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The progress of research on the nexus between food security and biodiversity conservation: a systematic review

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Introduction: The current global food system places a high burden on biodiversity, while food production depends on ecosystem services. This study demonstrated the recent progress in research on the link between food security and biodiversity conservation through a systematic review. based on the Web of Science database. A search for the keywords “food security, biodiversity, conservation” yields a mere 1,968 results, accounting for a negligible 0.76% of the results for “biodiversity.” This suggests that academic interest in the relationship between food security and biodiversity conservation remains minimal.

Methods: First, a literature search was conducted using the keywords “food security, biodiversity, conservation.” The keyword search was performed using the Web of Science database, covering the 10-year period from 2015 to 2024. Next, the 115 papers identified through the review were subjected to cluster analysis using the statistical software R, classifying them according to the themes and methodologies addressed in each paper.

Results: The first keyword search yields a mere 1,968 results, accounting for a negligible 0.76% of the results for “biodiversity.” This suggests that academic interest in the relationship between food security and biodiversity conservation remains minimal. The results of the cluster analysis classified the 115 papers into five clusters.

Discussion: The findings of this study provide insights into the sustainable transformation of food systems. The recent progress in research on the link between food security and biodiversity conservation demonstrates the advancing integration of biophysical-technical and socio-political approaches. It suggests that we may be getting closer to finding win-win solutions and overcoming the trade-off between biodiversity and food production. On the other hand, despite the growing body of literature directly addressing the nexus between biodiversity and food security, the overall volume of such publications remains limited. Key challenges persist, including the underdevelopment of research on political and economic dimensions, as well as a dearth of studies encompassing the entire food supply chain. The disparities in the number of studies and topics identified in this research serve as indicators of areas where further research is needed. In particular, the promotion of research in the political and economic domains is imperative for the development of a sustainable food system that integrates biodiversity conservation and food security.

KEYWORDS

food security, biodiversity, conservation, sustainable agriculture, food sovereignty, human-wildlife conflict (HWC), cluster analysis

Introduction

Improving food security and conserving biodiversity are pressing global concerns. Traditionally, food security and biodiversity conservation have been recognized and studied separately. However, as it has been pointed out that the food system places a high burden on biodiversity, discussions from the ecology and environmental conservation perspectives have gradually progressed (Brussaard et al., 2010; Fischer et al., 2014). Of the 28,000 endangered species worldwide, 24,000 (86%) are reported to have been identified as threatened only by agriculture (Benton et al., 2021). In recent years, there has been growing awareness that food production is contingent on ecosystem services and that it is imperative to conserve biodiversity in the production system (Food and Agriculture Organization (FAO), 2022).

It is extremely difficult to solve the problems of food security and biodiversity conservation, which have causes and consequences for several different sectors and are interrelated with multiple academic disciplines. Therefore, research on the relationship between the two requires an understanding of a wide range of topics and approaches, as well as the overall context surrounding the issue.

A structured literature review that attempts to sort out this complex situation is “The intersection of food security and biodiversity conservation: a review” (Glamann et al., 2017). The papers targeted in this 2017 review cover a five-year period, from 2010 to 2014. The review revealed that there is a lack of research addressing the nexus between food security and biodiversity conservation in general. Second, there is a gap between biophysical, technological and sociopolitical solutions in terms of the approaches employed. The biophysical-technological approach was broad and universalized, whereas the socio-political approach offered more complex and locally contextualized proposals for action.

In the decade following 2015, however, a period not reviewed by Glamann et al. (2017), the number of relevant papers published increased. The present study, thus, examined the hypothesis that the challenges in research identified by Glamann et al. (2017) had been overcome in the last decade. Specifically, it was to ascertain whether research addressing the nexus between food security and biodiversity conservation had increased, and whether the gap between biophysical, technological, and sociopolitical approaches had been narrowed. A review of research trends exhibited by studies from the previous decade (2015–2024) concerning the relationship between food security and biodiversity conservation is necessary to inform future research in this area. Comparing the prevailing research trends with those previously observed may provide insights into the evolution of research methodologies and the emergence of novel trends in scholarly inquiries. It is necessary to study the implications of the most recent approaches for future research in this field.

Therefore, this study presents an updated literature review of relevant papers published during the decade 2015–2024. This study aimed to (1) identify and characterize the different approaches used to study the link between food security and biodiversity, (2) identify similarities and differences among these approaches, (3) identify differences from the trends observed in previous studies, and (4) provide recommendations to facilitate future research on the link between food security and biodiversity conservation.

