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The socio-economic issues of agroecology: a scoping review

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Abstract

In recent years, agroecology has gained prominence as one of the innovative approaches to agriculture that could positively contribute to achieving sustainable food systems. As a transdisciplinary science, agroecology could benefit from the contribution of socio-economic sciences. This study aims to give an overview of how scholars have approached socio-economic issues in the field of agroecology. A scoping review was conducted by using the PRISMA-ScR method, searching both Scopus and Web of Sciences databases. The selected body of literature (183 articles) provides an overview of the key socio-economic dimensions analysed in the literature on agroecology and the results achieved by scholars. The findings allowed drawing the research gaps and the future research directions in this domain.

Keywords: Agroecology, Economics, Sustainable food system, Socio-technical transition, Transdisciplinarity

Introduction

Agroecology is an "old" concept that has acquired a growing importance in scientific, agricultural, and political discourses in recent years (Mouratiadou et al. 2024). Since the first use of the term in the 1930s, the definitions of agroecology have continuously evolved (Wezel and Soldat 2009). Currently, agroecology is widely considered as an innovative approach to agriculture aimed to achieve sustainable and equitable food systems that can be understood as: a transdisciplinary science, a set of practices, and a social movement (Méndez et al. 2013; Gliessman 2018; HLPE 2019). As a transdisciplinary science, agroecology includes elements from several disciplines (Dalgaard et al. 2003), increasingly focusing on the transformation of the whole agri-food system (Wezel and David 2020) to reduce environmental impacts and enhance social justice, food security, and nutrition (HLPE 2019). Compared to other approaches concerning the transition towards more sustainable food systems, the agroecological literature has still several gaps preventing a full understanding of its potential (D'Annolfo et al. 2017). For example, the economic viability and sustainability of the agroecological model are still debated. Indeed, one of the most contested aspects of agroecology is its assumed unprofitability, which would make it

dependent on public financial support (van der Ploeg et al. 2019). This argument could be a main obstacle hindering the uptake of agroecological transition. However, recent literature provides fresh insights about positive socio-economic outcomes of agroecological farming models (Mouratiadou et al. 2024). Integrating empirical and informal knowledge into modern agroecological research is an emerging challenge, and there is a need to ensure that technological innovations are accessible and appropriate for diverse farming communities (HLPE 2019). Moreover, compared with other innovative approaches, such as sustainable intensification, it is still disputed whether the agroecological transition of food systems can deal with ongoing food security and nutrition challenges (Bezner Kerr et al. 2021). Translating successful small-scale agroecological practices to larger agricultural systems poses also challenges, and research needs to explore strategies for scaling up these practices while maintaining their socio-economic benefits (Sourisseau 2014). There are still significant gaps in understanding the social and economic impacts of agroecological practices, including the dynamics of farmer decision-making and community-level outcomes (D'Annolfo et al. 2017), as well as the impacts of agroecology on society at large (Gonzalez de Molina 2013). Bridging the gap between agroecological research findings and policy implementation is also crucial to ensure that evidence-based practices are integrated into agricultural policies (Sabourin et al. 2018). In sum, getting a better understanding of these socio-economic and political factors is necessary to identify drivers and barriers to foster the agroecological transition (Sanderson Bellamy and Ioris 2017; Giraldo and Rosset 2018).

Against this backdrop, the role of economics discipline can be relevant (Fresco et al. 2021) and the present research falls in this domain. More specifically, this study aims to provide an overview of how scholars have approached and contributed to the socio-economic knowledge about agroecology. To reach this objective, a scoping review was performed to systematically map the research done in the field of agroecology for assessing the socio-economic issues of agroecological transition. This literature review aims to reply to the following research questions:

RQ1 What are the main socio-economic issues of agroecology that have been analysed?

RQ2 What are the main results achieved by scholars on the socio-economic issues of agroecology?

In addressing these research questions, our review contributes to map the existing literature on agroecology by highlighting the main socio-economic issues and the results achieved. Finally, we contribute to the literature by highlighting the research gaps that allow us to define a future research agenda. As general outcome, the present research is fundamental to reach a comprehensive understanding of how researchers have approached so far the socio-economic dimension of agroecology, thus highlighting burning issues, and allowing for the development of holistic and context-specific approaches to inquiry in this field.

The following sections describe the methodology of research, the results, the discussion of results, and conclusion.

Methodology

The scoping review is an ideal tool to characterise scientific literature on a given topic, determining the amount and type of extant studies. Scoping reviews are useful to bring out underinvestigated areas of inquiry and to eventually suggest the formulation of specific research questions (Colquhoun et al. 2014; Munn et al. 2018).

The review protocol was drafted using the PRISMA-ScR methodology—namely the extension for scoping reviews of the PRISMA protocol (Tricco et al. 2018)—, and databases search was conducted on 18 January 2023. The scoping review process consisted of four stages: identification, screening, eligibility, and analysis (Fig. 1).

In the first stage, we designed a searching protocol incorporating inclusion criteria and keywords for the application in two different databases, namely Scopus and Web of Science Core Collection (WoS). The search query was based on the Boolean combination of three keywords, i.e. agroecol* OR agro-ecol* AND econom*, applied to the following search fields: article title, abstract, and keywords. These keywords were chosen with the scope of identifying those studies that focus on agroecology by including the economic dimension. To get variants of the provided search terms, asterisk (*) at the end of the keyword was added. In the identification stage, a total of 5,436 entries were retrieved from both databases (Table 1).

The identification was further refined by applying automatic filters in each database (Table 2). In detail, the selection was restricted to articles published in the period

