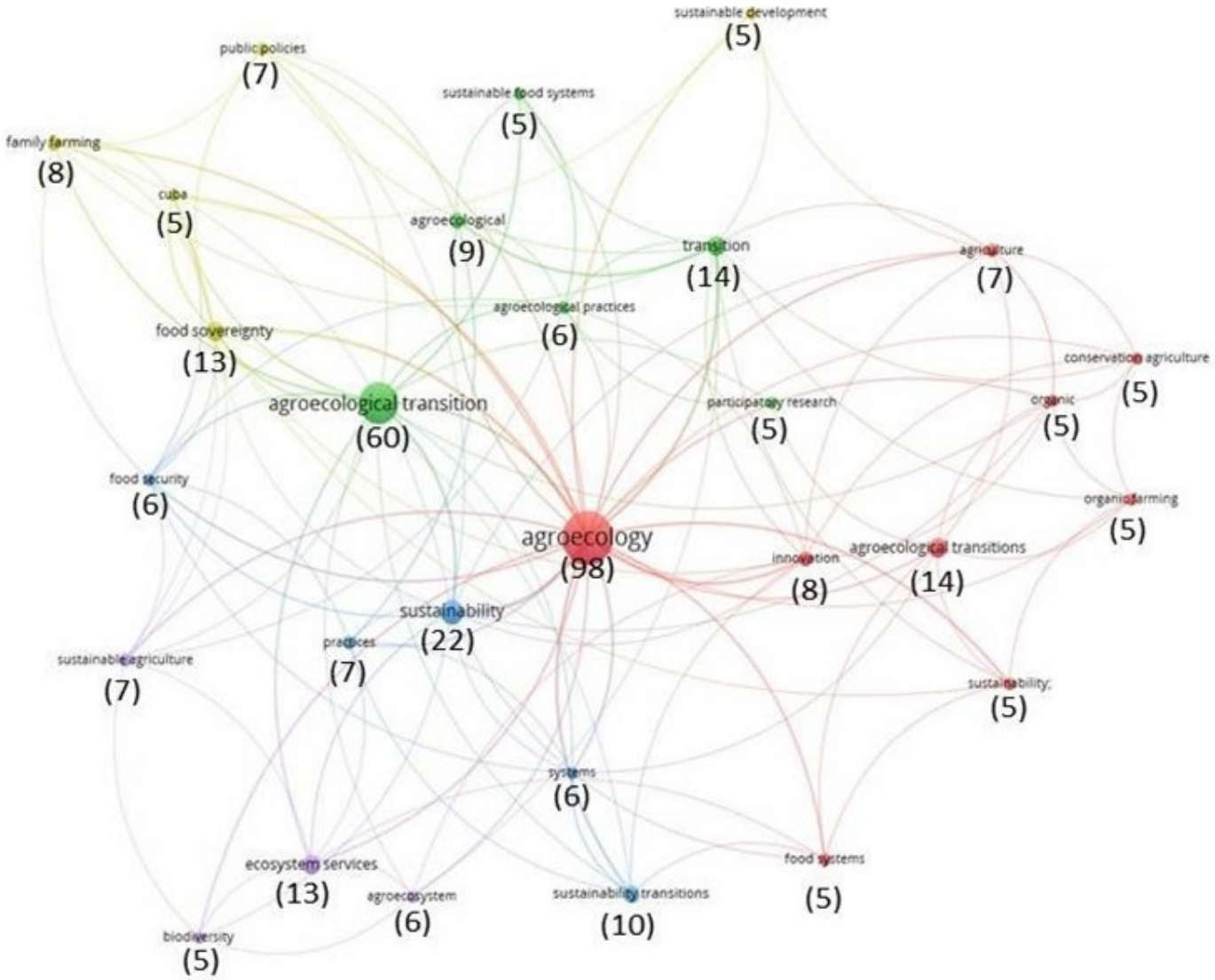

Figure 2. Network of keywords and their respective occurrence numbers. Source: Elaborated by the authors based on *VOSviewer* software (V. 1.6.20).

Figure 2 also reveals the connection between keywords since the articles in which they appear are also interlinked by cocitations. On the other hand, the number of occurrences points to the keywords with which scientific communications have been building the 'agroecological' theoretical and conceptual framework. Keywords from five groups, or clusters, are also linked by the co-occurrence criterium. Each cluster, represented by a color, rests on a set of ideas and concepts related to the 'agroecological transition'. Table 1 signals which contents are considered more relevant to agroecological transitions, departing from the keywords and naming each cluster.