Methods

Literature selection

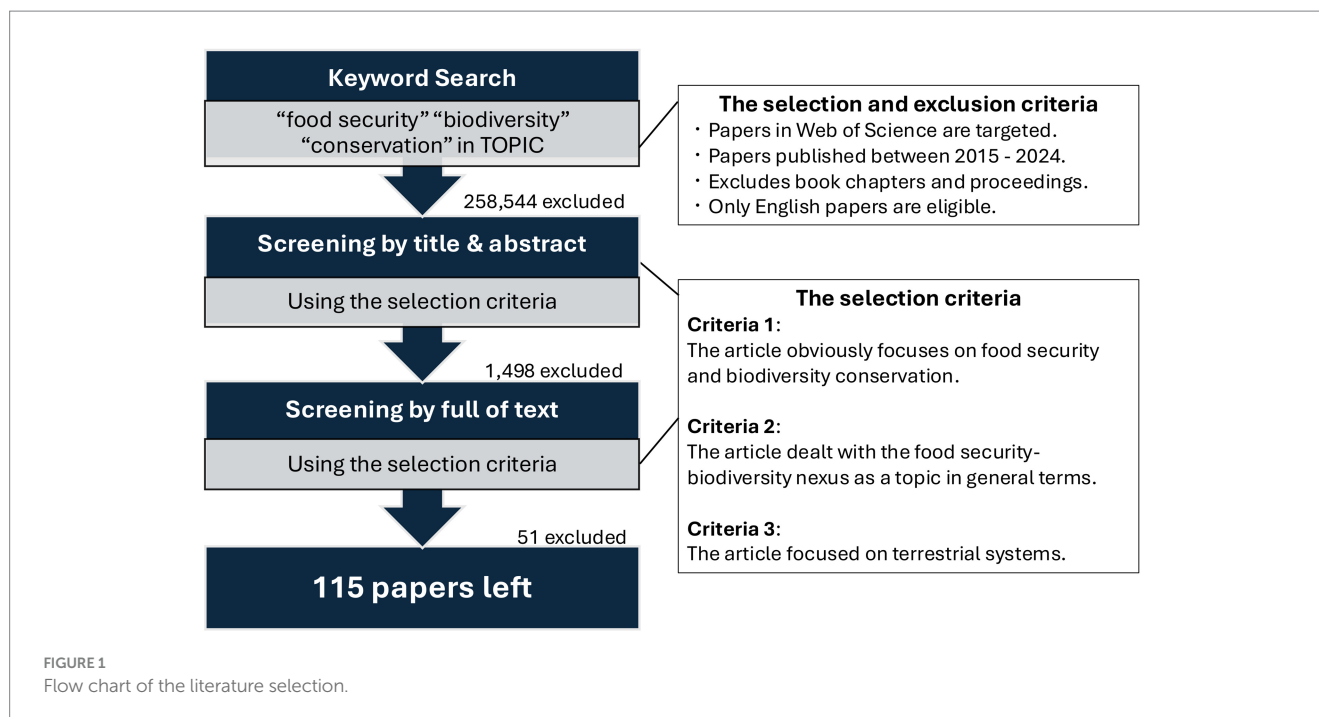
On January 2, 2025, a literature search was conducted in Web of Science using the keywords “food security” and “biodiversity,” and “conservation” in TOPIC. A search of the Web of Science for “biodiversity” yielded 260,248 articles. By adding the words “food security” and “conservation” to this list, the number of articles was reduced to 1,968. Only 0.76% of the literature was found by searching for “biodiversity.” The oldest study on this topic was published in 1994. Next, book chapters and proceedings were excluded, and the search was limited to English journal articles. All articles returned by the search were evaluated for relevance based on their titles and abstracts.

To facilitate a comparison with the results of Glamann et al. (2017), this study used the same literature selection criteria as in the study. The selection criteria are as follows: *Criteria one:* The article obviously focuses on food security and biodiversity conservation. To limit the scope to papers with a clear intersection between the two issues, those focusing on only one of the two issues—food security or biodiversity—were excluded. For example, “Can agricultural intensification help attain sustainable development goals? Evidence from Africa and Asia” (Dawson et al., 2019) focuses on how agricultural intensification affects the SDGs goal of ending hunger and malnutrition, and its relationship with biodiversity is not central to the argument. *Criteria two:* The article dealt with the food security-biodiversity nexus as a topic in general terms. Papers that did not address the nexus between food security and biodiversity as the subject matter of the paper were excluded from the review. For example, “Traditional agricultural practices in India: an approach for environmental sustainability and food security” (Patel et al., 2020) mentions that traditional agricultural methods contribute to the conservation of biodiversity, but the focus of the research is only on the relationship between traditional agricultural methods and the natural environment in general, including climate change. *Criteria three:* The article focused on terrestrial systems. The ecosystem structure of aquatic areas is an important issue, and many studies have been conducted on the conservation of marine biodiversity. However, because the subject matter to be analyzed is too large and the number of issues too numerous, papers dealing with marine, coastal, and aquatic ecosystems and fisheries products were excluded from the list, as in “Rapid change in Yangtze fisheries and its implications for global freshwater ecosystem management” (Zhang et al., 2020).

After reading the full texts using the same criteria, 78 papers were excluded, leaving 115 for analysis. These papers were published in 72 journals. The flow of the literature selection is shown in Figure 1.