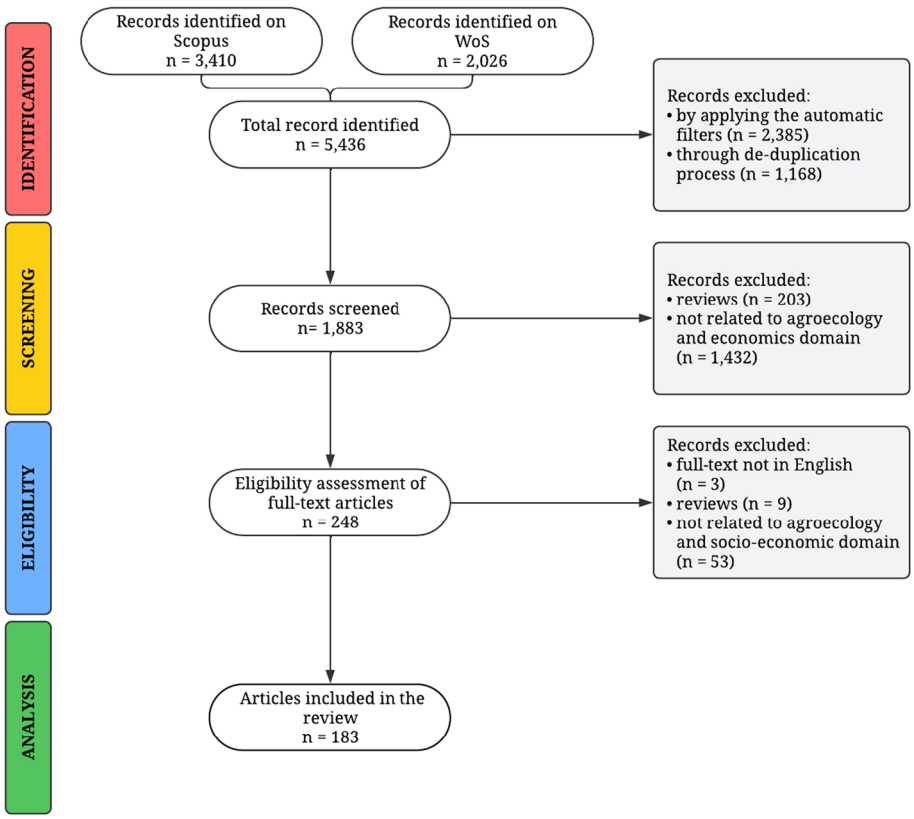


Fig. 1 PRISMA-ScR flow diagram of the selection process

Table 1 Databases search query

Database	Search query	Records
Scopus	TITLE-ABS-KEY ([agroecol*OR agro-ecol*] AND econom*)	3410
WoS	((TI = ((agroecol* OR agro-ecol*) AND econom*) OR AB = ((agroecol* OR agro-ecol*) AND econom*) OR AK = ((agroecol* OR agro-ecol*) AND econom*))	2026
Total		5436

Table 2 Identification criteria

Database	Automatic filters	Records
Scopus	Publication year: from 2013 to January 2023 Document type: articles, review, short survey Language: English Subject area: Agricultural and Biological Sciences; Business, Management and Accounting; Decision Sciences; Earth and Planetary Sciences; Economics, Econometrics and Finance; Environmental Science; Multidisciplinary; Social Sciences; Veterinary;	1772
WoS	Publication year: from 2013 to January 2023 Document type: article, review Language: English Group of subject categories: Agricultural Sciences; Biology & Biochemistry; Economics & Business; Engineering; Environment/Ecology; Geosciences; Multidisciplinary; Plant & Animal Science; Social Sciences, General;	1279
Total records		3051

2013–2023, following the assumption that scientists' interest in this topic increased after the International Symposium on Agroecology for Food Security and Nutrition held by FAO in Rome in 2014. To gather only high-quality publication, we included scientific articles published in peer-reviewed journals (Larson and Chung 2012) and written in English (Morrison et al. 2012). The selection was further limited to subject areas (Scopus) and groups of subject categories (WoS) most appropriate for studies in economics applied to agriculture and agri-food systems. The studies identified after applying the automatic filters in both databases (3051 in total) were imported into excel for the elimination of duplicates ($n = 1168$).

In the following screening stage, a total of 1883 records were reviewed by two of the authors. The screening process was performed by reading the article title, abstract, and keywords, and according to two criteria: research topic and type of article. As for the first criterion, only articles focused on agroecology as core field of study and performing an empirical analysis focused on the socio-economic issues were included in the review (Fresco et al. 2021). In detail, the articles excluded were (1) articles that just cited the words agroecology or agroecological but they were not focused on analysing the agroecological approach, (2) articles that were only tangentially about the agroecological approach, and (3) articles that were focused on the agroecological approach but they did not investigate any economic issues. When we were unable to deduce this information from the title or abstract, we included the paper for further examination via full-text reading. As for the second criterion, we choose to eliminate the reviews ($n = 203$) from

Table 3 Eligibility criteria applied through the full-text reading

Inclusion criteria	
1	Document type: peer-reviewed journal articles (reviews as well as other document types were excluded)
2	Full-text language: English
3	Focus of study: on agroecology as core field of study and performing an empirical analysis focused on the socio-economic issues. Theoretical studies were exceptionally included if they were considered useful to frame some theoretical issues

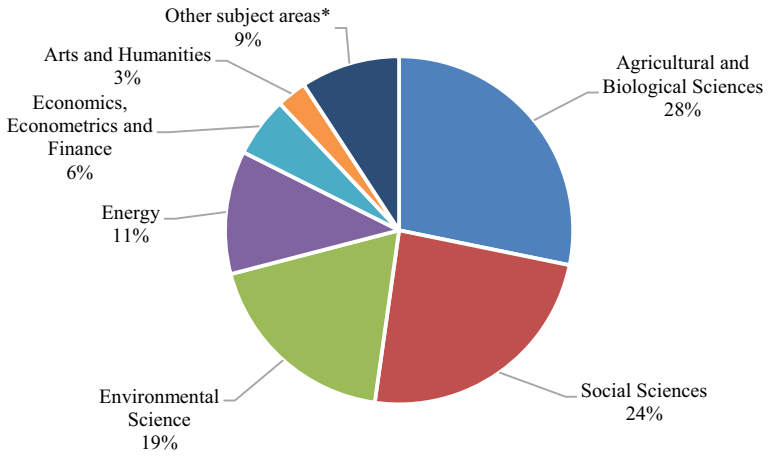


Fig. 2 Number of documents by subject area (Scopus database). *Other subject areas: Engineering; Biochemistry, Genetics and Molecular Biology; Business, Management and Accounting; Computer Science; Earth and Planetary Sciences; Multidisciplinary; Chemical Engineering; Mathematics; Medicine; Nursing; Veterinary

our database after ascertaining that their scope was different by our review objective. At the end of the screening stage, 248 articles were recorded.

At the end of the eligibility stage, based on full-text reading, a total of 183 articles were eventually incorporated in the review and constituted the body of literature for analysis. The eligibility assessment was based on criteria reported in Table 3.

In the fourth stage, a qualitative analysis was used to categorise iteratively (at posteriori) the reviewed studies. We identified first- and second-level categories according to the general and specific objectives of the documents. The next section provides a detailed description of the analysed literature, highlighting the main results achieved.