Table 1. Agroecological transition-related content obtained from keywords more frequently employed in each cluster.

Cluster and Its Denomination	Description of the Main Contents Obtained from More Frequently Used Keywords
Agroecology	Agroecology is the main descriptor of the documents (98 appearances). It is related to the innovation topic (8) and organic farming and conservation agriculture (organic farming—5, conservation agriculture—5).
Sustainability	The articles mobilize sustainability (22) together with concepts like practices (7), systems (6), and food safety (6).
Transition	It groups publications that focus on agroecological transition as a main descriptor (60), which, in turn, relates to agroecological practices (6), participative research (5), and the sustainability of the whole food system (5).
Ecosystemic services	It mobilizes concepts pertaining to ecosystemic services (13), the agroecosystem (6), and biodiversity (5).
Food sovereignty	The main descriptor in this cluster is food sovereignty (13). The subject is connected with family farming (8) and public policies (7).

The analysis of the most frequently employed keywords shows that, despite agroecological transition's growing visibility in scientific communication, most publications' conceptual kern is still agroecology, followed by sustainability. In the first assessment, this network seems to mobilize a weak association of keywords, given that it lacks density and variety. On the other hand, there are connections to wider concepts, such as 'innovations', 'sustainable agriculture', 'sustainable food systems', 'sustainable development', and 'organic farming', to mention but a few. Moreover, there are keywords that may oppose each other in a theoretical and practical sense, like 'agroecological practices', 'conservation agricultural', 'practices', 'food sovereignty', 'food security', and 'transitions'. This points to a relationship between agroecology and multiple societal questions, as well as a set of empirical means to promote it, apart from the different theoretical perspectives and related conceptual frameworks underlying the mapped 'agroecological transitions'. It is worth mentioning that this subject of transition has linked agroecology to innovation terminology. It has also repositioned agroecological practices' and family farming's role, allowing for a systemic and scale view of agroecology since it has added a dimensional analysis into agroecological studies by incorporating the whole agrifood system into them. In addition, it is also connected to 'ecosystem services', 'sustainability', 'organic farming', and 'food sovereignty'.

3.3. Analysis of the Journals' Co-Citation Network

The map of the most frequently co-cited publications, which, therefore, has become a reference for this subject, points to some trends in the contents associated with 'agroecological transitions'. Figure 3 lists those publications and shows how they link to each other in a network over the 25th occurrence.

The analysis of the image shows that there are 84 publications on the subject, forming four clusters of associated contents. The red cluster, denser (it groups 37 publications), covers several topics from sustainability, farming, and food systems to development and rural sociology, politics and economy, innovations, socioeconomic transitions, and global change. Due to the wide and multiple nature of the bibliographies connected in this cluster, we decided to designate it as 'Transdisciplinary'. The green cluster has an intermediate density (31 publications) and includes publications that deal with more specific subjects, like biology, agronomic sciences, soil sciences, and plant sciences. We named it 'Agronomic'. With a lower density, the blue cluster is even more specific (15 publications). It gathers literature on ecology, conservation, environmental systems management, and ecosystem

services. For this reason, we called it 'Ecological'. The smallest cluster is the yellow one, represented by a single publication, and is designated as 'Agronomic Innovations'. This cluster and its content are an indication of the general way in which 'agroecological transitions' are addressed, emphasizing transdisciplinary contents rather than more technical ones referring to innovations and management practices as well as specific agroecological systems. At the same time, they highlight the multi-transdisciplinary origin of agroecology itself, on which 'agroecological transitions' still rest, as shown by the keywords (see Figure 2).