Data analysis

The objectives of this study were to (1) identify and characterize the different approaches used to study the link between food security and biodiversity, (2) identify similarities and differences among these approaches, (3) identify differences from the trends observed in previous studies, and (4) provide recommendations to facilitate future research on the link between food security and biodiversity conservation.



Therefore, the articles included in the literature review were evaluated. For ease of comparison, this study adopted the analytical scheme of [Glamann et al. \(2017\)](#) with partial modification. The original scheme consisted of 68 questions to broadly address seven themes that have been repeatedly discussed in the literature regarding the field. This study coded each paper for a total of 69 questions, adding a question on human–wildlife conflicts, which had not been a major issue until a decade ago—but has been much discussed in that review this quarter ([Supplementary Table S1](#)).

Similar to Glamann’s scheme, the questions are organized by the following seven themes: (1) general approach to investigating the food security–biodiversity nexus: economic, ecological, political/institutional; (2) conceptual basis and farming practices, such as sustainable intensification, food sovereignty, land sparing–land sharing; (3) food security: availability, accessibility, acceptability (culturally appropriate food produced in a manner that does not undermine human rights and dignity), adequacy (ecological sustainability and safety of the food produced), and agency (sociopolitical requirements and institutions that enable food security); (4) measurement of biodiversity, such as single species/taxon, genetic diversity, species richness and abundance, apparent or associated biodiversity; (5) social structures, government, and policy; (6) economic aspects and consumption patterns; and (7) other aspects such as cultural ecosystem services and spatial scales.

The selected 115 papers were scored on a scale of 0–2 points for each of the 69 questions. Articles that did not consider a given issue or denied its importance in understanding and managing the link between biodiversity and food security received zero points. Papers that agreed with or considered an issue to some extent received one point, whereas those that agreed with or considered an issue to a great extent received two points. For example, [Fastre et al. \(2021\)](#) assigned a score of two for question 15 “Paper discusses arguments for land sparing,” because the primary focus of this paper pertained to research

on strengthening land conservation and integrated land use. All the 69 questions were given equal weight.

After coding each paper based on these 69 questions, this study used an agglomerative hierarchical clustering analysis was performed to find grouping structures in the analyzed papers. Ward’s clustering method, which minimizes within-group variance, was employed as a grouping method, and Gower’s dissimilarity was used to calculate the similarity between the papers. Ward’s clustering was chosen to produce clear group structures and the readily interpretable results. The dissimilarity matrix was square-transformed to obtain the Euclidean properties. Based on the cluster analysis, a dendrogram was derived to visualize the broad patterns within the perspectives discussed in this paper based on cluster analysis, from which a small set of clusters was identified. Analyses were performed using R version 4.4.3 (See [Appendix 1](#)). For a comprehensive list of all papers utilized in the cluster analysis, please refer to [Appendix 2](#).

The responsibility for the screening and coding was held by both authors, while the implementation of other reliability checks was not a part of the process.

Results

The review focused on articles published between 2015 and 2024 that were identified by searching Web of Science using the keywords “food security,” “biodiversity,” and “conservation” as “TOPIC” keywords. At that time, only papers published in English were included, while book chapters and proceedings were excluded. A total of 1,704 papers were identified. The selection process employed three criteria to narrow down the options: (1) The article’s focal point is evident in its emphasis on food security and biodiversity conservation. (2) The article addressed the general topic of the relationship between food security and biodiversity. (3) The article’s primary focus was on terrestrial systems.