Results

The 183 articles selected are indexed both in Scopus and WoS databases. According to Scopus classification of journals, they pertained to a broad range of subject areas, which highlight the multidisciplinary nature of this strain of literature (Fig. 2). The articles have been published in a total of 84 academic journals, the top ten by number of articles published being: Agroecology and Sustainable Food Systems (28), Agricultural Systems (11),

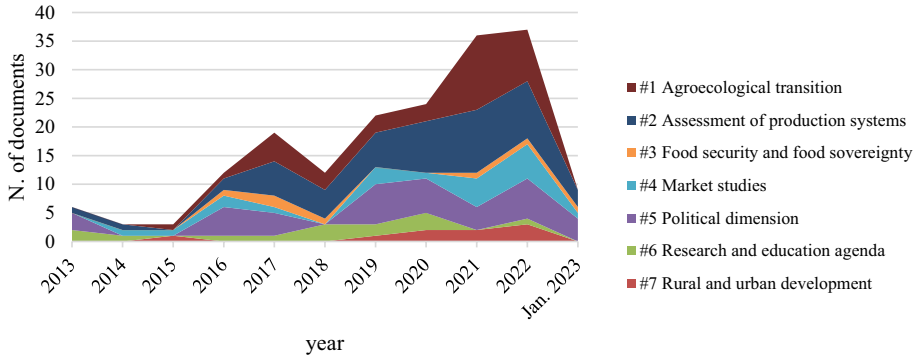


Fig. 3 Number of documents per topic published over the period 2013–2023. Note that the documents were retrieved in January 2023

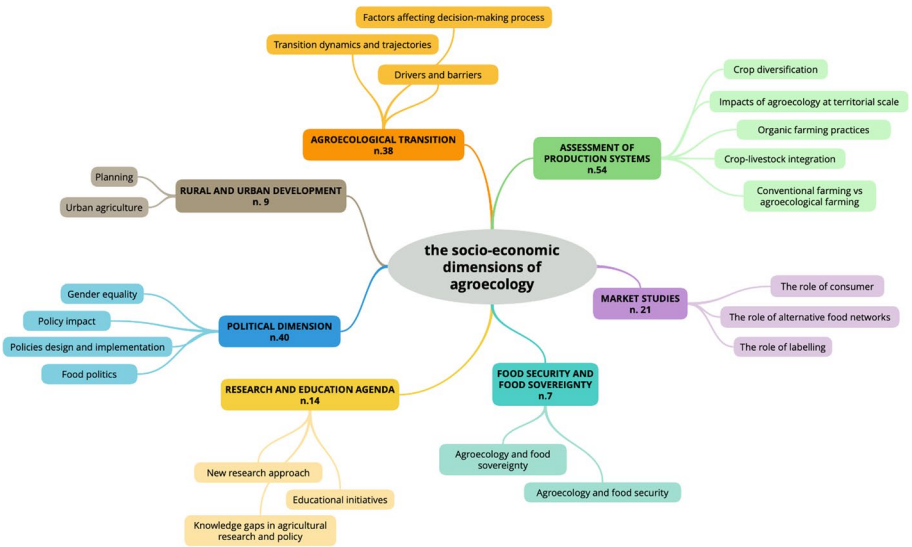


Fig. 4 Conceptual map of selected articles according to first-level (topics) and second-level categories (sub-topics)

Sustainability (9), Agronomy for Sustainable Development (8), Ecological Economics (7), Frontiers in Sustainable Food Systems (7), International Journal of Agricultural Sustainability (7), Journal of Peasant Studies (7), Geoforum (4), and Journal of Rural Studies (4). With reference to the years of publication, we observed an increasing trend during the considered period (Fig. 3).

The analysis of selected articles, based on full-text reading, allowed the identification of 7 first-level categories (research topics) according to their general objective, and 21 second-level categories (research sub-topics) according to their specific objectives (Fig. 4).

Also, the analysis allowed the identification of the country or the countries where each empirical study was performed. We found that the geographical distribution of the empirical studies is quite unbalanced among countries pertaining to Global North and Global South (Kowalski 2020), and even more unbalanced when looking to some

topics (Table 4). Specifically, topics related to agroecological transition and assessment of production systems are rather balanced. Food security and food sovereignty, market studies, political dimension, and rural and urban development studies are prevalent in the Global South, whereas only the research and education agenda has received more attention in the Global North. However, looking at countries level, most of the empirical studies were carried out in the Brazilian and French contexts (Fig. 5a). Indeed, in the latter countries agroecology was officially recognised through the incorporation of agroecological principles into national policies (Wezel and David 2020). While looking at geographical distribution of documents by country of authors' affiliation, we found that most of articles come from research institution of the Global North (Fig. 5b). The frequency analysis of articles keywords applied to all selected manuscripts highlighted the predominance of the following terms: agroecology, sustainability, food security, sustainable agriculture, agroecological practices. When looking at each topic the five most frequent articles keywords are quite different, with exception of the term agroecology that is always the most frequent (Fig. 6).

In the following subsections each topic and the related subtopics will be presented, seeking to highlight the main results achieved.

Agroecological transition

The topic named agroecological transition (AET) includes 38 papers dealing with the process of moving towards an agroecological food system. This corpus of studies is mainly focused on how to foster or broaden the adoption of agroecological practices. The analyses mostly involve smallholder and family farmers. Although many papers explore concurrently various intertwined themes, reflecting the multidimensional nature of transition processes, they were divided into three major sub-topics.

Transition dynamics and trajectories

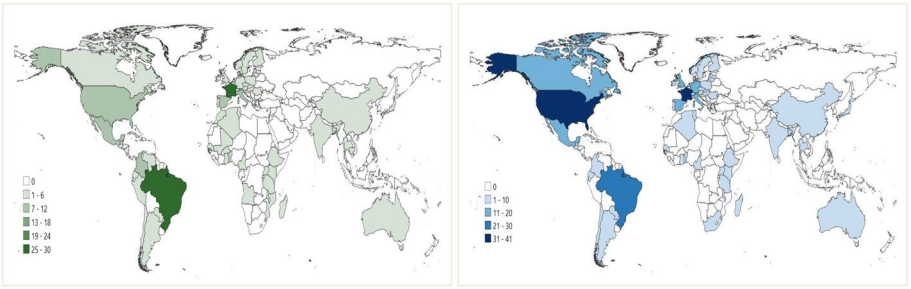
The works under this sub-topic ($n = 14$) aim to gain deep insights about the conditions that make transition processes happen, and the distinct pathways along which they may progress.

A few studies focus on transition to agroecological management at farm level, assessing the degree of farms' AET, or providing empirical evidence on the economic effects of transitioning. Overall, it has been found that within the European Union less than 3% of farms can be considered fully agroecological, while about 25% of them can be recognised as proto-ecological for using little external inputs (Matthews 2022). However, alternative models such as multifunctional farms can unconsciously operate according to agroecological principles and thus can be considered as precursory in AET, as investigated in the Italian context integrating qualitative case study analysis and quantitative estimation of parameters based on evaluation criteria (Gargano et al. 2021). Family farms can face high costs at the beginning of the transition, but gradually experiment increased and more stable net income, and better living conditions in the medium-long term, as co-assessed with Cuban farmers with participatory methods (Lucantoni 2020). Qualitative studies grounded on interviews and participant observation point out that farmers can implement the transition process differently and at varying speeds, depending on factors such as land tenure status, available economic capital, and production scale. As evidenced

Table 4 Number of articles per topic/sub-topic, number of theoretical articles, and number of empirical articles by geographical distribution of empirical studies