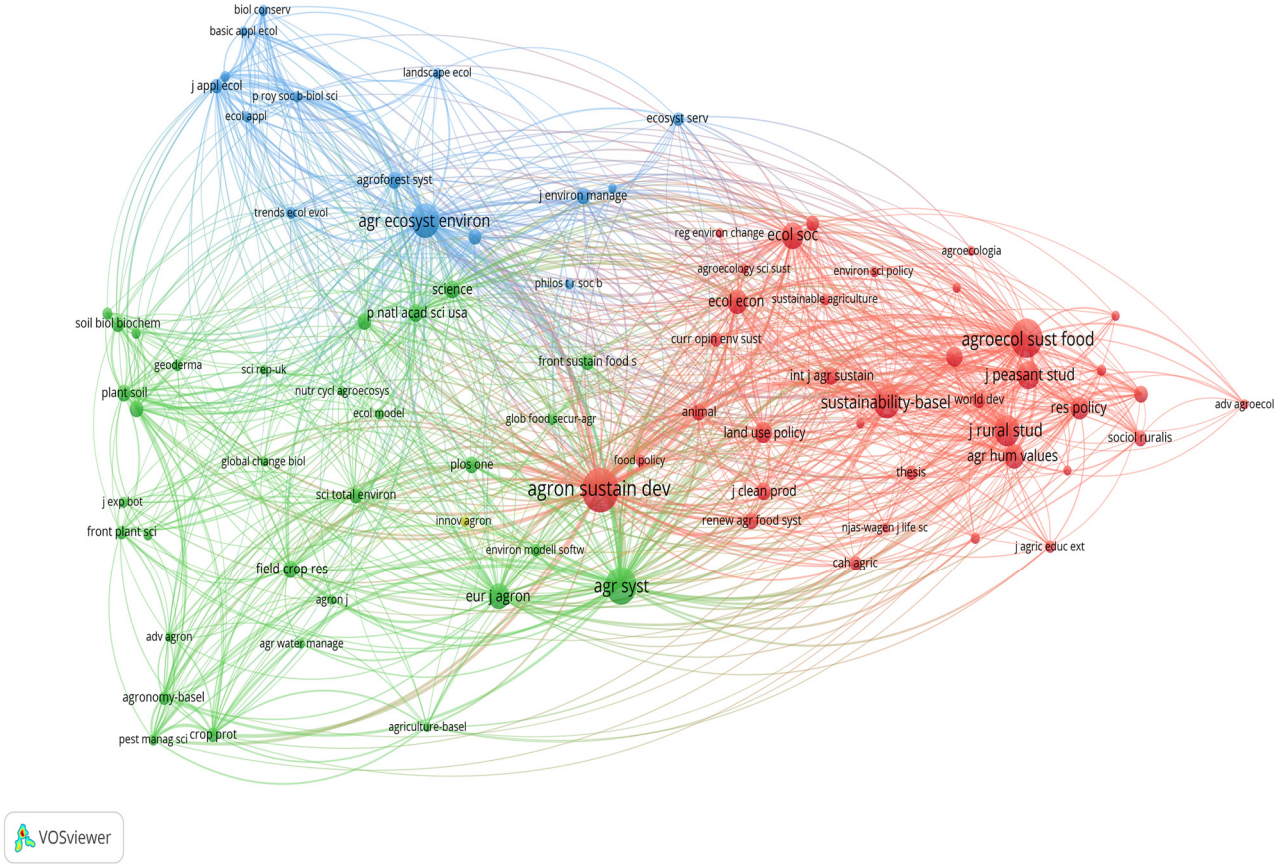

Figure 3. Map of the most frequently co-cited publications in the co-citation network, over the 25th occurrence. Details on the composition of this image may be found in the Supplementary Materials S1—Most co-cited journals equal to or more than the 25th occurrence. Source: Elaborated by the authors based on *VOSviewer* software (V. 1.6.20).

3.4. Analysis of Author Co-Citation Network

Another resource we have exploited was the map of the most cited authors and articles in a co-citation network presented in Figure 4. In this map, it is possible to identify both the authors and their articles that have been most cited within the database universe listed by date of publication up to the tenth occurrence, visualizing how these articles connect to each other in a co-citation network.

Figure 4 represents a network in which the most cited authors within the databases consulted connect themselves. It consists of 56 documents, published between 1995 and 2020, which compose the prevailing theoretical framework of the consulted database (from 2012 up to 2023). Since the authors are mentioned together with their respective dates of publication, it is possible to extract each document that represents the network points. Each set of documents, displayed in clusters of different colors, and their respective positions within the network are supposed to indicate the reinforcement or opposition of the theoreti-

cal and conceptual frameworks used. After the documents have been identified and looked into on the whole, it is possible to evaluate these theoretical and conceptual frameworks.