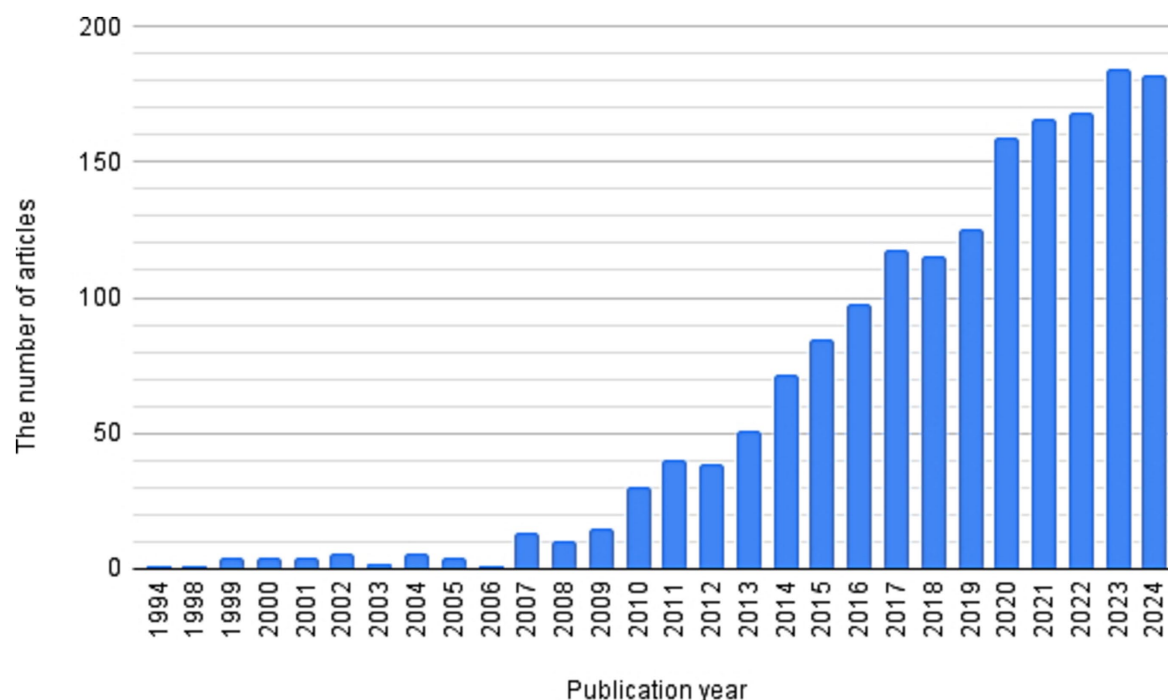


FIGURE 2

Number of publications and years of all articles on the Web of Science using the keywords food security, biodiversity, and conservation.

Temporal analysis

The number of publications and years of all papers in the Web of Science with the keywords “food security” and “biodiversity” and “conservation” are shown in Figure 2. The number of papers exceeded 10 for the first time in 2007, and there has been a nearly monotonic increase since then. The number of related papers exceeded 50 in 2013 and 100 in 2017.

In the following years, there was a significant increase in the number of papers compared to the previous year. The figures in parentheses show the percentage increase or decrease from the previous year; 2007 (1200%), 2009 (50%), 2010 (100%), 2011 (33.33%), 2013 (30.77%), 2014 (41.18%), 2015 (18.6%), 2016 (15.29%), 2017 (20.41%), and 2020 (27.20%). However, there was no year in which the number of papers decreased by more than five from the previous year. The number of papers increased steadily every year from 2013 to 2017, whereas in other years, they remained flat for 3 years before increasing sharply by 15 or more.

First, 2010 (an increase of 15 cases was observed) was the year when the Aichi Targets were adopted at the 10th Conference of the Parties to the Convention on Biological Diversity (COP10), and the UN Decade of Biodiversity was declared. The Aichi Targets are 20 specific international goals established for the period from 2011 to 2020 with the aim of reducing biodiversity loss. The increase of 35 papers from 2019 to 2020 can be regarded as a summary of the Aichi Targets, with 2020 as the goal. 2022 was the year of COP15, and the Kunming–Montreal Biodiversity Framework was adopted as the post-Aichi Target.

Cluster analysis

Visual examination of the dendrogram suggests that the papers fall into the following five clusters. The dendrogram is shown in Figure 3, and the cluster names and number of papers are shown in Table 1.

In the dendrograms of Glamann et al. (2017), papers with a strong focus on biophysical measurements are in the first major branch, and papers with a stronger focus on the sociopolitical context are in the second branch. However, this approach was not used in the present study. Therefore, we did not name the main branches but gave each cluster a separate name for each characteristic. Each cluster was named as follows: (1) Edible wilderness and agrobiodiversity ($n = 19$), (2) Pressures on food security through conservation ($n = 18$), (3) Agroecology, food sovereignty, and focus on farmers ($n = 25$), (4) Sustainable land use ($n = 37$), and (5) Social-ecological systems ($n = 16$).

It is possible to consider Clusters 1, 2, and 3 as a group of papers that address the relationship between biological species and humans. Cluster 2 addresses the relatively narrow theme of the relationship between nature reserves and humans, while Cluster 1, which is closely related to Cluster 2, comprises a group of papers that take a broader view of the relationship between nature and humans, such as edible wild species and agriculture and biodiversity. Finally, Cluster 3, which converges with the others, addresses the theme of broader human activities in the field of food production and biodiversity conservation, such as agroecology.

Meanwhile, Clusters 4 and 5 emphasize on systems for food production and biodiversity conservation. The fourth cluster focuses