ID	Topics and sub-topics	Total number of articles	No. of theoretical articles	No. of empirical articles by geographical distribution*		
				Global North	Global South	Global North & Global South
#1	**Agroecological transition**	**38**	**0**	**19**	**17**	**2**
1_1	Transition dynamics and trajectories	14	0	6	6	2
1_2	Drivers and barriers	16	0	11	5	0
1_3	Factors affecting decision-making processes	8	0	2	6	0
#2	**Assessment of production systems**	**54**	**0**	**26**	**28**	**0**
2_1	Crop diversification	7	0	6	1	0
2_2	Crop–livestock integration	10	0	8	2	0
2_3	Organic farming practices	5	0	2	3	0
2_4	Others agroecological practices	7	0	3	4	0
2_5	Conventional farming vs agroecological farming	10	0	3	7	0
2_6	Impacts of agroecology territorial scale	15	0	4	11	0
#3	**Food security and food sovereignty**	**7**	**1**	**0**	**6**	**0**
3_1	Agroecology and food security	4	1	0	3	0
3_2	Agroecology and food sovereignty	3		0	3	0
#4	**Market studies**	**21**	**1**	**4**	**15**	**1**
4_1	The role of consumer	4	0	0	3	0
4_2	The role of labelling	3	0	1	2	0
4_3	The role of alternative food networks	14	1	3	10	1
#5	**Political dimension**	**40**	**5**	**11**	**22**	**2**
5_1	Food politics	9	4	1	3	1
5_2	Gender equality	6	0	0	5	1
5_3	Policies design and implementation	11	0	8	3	0
5_4	Policy impact	14	1	2	11	0
#6	**Research and education agenda**	**14**	**3**	**7**	**4**	**0**
6_1	New research approach	6	2	4	0	0
6_2	Educational initiatives	5	0	1	4	0
6_3	Knowledge gaps in agricultural research and policy	3	1	2	0	0
#7	**Rural and urban development**	**9**	**0**	**1**	**6**	**2**
7_1	Planning	4	0	0	2	2
7_2	Urban agriculture	5	0	1	4	0
	Total	183	10	68	98	7

*The allocation of empirical articles among Global North and Global South was done according to the classification of world's countries reported in Kowalski (2020)



(a) (b)

Fig. 5 Geographical distribution of empirical studies by country (**a**) and geographical distribution of documents based on country's affiliation of authors (**b**)

All selected articles	F	#1 Agroecological transition	F	#2 Assessment of production systems	F	#3 Food security and sovereignty	F
agroecology	103	agroecology	21	agroecology	27	agroecology	6
sustainability	22	agroecological practices	5	sustainability	9	food sovereignty	2
food security	10	agroecological transition	4	agroecological transition	4	alternative food movements	1
sustainable agriculture	10	transition	3	sustainable agriculture	4	alternative food networks	1
agroecological practices	9	rural development	3	profitability	3	counter-hegemony	1
#4 Market studies	**F**	**#5 Political dimension**	**F**	**#6 Research and education agenda**	**F**	**#7 Rural and urban development**	**F**
agroecology	10	agroecology	24	agroecology	10	agroecology	5
community supported agriculture	3	public policy	5	ecosystem services	4	urban agriculture	2
alternative food networks	2	sustainability	5	sustainability	4	agroecological urbanism	1
participatory certification	2	food security	4	biodiversity	2	community garden	1
short supply chains	2	public procurement	4	social-ecological system	2	food in cities	1

Fig. 6 Word cloud showing the relative importance of articles keywords listed in all selected articles with a minimum of two occurrences. Listed keywords show the five most important articles keywords in all studies and the five most important in studies of each topic measured by the relative frequency (*F*) of their occurrence

for horticultural family farms in Argentina, AET typically entails a reconfiguration of production practices in the beginning and later involves innovations in marketing and sales, with a great impact on the logistic and work organisation (Parodi 2018). Diverse farm typologies can be involved differently within transition processes. Basing on quantitative methods such as multiple correspondence and cluster analysis, farm typologies can be classified according to factors such as production system diversification, family

workforce availability, membership to associations, access to technical assistance services, adoption of organic method, water management, and agricultural waste recycling practices (Escobar et al. 2019).

Most of the studies delve with systemic changes occurring across entire agri-food systems, often emphasising that local context plays a major role in understanding the specificity of AET trajectories. For instance, considering dairy farms from two very different agropastoral areas, Vidal et al. (2020) found that AET trajectories in France are mainly structured around organic farming label, food safety, and quality challenges, with the consumer demand playing a key driving role; instead, in Burkina Faso they are more guided by food security issues related to the need to diversify food commodities. Other studies employ the multi-level perspective (MLP) approach to understand transition processes. Among them, analysing the fresh vegetable production system in Belgium, Dumont et al. (2020) illustrate the coexistence between different socio-technical configurations of agroecological systems, one of which was able to scale from the niche to the regime level by modifying some technical and marketing practices, and interacting with the organic and conventional systems. Instead, Ryschawy et al. (2021) individuate the bottom-up processes and the macro-economic and institutional dynamics, through which an agroecological crop–livestock system (integrated sheep-vineyard) can emerge to disrupt the conventional agricultural regime in California.

Andrieu et al. (2022) apply methods of participatory scenario development and visioning to identify the key changes needed for an AET in Guadeloupe, integrating three analytical levels (farming, socio-technical, and socio-ecological systems) and considering the farms' position along an AET gradient. In general, farmers envision transition as a gradual and multiscale process, rather than a disruptive change. However, according to Plumecocq et al. (2018) it is precisely the intensity of change, from incremental to radical, that generates transition types and pathways. Basing on institutional analysis, the authors argue that the models that are more aligned with the values of the dominant regime entail minor and incremental adjustments to the conventional system, often involving mainly the technological sphere. Alternative models shaped by radically different values require disruptive changes also in the organisational and institutional domains, such as markets, standardisation forms, norms, and social relationships. Moreover, AET needs a radical change of social relations in agricultural production towards a greater autonomy of farmers, as van der Ploeg (2020) highlights through the case study of a farmers' cooperative in the Netherlands.

Whitin the social actors promoting agroecology, the crucial role of grassroot peasant movements with significant organisational capacity is acknowledged, while governments have often failed to incorporate into their agenda the forging of a new food system (Intriago et al. 2017). According to Dorin (2022) it makes an exception the case of the South Indian State of Andhra Pradesh, where a strong engagement at political level may lead to the first large-scale AET in the world, following the development of an existing alternative niche (i.e. Zero Budget Natural Farming).

Finally, territorialisation and massification of agroecology are crucial to reach an adequate scale to enable a systemic transition. In particular, McGreevy et al. (2021) evidence the role of agroecological farms as lighthouses able to facilitate and amplify the uptake of agroecological practices in rural communities.