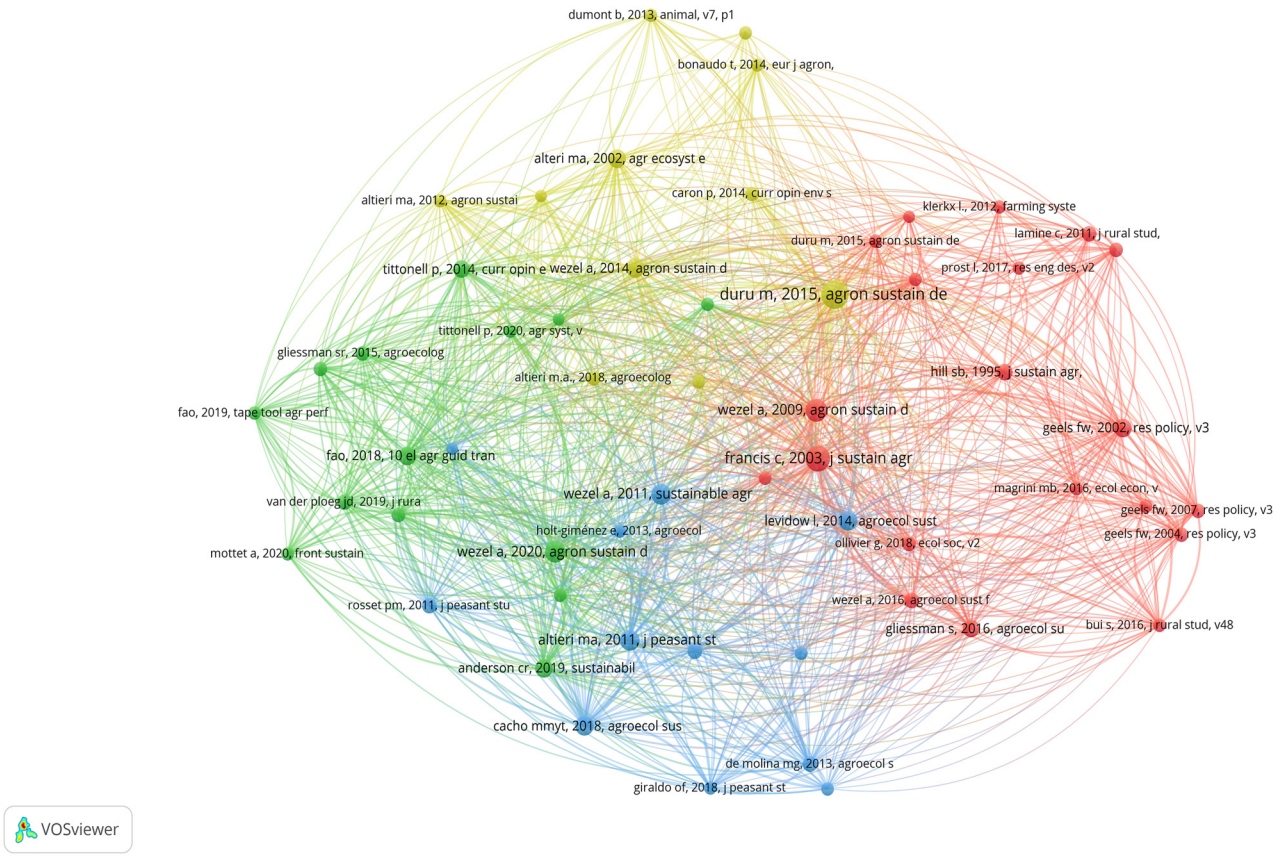

Figure 4. Map of the most cited authors and articles in a co-citation network. Details on the composition of this image may be found in Supplementary Materials S2—Most co-cited authors and articles until the 10th occurrence. Source: Elaborated by the authors based on software *VOSviewer* software (V. 1.6.20).

In other words, the 'map of most cited authors and articles in a co-citation network' allows for two analytical perspectives. The first, temporal, singles out the articles that appeared first and have later fuelled other articles. The second, regarding the content, reveals the connection between publications from the theoretical and conceptual bases that so far have guided the building of the 'agroecological transition'. The displaying of the clusters also expresses the reinforcement and opposition relationship between the works and their respective approaches. In order to better present the discussions, we will first look into each cluster and then comment on the connection and antagonism their content may show.