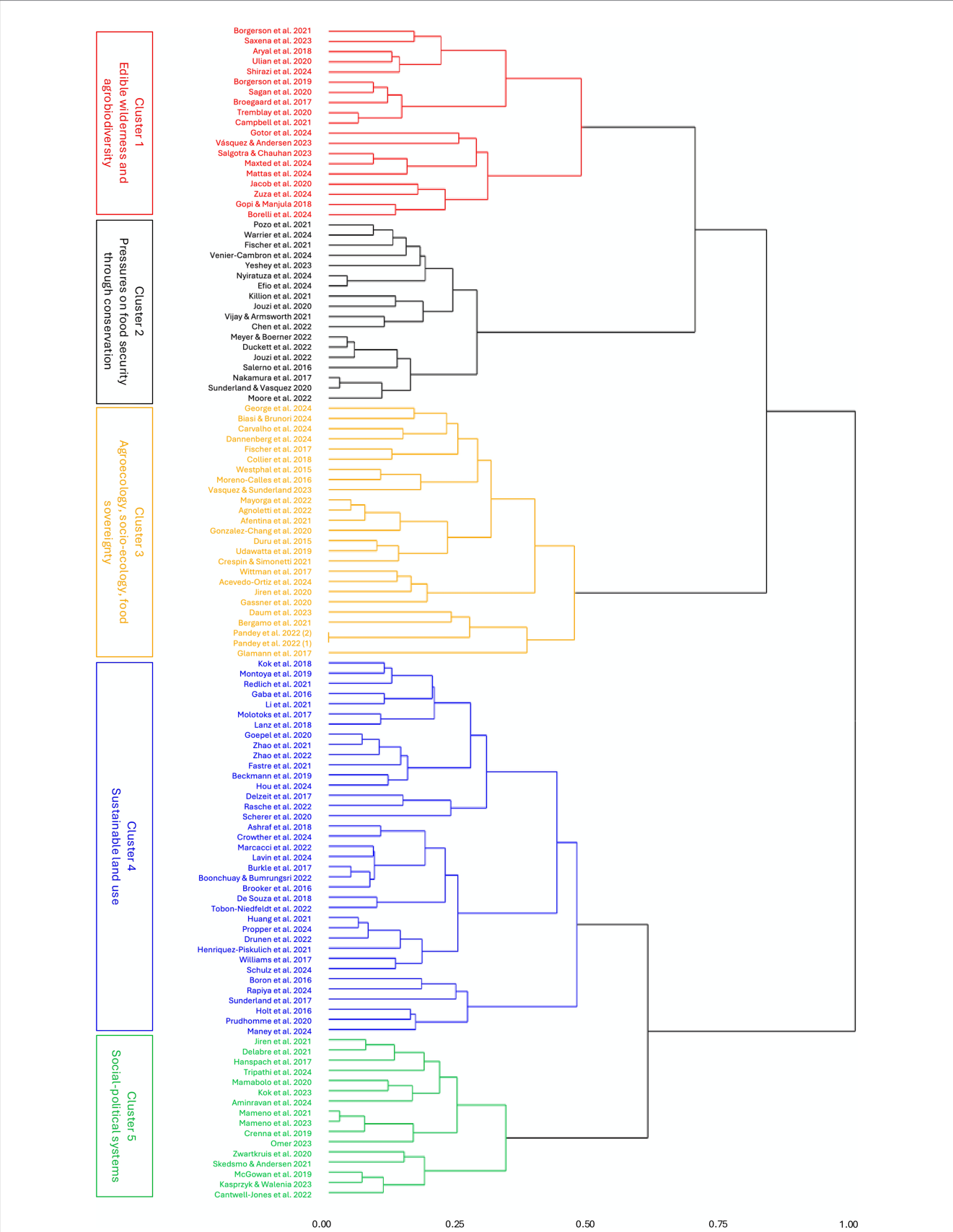


FIGURE 3
Dendrogram illustrating how the analyzed papers addressed the intersection of food security and biodiversity conservation.

TABLE 1 Names and numbers of papers in each cluster.

Cluster	Cluster name	<i>n</i>
1	Edible wilderness and agrobiodiversity	19
2	Pressures on food security through conservation	18
3	Agroecology, socio-ecology, food sovereignty	25
4	Sustainable land use	37
5	Social-political systems	16

on the discussion of methodologies for achieving the aforementioned objectives, while the fifth cluster centers on the examination of political and economic systems that have the potential to facilitate the realization of both objectives. The latter two clusters are more proximate and exhibit greater similarity to each other than the former three clusters.

Note that not all papers in a particular cluster necessarily support the approach discussed in this cluster.

Edible wilderness and agrobiodiversity (*n* = 19)

The main research approach adopted in this cluster was to measure the contribution of this diversity to food security by measuring biodiversity, including agrobiodiversity, and genetic diversity. Many studies have applied combined methods, such as natural science and interviews with local communities.

Typical themes include those that seek to survey and conserve wild and non-cultivated edible plants (WNEPs) in the region, as they are key to providing climate-smart crops (Aryal et al., 2018; Borgerson et al., 2021; Mattas et al., 2024); and attempt to show that agricultural biodiversity, which can be damaged by conversion to a single high-yielding crop, contributes to food security (Jacob et al., 2020; Borelli et al., 2024).

Most papers in this cluster were positive about the positive effects of biodiversity on local agriculture and food security and sought to conserve it by identifying its contribution.

However, some studies have indicated that the use of wildlife as food may increase the risk of zoonotic diseases and wildlife decline (Sagan et al., 2020). Here it is stated that food security should be addressed in conservation and public health strategies aimed at reducing human–wildlife contact.