Drivers and barriers

The studies under the second sub-topic ($n = 16$) deal with the factors that may hinder (barriers) or facilitate (drivers) the transition towards agroecological food systems within diverse territorial contexts. Methodological frameworks are mainly based on case studies, qualitative analysis of interviews or focus groups, sometimes combined with quantitative statistical analysis. Some factors are strictly dependent on farm management, while others are related to the broader socio-political system, organisational forms and market structures in which farmers operate. The combination of distinctive internal and external factors on each farm can be relatively unique, making the transition process inhomogeneous (Dupré et al. 2017).

At farm level, several factors can influence the implementation of agroecological practices, including the economic benefits outweigh the costs, the availability of substantial resources such as capital and labour, the amount of subsidies and the level of farmer education. In detail, the main barriers reported are: the preference of smallholders for industrial farming (Castellanos-Navarrete and Jansen 2018); the knowledge gap and the unavailability of agroecological inputs (Boulestreau et al. 2021); the need to acquire manifold knowledge and skills, and the heavy administrative burden to comply with more regulations when the activities are diversified (Aare et al. 2021); the lack of appropriate training, technical support and advisory service (Punzano et al. 2021); and the expensive cost of agroecological inputs, the time-consuming complexity of their management or the lack of some needed machineries (Surchat et al. 2021). Farm-work organisation and working conditions can influence the uptake of agroecological practices, especially those related to crop–livestock integration, which requires more intense and skilled labour compared to specialised systems (Fanchone et al. 2022). Limited access to water and shortages of land, labour, and money have been found as main hindering factors in Ethiopia (Mekuria et al. 2022). Constraints at farm level can be influenced by external factors, such as land tenure and market incentives. However, such constraints could be tackled through collective strategies like pooling of resources, labour, and land (Isgren 2016). Cooperative farmers trying to operationalise agroecology within collective projects can face further challenges: as for a Belgian case study, they lack an encoded organisational model and often proceed by trial and error; moreover, multiple aspirations and institutional logics can create internal tensions (Plateau et al. 2021).

The external barriers at the broader socio-technical level inhibit systemic changes of the conventional agri-food model. The main ones identified are: a technological lock-in of specialised agri-food systems around the few major cultivated crops, hindering diversification pathways (Revoyron et al. 2022); the conventionalisation of the organic regime (Boulestreau et al. 2021); unsupportive legislation that often fails in meeting the needs of diversified farms (Aare et al. 2021); the persistence of neoliberal approaches in the policy sphere; the low-cost and export-oriented strategies and corporate power exerted by oligopolies within the current industrial food system at the market level; productivist solutions prevailing in the technological domain; the industrial mode of thought in which the scientific culture is chiefly embedded (Iles 2021); and the lack of citizen awareness about ecological production at social level (Punzano et al. 2021). Moreover, the development of a well-functioning innovation

system depends on existing actors, institutions, and infrastructure that are strongly aligned with the current agri-food regime, making it difficult to challenge (Vermunt et al. 2022).

Internal transition drivers due to farm management are related to farm characteristics and its environment, the labour force, and the farmer's environmental concerns (Dupré et al. 2017). Farmers with a better knowledge about agrochemicals and their effects on health, relying on different sources of information, show a higher intention to adopt agroecological practices (Punzano et al. 2021).

As for the external drivers, the literature points out the importance of: ensuring regulatory adjustments attentive to the structural conditions that favour diversified farming systems (Aare et al. 2021); obtaining social recognition for the farmer's ecological work (Punzano et al. 2021); promoting consumer education through targeted public campaigns on sustainable diets; training the local extensions services staff (Surchat et al. 2021); facilitating access to agroecological inputs; building participatory agroecological knowledge; developing cultural and territorial vitality services bundles (Beudou et al. 2017); creating multi-stakeholder platforms; providing an enabling policy environment, able to value the public goods deriving from diversified farming; and creating favourable markets, such as alternative sale channels where farmers can have greater control on selling terms and prices, and establish reliable networks of customers (Iles 2021). As for the market drivers, it is suggested to capitalise on consumer willingness to pay a price premium for more ecological products or ensuring the internalisation of full social and environmental costs of conventional production, e.g. through market regulation or pricing mechanisms.

Farmers' organisations can play a key intermediary role to facilitate both knowledge and adoption of agroecological innovations among farmers, thanks to many vertical and horizontal connections (Iyabano et al. 2022). External organisations, such as foreign NGOs and institutions, can also contribute to propel agroecological conversion in peripheral territories (Einbinder et al. 2019).

Factors affecting decision-making processes

These factors can be understood as a particular category of internal drivers, specifically related to farmers' choices, motivations, and behaviours laying behind the adoption of agroecological practices. The studies ($n=8$) are mainly based on in-depth qualitative interviews aimed to capture farmers' perception of their system of practices, sometimes combined with quantitative approaches.

Intrinsic motivations, based on self-determination and congruency with personal values, and extrinsic motivations, linked to site-specific conditions and needs, seem to be more relevant than external stimulus (rules or economic incentives), as Garini et al. (2017) evidence for Italian winegrowers by implementing a cognitive mapping approach. Similarly, employing discrete choice experiment to analyse socio-economic trade-offs faced by French farmers in AET, Bjørnåvold et al. (2022) argue that their behaviour could be more influenced by peers' perception and support than by outside pushes. De La Cruz and Dessein (2021) use the lens of institutional bricolage to identify the prevailing powerplay mechanisms influencing individual decisions to adopt agroecological practices in Peruvian rural villages: (1) copying and learning on transition feasibility from

wealthier farmers; (2) the manageability of the risks. Antonio et al. (2019) observes that the main motivations beyond production changes among Brazilian family farmers are: (1) good performance, (2) easy cultivation and adaptability, and (3) the need of adapting to climate change.

Other studies employ descriptive and inferential statistical analysis to identify explanatory variables associated with decisional patterns. Basing on data surveyed from Cameroonian smallholder farmers, Epule and Bryant (2017) find that the decision to adopt agroecological practices is conditioned by socio-demographic characteristics (higher propensity is associated with fewer years of experience, higher level of income, and more family members living and working on farm), while Awazi et al. (2021) show a positive causal relationship with socio-economic and institutional attributes (age of household head, access to information, access to credit and degree of vulnerability). Segnon et al. (2015) show that the adoption of diversified farming systems in Benin vary according to geographical and ecological conditions, sociolinguistic affiliation, and socio-economic factors. Besides, farmers' ecological knowledge emerges as a crucial driver for adopting more environmental-friendly models and for choosing specific management options (e.g. crop–tree–livestock VS agroforestry). Using an Extended Theory of Planned Behaviour Model, also Tama et al. (2021) found that knowledge exerts the greatest influence on farmers' intention towards agroecology in Bangladesh.