The publications included in the red cluster, designated as 'Transition Theory', are the precursors of the whole network, apart from being more referred to, with 308 citations. It comprises 19 documents, and the first publication, by Hill and MacRae, dates from 1996 and is entitled 'Conceptual framework for the transition from conventional to sustainable agriculture' [38]. It contains materials that initially focussed primarily on the 'agroecology' concept and its transdisciplinarity. After 2002, the documents that were produced began to draw on Geels' (2002, 2004) [39,40] and Geels and Schot's (2007) [41] works, which brought 'Transition Theory' into the spotlight. Therefore, in more recent publications, the articles developed a connectivity approach between agronomy and innovation sociology. The ties between agroecology and transition theory allowed the scientific production to diversify into an agroecological transition seen as 'the transition of the whole agrifood system', thus uncovering integrated transition systems at various levels.

This connectivity also enabled the combination of agroecology with the analytical tools associated with 'Transition Theory'—the Multi-level Perspective (MLP)—and its levels of associated sociotechnical systems: niches, regimes, and landscapes [39]. Hence, agroecology became embued with the touch of innovation, and it was possible to observe agroecological transition within the dynamics of sociotechnical systems. By relating agroecology to innovation and connecting it with MLP, it was possible to view it in its conception and testing environment (conceptually treated as a sociotechnical niche); in its validation and acceptance space, and in its production and consumption status quo (which corresponds to the sociotechnical regime); and under the influence of the environment from which macroinfluent phenomena emerge that affect innovations at the other two levels (conceptually designed as sociotechnical landscape). In other words, the MLP draws attention to the possibility of addressing agroecology in a more dynamic way since it allows one to capture innovation trajectories in and between analytical levels due to a time variable [42,43].

Additionally, by fostering a more intimate connection between agroecology and the 'regime', this theoretical and conceptual framework also relates the former to other aspects that compose the latter. These aspects are of a very diverse nature, like culture, infrastructures, politics, markets, uses and practices, industrial and corporate networks, technology, and knowledge [39,44]. In so-doing, hindrances and supports to agroecology developmental processes emerged and became visible.

The second cluster is the yellow one, which we refer to as 'Techniques and Practices'. It became known in 2007 after the publication of Zhang, Ricketts, and Kremen's 'Ecosystem services and dis-services to agriculture' [45]. This cluster results from the combination of contents that relate agroecological practices, such as ecological intensification [46], crop-livestock integration [47], temperate agriculture practices [48], or diversified farming systems [49], with indicators that help monitor and assess the performance of such practices. These indicators may undergo several treatments of different magnitudes, like agroecology optimizing principles (biodiversity, pollution decrease, and production factors) [50]; resilience, self-sufficiency, productivity, and efficiency [47]; environmental, social, and economic performance [50]; supply of critical inputs to agriculture (namely fertility, pollination, pest control) [49].

The publications grouped will explore ecosystem services-related issues, agroecological practices, and indicators that allow for the monitoring and assessment of the said practices. This is a cluster that associates publications of empirical studies, which confirms that the techniques and practices at the basis of the agroecology conception were indeed important references to the 'agroecological transition'. It is also the cluster with the least number of citations (190) and documents (11), and its composition and formatting are more dispersed than those of the other clusters. This seems to indicate there is room for further research that leads to the systematization and dissemination of specific agroecological systems management techniques and practices in a transition context.

The third cluster, the blue cluster, was designated as 'Political and Social'. The documents that compose it (12) are cited 202 times. It began to take shape after 2011 thanks to three publications: 'Agroecology as a science, a movement and a practice' (2011) by Wezel, Bellon, and Doré [51]; 'The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants' (2011) by Altieri and Toledo [52]; and 'The Campesino-to-Campesino agroecology movement of ANAP in Cuba: social process methodology in the construction of sustainable peasant agriculture and food sovereignty' (2011) by Rosset, Machín Sosa, and Roque Jaime [53].

It is quite a varied cluster as regards its influences and carries contributions from various approaches, like innovation [52], agroecology [10,53], participatory action [54,55], sociotechnical systems [56], political ecology [57,58], peasant farming and civil society movements, and CAC methodology (Campesino-a-Campesino) [59–62].