Pressures on food security through conservation (*n* = 18)

The papers in this cluster focused on the negative impact of biodiversity conservation on food security. In particular, several studies have addressed this as a major point of contention regarding the potential for the establishment of protected areas (PAs) to restrict access to food for the surrounding population (Nakamura and Hanazaki, 2017; Jouzi et al., 2022). Other issues include those that discuss the damage caused to livestock and crops by protected and increased wildlife (human–wildlife conflict; HWC) (Killion et al., 2021; Eño et al., 2024). Another examined the situation of HWC along with the theme of limited food access mentioned above (Salerno et al., 2016).

Although these issues were not treated as major issues in the preceding reviews, several papers in this review have mentioned them. Traditionally, when discussing the trade-off between biodiversity and food security, attention has focused mainly on the negative impacts of

food production on biodiversity, such as the burden on ecosystems caused by the expansion of farmland for food production and the use of chemical fertilizers and pesticides. Studies in this category argue against the conventional trends.

The research methods were not limited to mere statistics and analysis but combined multiple research techniques, including interviews with local residents and field surveys.

Agroecology, socio-ecology, food sovereignty (*n* = 25)

Papers belonging to this cluster primarily adopted an agroecological perspective. Agroecology is a holistic and integrated approach that simultaneously applies ecological and social concepts and principles to design and manage sustainable agricultural and food systems. While agroecology seeks to optimize interactions among plants, animals, humans, and the environment, it also addresses the need for socially equitable food systems in which people can choose what they eat, where, and how food is produced (Food and Agriculture Organization (FAO), 2024).

In other words, agroecology is a concept that has been developed through a combination of on-the-ground agricultural practices and science aimed at solving bottom-up local environmental problems and designing and managing sustainable food systems. Those that include social movement perspectives, such as food sovereignty and farmers’ participation in biodiversity conservation (Moreno-Calles et al., 2016; Gonzalez-Chang et al., 2020) were also included in this cluster. In addition, because agroforestry is a forest management approach based on agroecological values, studies have evaluated the effects of agroforestry on food security and biodiversity (Afentina et al., 2021; Agnoletti et al., 2022). Some studies have adopted a socio-ecological approach, a concept similar to agroecology, which discusses the relationship between humans and the environment in an integrated manner (Wittman et al., 2017; Crespin and Simonetti, 2021).

The papers within this cluster assume that it is possible to overcome the trade-off between food security and biodiversity conservation, and biodiversity-friendly agriculture can contribute to food security. In addition to the issues mentioned above, this cluster formed the second-largest set because many studies have been conducted on sustainable food production from a broad range of perspectives.

Sustainable land use (*n* = 37)

The papers in this cluster are primarily concerned with the conflict between food security and biodiversity, with research approaches that seek to quantitatively identify effective and sustainable land-use practices for biodiversity conservation.

In particular, the themes of sustainable intensification (Göpel et al., 2020) and land sharing/conservation (Williams et al., 2017; Zhao et al., 2021) are typical themes common in previous reviews. However, in the current category, there are several studies on sustainable land use that do not address these issues. For example, some of these studies have simulated the impact of agricultural land expansion for food production on biodiversity (Beckmann et al., 2019; Fastre et al., 2021). Other studies have assessed the impact of land use on pollinators (Burke et al., 2017; Marcacci et al., 2022; Van Drunen et al., 2022). A study was conducted in 2024 (Hou et al., 2024) to examine effective methods to balance food production and the 30 by 30 target, which was set out in the Kunming-Montreal Global

Biodiversity Framework. The 30 by 30 initiative aims to achieve the effective conservation of more than 30% of land and sea as healthy ecosystems by 2030, along with ensuring the sustainability of food production. Although many papers in this category assumed a trade-off between food security and biodiversity, the majority suggested that it is possible to achieve a win-win solution for these two issues.

Social-political systems ($n = 16$)

Many studies in this cluster have focused on legal, social, and economic systems. Methods and themes vary, and with respect to legal and social systems, some use social science methods to evaluate the effects of biodiversity frameworks (Delabre et al., 2021), others use integrated approaches to examine intra-regional governance for food security and biodiversity conservation (Jiren et al., 2021), and others examine value chain agreements for biodiversity conservation in Europe (Aminravan et al., 2024). Papers that focus mainly on economic aspects include those that seek to identify the impact of food consumption on the current biodiversity decline (Crenna et al., 2019) and those that analyze the impact of wildlife-friendly labels on consumer behavior (Mameno et al., 2021; Mameno et al., 2023).

These papers were relatively neutral on the trade-off between biodiversity and food security and attempted to objectively assess the degree to which and how the two issues could be reconciled.