Assessment of production systems

These studies ($n=54$) focus on the assessment of production systems in terms of sustainability performance of the agroecological paradigm at various scales of analysis, i.e. from plot or farm scale to territorial scale. They evaluate, through the use of a variety of indicators, how the adoption of different agroecological practices affects some or all of the environmental, social, and economic domains. In particular, some articles cover subtopics concerning the diversification of faming systems (e.g. crop–livestock integration, crop diversification). Few studies perform an analysis of agroecology in terms of transitioning to organic farming, or the impact of adopting several others agroecological practices in conventional farms (e.g. biocontrol, organic fertilisation, use of biostimulants), while others perform a comparison between conventional farming vs. agroecological farming. Finally, other studies focus on the impacts of AET at territorial scale.

Crop diversification

Crop diversification is the farming strategy based on spatial and temporal diversification of cropping systems. There are several options to diversify cropping systems, i.e. crop rotations, intercropping and cover crops. This strain of literature ($n=7$ studies) evaluates the impact of crop diversification on sustainability performance of agricultural production systems. The assessment considers the economic, environmental and social dimensions by using several approaches, such as multicriteria analysis, sustainability indicators analysis, dynamic model of the sequence of agricultural productions and Sustainability Assessment of Food and Agricultural Systems (SAFA).

All the authors found that crop diversification positively impacts environmental sustainability (Puech et al. 2021; Rodriguez et al. 2021; Alletto et al. 2022), i.e. reducing the dependence on synthetic inputs (Bonnet et al. 2021). However, they found contradictory

results regarding the impact of diversification on social and economic dimensions. Some authors found that crop diversification improves the social sustainability of farming systems (Puech et al. 2021; Alletto et al. 2022), while Rodriguez et al. (2021) found that farmers still face many challenges in the social domain (e.g. contribution to employment, work condition, and farmers' quality of life). As regards the economic sphere, some authors found that diversification strategies might reduce profitability (Puech et al. 2021; Rodriguez et al. 2021; Bonnet et al. 2021). Conversely, Islam et al. (2021) found that the intercropping strategy might have the potential to be used to increase cropping intensity, overall yield, and earnings per unit area. Moreover, Alletto et al. (2022) highlight that economic performance was very variable according to the cases analysed, and Durand et al. (2017) showed that a farm with increased crop diversity lowers the cost of soil restoration. Nevertheless, their economic analysis reveals that farmers might struggle to cover the costs of AET. Finally, Nilsson et al. (2022) found that functional crop diversity increases farm economic performance and input self-sufficiency, whereas diversification based on genetically linked crops has the opposite effect.

Crop–livestock integration

These studies ($n = 10$) investigate whether the integration of crop and livestock at farm or territorial scale could be a viable farming strategy, according to agroecological principles. They are primarily based on simulations of crop–livestock integration scenarios. A variety of methodological approaches are used, including the Orfee model, an agent-based integrated modelling framework, and participatory approaches for co-designing the farming systems. Among these studies, Pissonnier et al. (2019) evaluated the long-term effects of integrating animals into the production system of farms specialised in perennial crops. They found a reduction in the use of pesticides, even if in some scenarios this reduction is modest. However, the additional costs associated with livestock are not entirely offset by the increase in revenue, nor by the benefits associated with the elimination of chemical weeding and orchard health protection. Moreover, Alexandre et al. (2021) explored the impact of livestock integration in agroforestry production, discovering that making this connection in a planned and rational manner increases yields while also benefiting the environment. Additionally, a study proposed by Bonaudo et al. (2014) investigated two alternative farming systems integrating crops and livestock. The first case shows how combining moderate de-intensification with increased crop–livestock integration can significantly reduce external inputs (e.g. fertilisers, pesticides, feed) through improved recycling of crop and livestock by-products (e.g. straw, manure). This strategy reduces environmental externalities while causing a limited production loss. The second case demonstrates how a combination of moderate intensification and increased crop–livestock integration might reduce the usage of chemical inputs (herbicides and fertilisers), resulting in increased output while mitigating environmental impacts. Moreover, Mosnier et al. (2017, 2022) compared mixed systems to their specialised equivalents, in order to determine which one is more sustainable. Their findings show that mixed farms compared to specialised farms produce greater net revenue and have lower overall production costs. However, the profitability and revenue variability of mixed farms do not outperform the top performing specialised farms. Moreover, Castelo Branco Brasileiro-Assing et al. (2021) compared sustainability performances of

farmers who adopted the agroecological practice named Management Intensive Grazing (MIG) with those who did not apply this practice. Findings highlight that the adoption of MIG increases profitability and farm income. Furthermore, Mugnier et al. (2020) focused on mixed-species livestock farming systems finding that, due to the seasonality and the type of products, mixing species guarantees revenues and makes them more stable throughout the years. Likewise, considering animals' complementary feed needs and behaviour, there are additional benefits, including increased consumption of on-farm forage and better utilisation of grassland resources. Finally, some studies investigated the possibility of crop–livestock integration at the territorial level when implementation at farm level was not possible. In particular, these studies focused on developing cooperation between producers specialised in arable crops and producers specialised in animal husbandry. Authors found that this might be a solution to overcome the issues related to work organisation (Ryschawy et al. 2017), rising workloads, logistical challenges, and social problems (Ryschawy et al. 2019). They found that farming systems might potentially become less vulnerable, while becoming more sustainable (Catarino et al. 2021) also increasing gross margins (Ryschawy et al. 2019).

Organic farming practices

The present topic includes those studies ($n=5$) that have examined the sustainability performance of organic farms and their role in fostering AET. Agroecology is increasingly understood to be an evolution of organic farming, especially regarding crop management. The empirical studies are based on a variety of indicators, i.e. gross margin and return on investment, and employed several methods such as cluster analysis, life cycle assessment (LCA), endogenous switching regression model, and production function framework. Some studies focus on the factors that might stimulate farmers to adopt agroecological practices in their organic farms. Kleemann and Abdulai (2013) found a higher propensity to adopt agroecological practices in the presence of organic certification. Moreover, Pépin et al. (2021) identified some differences between "agroecological" organic farms and "conventionalised" organic farms that are based on input substitution. They discovered that farms created as organic tend to be more agroecological than farms converted from conventional farming. Furthermore, while some long supply chains exhibit good agroecological performances, the best ones are associated with short supply chains. Likewise, other authors investigated how agroecological organic farming affects farm economic and environmental outcomes. According to Montalba et al. (2019), agroecological organic farming has the least negative environmental effects on freshwater eutrophication, acidification, and global warming when compared to conventional and conventional organic farming. Additionally, agroecological farms achieve the highest yields and the lowest costs of production. Similarly, other researchers found that agroecological organic farming has more advantageous economic outcomes in terms of return on investment (Kleemann and Abdulai 2013) and gross margins (Mohamad et al. 2018; Schader et al. 2021).