It also links publications that acknowledge agroecology as a practice [61], in addition to documenting experiences in countries where it goes beyond 'the ecology of farming

systems'. That is to say, they explore agroecology's important role as the expression of a political and social movement that would even be considered to be part of agroecology itself [58]. They also address the issue of agroecological approach and agroecology expansion scales, assuming that it can be viewed from a mere agricultural plot to the whole agrifood system [56,61]. The question of agroecology's territorial scale is also recognized as a function of ecological policies [57,58]. References take on an ideological character and assign an important social role to agroecology by associating it with poverty mitigation, food safety, and an alternative to agricultural sustainability.

The last cluster to emerge on the timeline is the green cluster, 'Transition Criteria'. With 14 documents, it is the second largest in terms of citations, totaling 209. It began in 2012, after Seufert, Ramankutty, and Foley's 'Comparing the yields of organic and conventional agriculture' was published [63]. It combines materials that explore the development of food systems' 'transition criteria' into more sustainable frameworks (involving such parameters as biodiversity, circular and solidary economy, knowledge co-creation and sharing, responsible governance, access to natural ecosystems, culture, networks, discourse, gender, equity, labor tax justice, characteristics of farming families, production strategies, land use, participation in public policies, extension services, and economic metrics). These criteria usually relate to the sustainable development goals defined by FAO [6,64] in 'The 10 Elements of Agroecology Guiding the Transition to Sustainable Food and Agricultural Systems' and 'TAPE: Tool for Agroecology Performance Evaluation'.

Figure 5 illustrates and sums up the possibilities of analzsing the clusters regarding their spatiality, showing their proximity or opposition to each other and, therefore, the connections and oppositions between 'agroecological transitions' theoretical and conceptual frameworks. It is built on the interpretation of Figure 4.

A more attentive look into the cluster layout also reveals the various analysis possibilities. We first highlight the proximities between the clusters referred to as 'Techniques and Practices' and 'Transition Criteria'. Both include publications dedicated to agroecological practices that also concern themselves with relating those practices to transition indicators and criteria, although the former's are more diversified than the latter's, namely those proposed by FAO. The two clusters, with a more programmatic content, point to the need for quantifying the results of agroecological practices so that they justify transition efforts and provide them with normative and political guidance. Similarly, there is a proximity between the 'Transition Theory' and 'Political and Social' clusters. Although the former assigns an important role to theory in explaining transition processes and the latter is more focused on agroecology's political and social dimension, both are oriented to transition's more qualitative aspects.

As for spatial opposition, note the horizontality between the clusters 'Transition Theory' and 'Transition Criteria'. While the former develops an agroecological perspective through the contribution of innovation sociology and sociotechnical systems, the latter proposes developing evaluations of how much an agrifood system has already 'transitioned' into sustainability. The same occurs with vertical opposition. While the 'Political and Social' cluster's content is marked by a sociopolitical bias, the 'Techniques and Practices' cluster focuses on agroecological empirical aspects, too.

Overall, one can say that the articles in clusters 'Techniques and Practices' and 'Political and Social', respectively, have maintained the publications' agroecological references and supported the relationship between the agroecological transition bibliographies and the practices, the social movements, and agroecological-related policies. The articles are mentioned together 392 times, forming an axis in Figure 5 which we named the 'Agroecology Axis', whose publications kept faithful to agroecological practices and principles.

The clusters 'Transition Theory' and 'Transition Criteria', in turn, illustrate the kind of novelty that transition has incorporated into the subject, either by looking into agroecology from a qualitative perspective, placing it in multi-level sociotechnical systems, or quantifying agroecological techniques and practices by developing evaluation systems to assess agrifood systems' transition into sustainability. In total, the documents that compose

this cluster are mentioned 517 times, showing how the new 'agroecological transition' approaches have been gaining expression in bibliographies. Both clusters form an axis in Figure 5 designated as 'Transition Axis'. Of a more diversified nature, it groups references that express the belief in agroecology's possibilities to transition into agrifood systems, among others.