Discussion

Glamann et al. (2017) highlighted the discrepancy between biophysical-technical and socio-political approaches. Prior to 2014, they argue, research in the field of biophysical technology primarily focused on technological enhancements to food security, neglecting to address it as a political-economic issue or a social relations concern. In summary, primary emphasis was placed on enhancing food production, with the fundamental trade-off between food security and biodiversity conservation serving as an overarching consideration. Conversely, research in the sociopolitical field prior to 2014 did not presuppose an inherent trade-off between food production and biodiversity conservation. However, it has been argued that maintaining biodiversity is essential to ensure food security. Moreover, the focus in this domain was on issues of equity, justice, and distribution rather than total food production, and sought to identify a win-win human society-nature relationship and a sustainable food-biodiversity nexus. A significant divergence existed between the two approaches prior to 2014, manifesting not only in their methodological distinctions but also in their underlying assumptions and perspectives (Glamann et al., 2017).

This review of the most recent literature since 2015 reveals that the divide between biophysical-technical and social-political approaches has been resolved to a considerable extent. First, in the cluster analysis, the biophysical-technical and socio-political approaches were not depicted as distinctly different clusters on the dendrogram, unlike the results of Glamann et al. (2017).

A relatively large number of papers that adopted what could be called a biophysical-technical approach were found for sustainable land use (Cluster 4). Classic studies on land sharing/sparing in the context of land use assume a trade-off between biodiversity and food production. The main focus is on the extent to which the negative

impacts on biodiversity and food security can be reduced. However, in Cluster 4, more papers suggested that biodiversity can help food production and that both can be increased. It can be argued that there is a common understanding in academia that sacrificing biodiversity for food security is no longer acceptable and that achieving both is an urgent issue.

In addition, papers classified under the category entitled “Pressures on food security through conservation” (Cluster 2) include those addressing not only the technical aspects of land use, as in the past, but also the consequences of land allocation for people and issues of equity (Vijay and Armsworth, 2021; Warriar et al., 2024; Venier-Cambron et al., 2023). For instance, Warriar et al. (2024) found spatial variations in changes in household well-being when pastoral households across Kenya lost access to nearby nature reserves. The results of the scenario analysis demonstrated that, in the event of access to reserves being lost, hunger and debt, especially among non-settled and agropastoral households, would increase. Furthermore, this study suggests that the rate of cross-border migration will increase in the future.

Consequently, within the context of biophysical-technical papers published since 2015, the relationship between humans and biodiversity has been increasingly elucidated using natural science methodologies. This was complemented by conducting interviews with individuals residing in protected areas concerning their income and dietary circumstances, in addition to economic analysis. A growing body of research has elucidated the relationship between humans and biodiversity. The conventional biophysical-technical approach, which has been criticized for its narrow perspective, has been superseded in recent years by a more comprehensive approach that seeks to understand the nexus between human society and biodiversity. This new approach goes beyond the mere observation of increases or decreases in organisms or food production. It incorporates the experiences and voices of people involved in conservation and food production. It also explores future strategies.

Furthermore, the emergence of pressure on food security through conservation (Cluster 2) is a novel phenomenon within academic discourse. Although issues such as the conflict between PA, food security, and HWC were not observed in the literature before 2014, this review found a sufficient number of papers mentioning them as a cluster. Papers within this category point to trade-offs between biodiversity conservation and food security from perspectives other than conflicts with agricultural production. This position runs counter to the assumption, typical in previous discussions, that food security imposes a burden on biodiversity. With respect to this area, Venier-Cambron et al. (2023) noted: “If these spatial outcomes produce an inequitable distribution of tradeoffs with human development, then future conservation planning may hold an obligation to better include an explicit measure of socially disaggregated land-use needs and values as an additional objective to be optimized.”

The emergence of papers on the subject shows that the implementation of environmental protection policies that ignore the people who use “pristine nature” has created problems that threaten their food security (Sunderland and Vasquez, 2020). For example, nature reserves restrict the collection of wildlife, including plants and animals that provide food. Prohibiting residents who used wild food in the area prior to the establishment

of the nature reserve from collecting it in the protected area can be seen as a violation of food sovereignty (Sunderland and Vasquez, 2020). In other words, biodiversity should be considered when developing agricultural food policies. However, regional food security must also be considered when developing biodiversity policies. These findings emphasize the need for multiple perspectives to address these issues.

In Glamann et al. (2017), a cluster titled “Agroecology and food sovereignty” was identified. This cluster encompasses a total of five papers. In contrast, in this review, papers related to food sovereignty are classified under Cluster 3, “Agroecology, socio-ecology, food sovereignty.” Within this cluster, only two studies (Moreno-Calles et al., 2016; Acevedo-Ortiz et al., 2024) discussed the possibility of using ethnobotanical agroforestry methods or an integrated approach that incorporates indigenous traditional knowledge, with food sovereignty as the central focus. Nevertheless, the observation that the number of papers focusing on this theme has decreased compared to the period preceding 2014 does not necessarily imply a decline in public interest in the themes of food sovereignty and biodiversity. As previously stated, this phenomenon can be attributed to the integration of the concept of food sovereignty within the discourse surrounding PA and the food security of local residents. It can be seen that the number of papers dealing with food sovereignty has actually increased.