Others agroecological farming practices

These studies ($n=7$) concern the assessment of some other agroecological practices that differ from those previously illustrated. Different methodologies have been

employed by the authors, such as sustainability indicators analysis, cost–benefit ratio analysis, spatial diffusion model, and Characterization of Agroecological Transition (CAET). Some authors looked at the impact of incorporating biocontrol practices into farming pest management. They discovered that using natural methods based on plant extracts to control and manage crop pests and diseases covers all ten elements of agroecology and does not significantly increase farmer costs (Belmain et al. 2022). Another study found that biocontrol improves profit while reducing pesticide use (Martinet and Roques 2022). Other authors investigated the effect of using organic fertilisers instead of chemical ones, demonstrating that the substitution enhances economic performance by increasing profitability (Cabanillas et al. 2017; Kocira et al. 2020; Escobar Cazal et al. 2021). Additionally, De Leijster et al. (2020) analysed the economic performances of introducing three different agroecological practices: no-tillage, green manure, and compost. The authors found that the economic benefits depend on the practice adopted. In particular, the adoption of compost increases revenue, while no-tillage and green manure reduce economic outcomes. Finally, Ameur et al. (2020) investigated the effect of several agroecological practices, finding that their introduction enhances land use and input efficiency, and reduces exposure to market risks and production costs.

Conventional versus agroecological farming

These studies ($n=10$) aim to compare agroecological farming systems with conventional ones. As for conventional farming systems is meant a farming system which is not based on agroecological principles (generally called industrial farming system or based on intensive use of fossil fuel and chemicals). The articles assess the sustainability performances applying different methodologies. Some researches are mainly based on comparing several indicators, i.e. income, resilience, energy return on investment. Other researches used Sustainability Assessment of Food and Agriculture Systems (SAFA) and multitemporal economic analysis, such as budget, probabilistic cash flow, and cost–benefit analyses. All the studies agreed that agroecological production systems have a positive impact on environmental sustainability, impacting several aspects such as the maintenance of scenic landscapes, biodiversity, input usage (e.g. reducing pesticides, fossil fuels, and energy), and water and soil quality (Balamatti and Uphoff 2017; Aparicio et al. 2018; van der Ploeg et al. 2019; Landert et al. 2020; Pronti and Coccia 2020a, b; Gil et al. 2022). Moreover, they found that agroecological practices positively influence the social domain by increasing the number of workers involved in the production process (van der Ploeg et al. 2019; Gil et al. 2022), the well-being of farmers and employers (Soldi et al. 2019; Landert et al. 2020) and food security (Pronti and Coccia 2020a, b). However, the findings about the economic impact are divergent. Some authors found that the introduction of agroecological principles into farm management increases incomes (van der Ploeg et al. 2019), profitability (Balamatti and Uphoff 2017; Aparicio et al. 2018), income stability and economic resilience (Soldi et al. 2019; Pronti and Coccia 2020a, b). Moreover, (Lalani et al. 2017) found that there are short-term benefits, but they mostly depend on the crop mix and the labour opportunity cost. Additionally, (Pronti and Coccia 2020a, b) found that even if agroecological farms yields are lower, economic results in terms of income stability are higher than those of conventional farms. Finally, other studies highlighted that there are no significant differences in revenue between the

farming systems under investigation (Capellesso et al. 2016). However, according to Gil et al. (2022) although if there are similar financial returns among production systems, the flow of value-added is distributed more equally among actors of the agroecological supply chain than in the conventional ones.

Impacts of agroecology at territorial scale

This sub-topic includes articles ($n = 15$) that approached the impact of AET beyond the farm scale, looking at the territorial scale. This sub-topic differs from the others because many aspects are far beyond the control of the individual farm, taking into consideration the interactions of farms with the wider food system to fully assess the effects on sustainability performances (Resare Sahlin et al. 2022). Therefore, authors employed novel methodology to evaluate the effect of adopting agroecological practices on farming sustainability at territorial scale. This is because numerous tools for assessing sustainability performance of the agricultural systems are not adequate to measure the effect of agroecological practices (Trabelsi et al. 2016). Therefore, some authors applied a Framework for the Evaluation of Management Systems incorporating Sustainability Indicators called MESMIS to evaluate the sustainability of the agroecosystems. In particular, Calderón et al. (2018) found that agroecological farms enable increased resilience to environmental and economic factors, the latter because they can offer a wider range of products in local markets. Furthermore, Domínguez-Hernández et al. (2022) found that agroecological fertilisation management improves the sustainability and overall resilience of the systems, having a favourable impact on production, soil health, and a favourable benefit–cost ratio. Moreover, Volkmer and Pedrozo (2019) adapt the 3D sustainability model for analysing agroecological farms located near or within protected areas considering not only environmental, social, and economic sustainability, but also system carrying capacity. In addition, Padró and Tello (2022) developed the Sustainable Agroecological Farm Reproductive Analysis (SAFRA) to assess the most sustainable agroecological scenarios that could be implemented. The authors observed that the best possible scenario would be the intermediate one between that in which food is purchased locally, and that in which trade specialisation allows to satisfy the food supply. Finally, a new method named as Tool for Agroecology Performance Evaluation (TAPE) was introduced by Mottet et al. (2020). It is a multi-step methodology that can be used to evaluate economic, social, and environmental performance in relation to ten elements of agroecology. This methodology has been applied by several authors, which found different agroecological performances. Lucantoni et al. (2023) found that agroecological farming performs better in economic terms and produces higher income, while using less external and industrial inputs than conventional systems. Additionally, more advanced agroecological farms use less agrochemicals, have greater soil health, higher levels of agrobiodiversity, and more natural vegetation and pollinators on their property. All these factors all contribute to the environmental dimension of sustainability. Comparable trends are seen in the social aspect of sustainability: households with advanced agroecological practices have more food security and dietary diversity. Furthermore, there is a clear and solid connection between youth empowerment and the agroecological transition. Additionally, agroecological farms are able to maintain a larger population in rural areas and employ a larger share of the family directly on the farm, including women and young people. Similarly,

Barrios Latorre et al. (2023) found that agroecological practices improve performance as regards social and environmental aspects. Ultimately, the income criterion was deemed unsustainable, as the majority of farmers reported a decrease in their income over time, although they did not think that it differed significantly from regional values. Lastly, Passaro and Randelli (2022) emphasised the importance of collaboration in enhancing agroecological performances, by highlighting the function of biodistricts as groups of actors who share similar social and human values and foster an atmosphere favourable to knowledge creation and exchange. Finally, several other studies applied heterogeneous methodology based on different indicators (i.e. net revenues, gross margin, and holistic risk index) to evaluate the economic aspects of agroecological farming systems. The authors found that the adoption of agroecological practices positively impact the resilience (Auffhammer and Carleton 2018; Machado-Vargas et al. 2018), and profitability (Auffhammer and Carleton 2018; Rakotovao et al. 2021; Laske 2022). On the contrary, Stratton et al. (2021) found that early-stage farmers face lower incomes and challenging working conditions, but experienced agroecological smallholders with strong peer support and access to diverse markets have higher net household incomes and improved work quality.