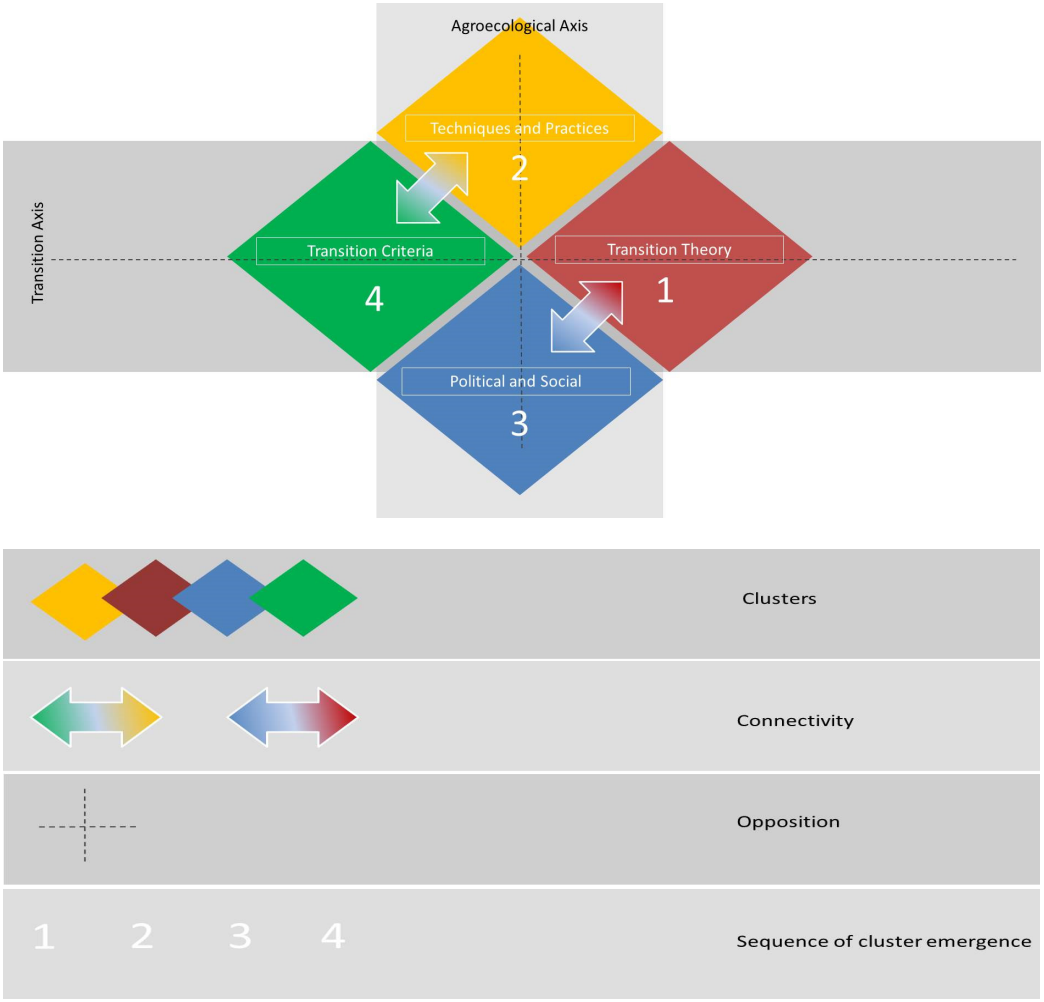

Figure 5. Illustration and synthesis of the connections and oppositions between 'agroecological transitions' frameworks. Source: Elaborated by the authors based on the interpretation of the data in Figure 3.

These results confirm the notion that the agroecological transition is not only transdisciplinary, as it has been observed previously, but is also linked to two different frameworks. The first relates to agroecology and its pure conceptual states as a scientific discipline, an agricultural practice, and social movement, or a combination of these [10]. The second is linked to the development of guidelines and norms to help transition into agroecology, such as the guidelines issued by FAO [5] or the HLPE agroecological principles [65].

According to Gliessman (2024) [66], the first framework depended on the pressure exerted by civil society—citizens, farmers, and scientists—for a transition of agricultural systems into agroecology. On the other hand, despite civil society's strong influence on how agrifood systems are reconfigured, one has to take into account the repercussions of norms and policies. These are correlated to the second possible framework for agroecological transitions.

In the European continent, where in fact, the largest number of references to the subject stem from (see Figure 1), the 'Farm to Fork Strategy' (European Commission, 2020) [67], the main tool of the 'The European Green Deal' (European Commission, 2019) [68], wishes not

only to create a more sustainable food system in the European Union but also to legitimize its transformation globally. Both guidelines aim to consolidate agrifood systems' sustainability by means that are not necessarily agroecological—such as diet changes, reducing food waste and external inputs, valuing ecosystem resources, reducing greenhouse gas emissions, optimizing the use of resources, and cooperative innovations, among other things [69–71].