In the context of this review, a relatively small proportion of studies employed an economic approach. Five studies utilized an economic approach (Crenna et al., 2019; Mameno et al., 2021; Omer, 2023; Kasprzyk and Walenia, 2023; Mameno et al., 2023) within socio-political systems (Cluster 5), and one study focused on edible wilderness and agrobiodiversity (Cluster 1) (Gotor et al., 2024). Despite the established correlation between food production and economic activities, only six studies that considered biodiversity conservation from an economic perspective were identified in this review. This finding may indicate a lack of interest in biodiversity-related businesses within the academic community. Nevertheless, interest in ESG investments and biodiversity is growing in the business sector. At the 16th Conference of the Parties (COP16) to the UN Convention on Biological Diversity in 2024, major global banks, such as JPMorgan and StanChart, will send representatives for the first time and are beginning to move toward the monetization of “nature and biodiversity” (White, 2024). In light of this global interest, the economics of businesses related to biodiversity conservation should be further analyzed in the academic field, including in areas related to food security.

There is also a dearth of research in the legal and political systems domains. Cluster 5 contained six articles pertaining to social and political systems, which are pertinent to legal and political systems. However, these studies exhibit a paucity of methodological consistency and thematic coherence. While there are extant studies on narrowly focused themes, such as the evaluation of policies and governance within a particular region, there are no studies from a broad perspective, especially from an international or comparative political science perspective, or their scope is overly abstract. In the politics and policy domain, where various research methods are available, investigations into food security and biodiversity conservation remain underdeveloped.

Limitations

One limitation of this study is that only peer-reviewed papers from journals indexed in the Web of Science were reviewed. Book chapters, and proceedings papers from other journals were not reviewed in this study. While databases such as Scopus are renowned for their strength in the social sciences, they are not accessible within the author’s research environment. Consequently, they were not utilized in this study. The small number of studies adopting an economic and political science approach pointed out by this study could be attributed to database bias. Similarly, if book chapters and proceedings papers were added to the analysis, different results were obtained.

Moreover, in this paper, the focus was exclusively on papers related to biodiversity conservation that included the keyword “conservation.” The employment of alternative keywords or synonyms (e.g., “restoration”) in the search query may yield disparate cluster analysis results.

It is also necessary to be aware of the possibility of authors’ thinking bias when narrowing down the target papers and analyzing the trends of each group.

Conclusion

With international efforts, such as the biodiversity COP16, underway, there is an urgent need to develop effective strategies to achieve food security and biodiversity conservation simultaneously. This study demonstrates the recent progress in research on the link between food security and biodiversity conservation. In particular, the advancing integration of biophysical-technical and socio-political approaches suggests increasing proximity to win-win solutions and to overcoming the trade-off between biodiversity and food production.

However, this study also revealed some important challenges. The first challenge is that there is still little research on the relationship between food security and biodiversity conservation. A search for the term “biodiversity” in Web of Science yields over 260,000 papers, while a search for the term “food security” yields over 130,000. However, a search employing the keywords “food security, biodiversity, conservation” yields a mere 1,968 results, accounting for a negligible 0.76% of the results for “biodiversity.” While integrated research has increased in comparison with 10 years ago, academic interest in the relationship between food security and biodiversity conservation remains minimal when viewed as a whole. To further investigate the relationship between food security and biodiversity conservation, additional studies are required.

The second challenge is the underdevelopment of research in the political and policy fields. The lack of economic perspectives and political science approaches indicates that food security and biodiversity conservation are not yet harmonized in the real world. Further research is needed on institutions and policies that balance food security and biodiversity conservation from the perspective of international and comparative politics.

The third challenge is the lack of interdisciplinary research on the entire food production supply chain. Numerous biological and chemical studies have covered a wide variety of species and regions, and studies related to land use have both universal and regional perspectives. However, research using social scientific approaches

has been limited to interviews with people living in rural and regional areas. Therefore, research should be conducted on the processes from food production and biodiversity protection to food consumption. In the present review, only one study (Aminravan et al., 2024) attempted to examine the entire supply chain. It is anticipated that similar research endeavors will be undertaken in the future. As more policies and businesses related to biodiversity are implemented, expanding and validating quantitative research from perspectives such as political science and economics will encourage the implementation and improvement of environmentally sound agricultural policies.

The findings of this study provide insights into the sustainable transformation of food systems. In the future, it will be necessary to increase the number of studies in areas where there is a lack of papers and expand the base for conducting integrative research. Integrative research in this field should be deepened to build a new model that contributes to the realization of a sustainable society in which biodiversity and food security are harmonious.

Author contributions

MN: Conceptualization, Data curation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. TS: Project administration, Supervision, Writing – review & editing.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2025.1664633/full#supplementary-material>

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