Whether it is an effective agroecological transition or a sustainable transition of agrifood systems, these two frameworks underlie the formation of scientific reference clusters that we have found, which clearly points to there being different trends regarding the approaches to agroecological transition. One of those trends, more faithful to agroecology, establishes tenets and practices that become the guidelines to agrifood system transitions (thus validating the existence of publications on the subjects pertaining to clusters 'Agronomic' and 'Ecological' as seen in Figure 3). The other, more diversified, admits agroecology as part of a wider process of agrifood and sociotechnical systems transitions (which is corroborated by the 'Transdisciplinary' cluster, simply the largest cluster of publications on this subject according to Figure 3).

4. Conclusions

The term 'agroecological transition' appears in publications across four continents and in approximately 300 peer-reviewed scientific articles, serving as an analytical framework that warrants thorough examination by the scientific community. This article provides a review of the theoretical perspectives and conceptual frameworks that shape various understandings of 'agroecological transitions', with a focus on the integration of elements from Transition Theory and the concept of agroecology, considering its diverse interpretations.

The review reveals that research on 'agroecological transitions' is drawing increasing interest from scientists across multiple disciplines and transdisciplinary approaches and is evolving rapidly, as reflected in recent publication dates. The bibliometric networks associated with this research are dispersed and show limited diversity in terms of associated keywords, study origins, and cited authors.

Although agroecology and its original principles regarding agroecological practices and political and social movements remain relevant and valid, as indicated by the keywords, the addition of 'transition' has opened new avenues for analysis and interpretation. While this multidisciplinary and transdisciplinary foundation still underpins agroecological science and practice in the context of 'agroecological transitions', there are other fields and concepts that research on this topic can explore and emphasize further.

The concept of transition introduces into agroecology the idea of processes, changes, and a transformative pathway grounded in innovations not only in farmers' practices but also in other dimensions. Examples include the interface of these practices with new technologies, the convergence of the agrifood system with other systems, the timescales of transformations interconnected by transitions, or the potential to analyze the trajectories of agroecology adoption and its positioning within the dynamic system of niche, regime, and landscape as proposed by Transition Theory and its operationalization in the Multi-Level Perspective (MLP). This connection enables agroecology to be examined, for instance, through a phased approach to transition trajectories [72]; from an anchoring perspective [43,73]; or as part of an approach focused on inducing and steering desired transitions [40].

The end result is that the transition approach provides a theoretical and conceptual framework that positions agroecology within a complex context of changes in the agri-food system. These changes encompass issues that go far beyond the semantics of the concepts of agroecology and transition. They also include technical, empirical, theoretical, and analytical aspects of how a sustainability-oriented approach to agrifood systems will shape the supply of inputs, in both quantity and quality, for future generations.

Although agroecological science has also explored related political and social aspects, our study shows that agroecology continues to shape the scientific discourse on transitions. The difference is that the transition approach has provided a theoretical and conceptual framework

that allows agroecology to position itself within a complex context of change [26,27,74]. In this sense, the connection with 'Transition Theory' marked a significant milestone in the evolution of publications and studies. Both its conceptual and analytical framework, along with the Multi-Level Perspective (MLP) and its sociotechnical levels, have provided agroecological transition with a multi-level approach that links it to the transition processes of agri-food systems toward other systems [75], within the process of more sustainable structural redefinitions [56,76].

Whether through Transition Theory or the MLP, these frameworks have also positioned agroecology within dynamic contexts, providing it with an evolutionary perspective as the theory incorporates a temporal variable into analyses. With this tool, agroecology can be examined within the context of technical changes and the trajectories that unfold on farms because of these changes.

Obviously, there are still some gaps that need to be addressed through research. In this context, there are certain components of the regime that could benefit from more in-depth analysis. Examples of this include cultural issues related to farmers, consumers, and other stakeholders that may influence agroecological transition processes, as well as new technologies and economic and market aspects, which, although associated with agroecological transitions, were not highlighted in our analyses. The more recently developed criteria for 'agroecological transition' could encourage future research that may lend greater credibility to results in the field of transition economics. These, in turn, could inform more suitable policies for the development and implementation of such processes.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/land13111930/s1, Supplementary Materials S1—Most co-cited journals equal to or more than the 25th occurrence; Supplementary Materials S2—Most co-cited authors and papers until the 10th occurrence.

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