Food security and food sovereignty

This topic includes seven articles that explore, through different approaches, the relationship between agroecology and the issues of food security and food sovereignty. Most of these studies concern countries from the Global South.

Agroecology and food security

These studies ($n=4$) specifically analyse how, and to what extent, agroecology may contribute to reach food security and nutrition goals. In particular, van Zutphen et al. (2022) theoretically identify the multiple pathways through which agroecology can impact on food security by analysing in-depth the 13 FAO agroecological principles which have been recognised as an actionable framework to catalyse agri-food system transformations, and to improve the likelihood of meeting global nutrition needs. The other three studies, instead, provide empirical assessments of the postulated linkage between agroecology and nutrition outcomes, by considering specific case studies in different countries, specifically Ecuador (Deaconu et al. 2021), Malawi (Nyantakyi-Frimpong et al. 2016) and Guatemala (Rice et al. 2023). These studies use mixed methods of analysis (key informant interviews, questionnaire surveys, focus group discussions) to demonstrate that peasant communities adopting agroecological practices have more adequate nutrient intake and dietary diversity, mainly due to a wider diversification of food production. In particular, Rice et al. (2023) also emphasise the key role of social networks and mutual solidarity within agroecological peasant communities in supporting more equal access to food.

Agroecology and food sovereignty

These studies ($n=3$) provide empirical evidence on how agroecology may contribute to reaching food sovereignty. In particular, Hernández et al. (2017) measure a set of food sovereignty indicators on a sample of peasant families in Mexico, and demonstrate that

the adoption of agroecological practices contribute to build sustainable agri-food systems strongly rooted in local knowledge, culture, and food production and consumption practices, adequately meeting the nutrition needs of local communities. On the other hand, Calvário (2017) and Diaz and Hunsberger (2018) used qualitative research methods to investigate how food sovereignty is understood, and how it can be achieved by farmers participating in agroecological organisations in Puerto Rico and Spain. Results show that food sovereignty is essentially understood as the right of self-determination and, in particular, the right to decide autonomously how to ensure adequate food access for local communities. In particular, the authors emphasise the strategic importance of AET as a key process for reaching food sovereignty through supporting ideological struggles, helping build alliances and pushing towards collective mobilisation in order to break down social and political barriers that hinder the transition towards food sovereignty.

Market studies

This topic includes 21 articles which investigate market issues strictly related to the transition process towards agroecological food systems. Most of these studies have been carried out in the Global South.

The role of consumer

These studies ($n=4$) highlight that the transition process towards agroecological food systems needs to shift from farm-level solutions to the interactions within the entire value chain, from production to consumption. Following a demand-driven approach and using econometric analysis of consumer' survey data, two studies, conducted in Mexico (Revollo-Fernández 2016) and Brazil (de Araújo and Marjotta-Maistro 2023), demonstrate that agroecology is not necessarily a type of subsistence farming, because there is a relevant segment of consumers strongly interested in purchasing agroecological food products, also by paying a premium price. The other studies, instead, emphasise the importance of the active role of consumers in planning and managing the overall agroecological food circuits, from production to consumption, as a powerful force for driving the transition process. In particular, Mehrabi et al. (2022) conducted a theoretical analysis based on the multi-level perspective (MLP) approach to investigate how consumers/citizens may be more actively involved in AET, by also identifying the business models with higher degrees of consumers/citizens engagement such as collective food buying groups, participatory guarantee systems, crowd farming, self-harvested gardens and community supported agriculture. Instead, Castilla Carrascal (2021) used ethnographic methods (participant observation, in-depth interviews) to analyse an exemplary case of a pioneer collective food buying group in Ecuador, later organised as a solidarity economic circuit, that was successful in reconnecting indigenous-peasant practices to the entire local communities, by fostering agroecological food production and consumption as a right, not a privilege.

The role of labelling

These studies ($n=3$) analyse the effectiveness of this specific market tool for supporting and fostering AET. In particular, Swagemakers et al. (2021) used a case study approach

and mixed qualitative research methods to investigate the role of green labels in different European countries, and show that, despite these labels effectively communicate to consumers some readjustments to sustainability, a more profound transition to agroecology needs to design and implement what is really sustainable at local level. On the other hand, Arroyo-Lambaer et al. (2022) conducted a qualitative study using cognitive mapping in Mexico to investigate the points of view of producers about the introduction of a specific label to differentiate food products coming from a local agroecological system. Results show that producers perceive some relevant constraints in implementing the proposed green label, in particular due to the high costs of certification. Finally, Hirata et al. (2019) used mixed qualitative methods to analyse a case study of Participatory Guarantee System in Brazil, and highlight that this specific certification system, based on the assessment of organic compliance combined with technical assistance for the adoption of agroecological practices, has greatly contributed to strengthening agroecology at local level.

The role of alternative food networks

These studies ($n = 14$) provide empirical assessment on how, and to what extent, Alternative Food Networks (AFNs) may contribute to the transition towards agroecological food systems. AFNs are specific organisations based on the partnership and social cooperation between consumers and small-scale farmers at local level, with the aim to re-connect consumption and production by using short distribution channels such as farmers' markets, collective points of sale, box schemes, farm shops, and other forms of direct selling. In particular, three studies (Nigh and González Cabañas 2015; Darolt et al. 2016; Muñoz et al. 2021) used mixed qualitative research methods to investigate and compare different experiences of AFNs in both the contexts of North and South of the world. These studies emphasise the key role of AFNs as the more suitable options for the growth of agroecology, but they also identify some relevant weaknesses of these market organisations, mainly related to their limited dimensional scale. Other studies (Espelt et al. 2019; Espelt 2020; Cechin et al. 2021; Levidow et al. 2022; Moreira 2022) focus on the most advanced model of AFNs, namely Community Supported Agriculture (CSA), which is a long-term institutional arrangement between local consumers and small farmers who agree in advance what, how much, and how to produce, as well as the prices to be applied for product exchange. By using a case study approach with both qualitative and quantitative methods of analysis, these studies investigate the functioning of different CSAs in various countries (Brazil, Portugal, Spain), concluding that they are capable to strongly facilitate the adoption and spreading of agroecological practices, even though there are some limitations mainly related to the lack of professional management. Finally, the remaining studies investigate farmers' markets, which represent the most common circuit for the distribution of agroecological food products worldwide (Chaparro-Africano and Calle Collado 2017; Chaparro-Africano 2019; Santos et al. 2014; Perez-Castillo 2021; Gütschow and Feola 2022; Little and Sylvester 2022). These studies also used a case study approach with both qualitative and quantitative methods of analysis to highlight that farmers' markets are not only organised spaces where producers and consumers exchange agroecological food products and share utilitarian benefits, but they are also spaces for establishing and strengthening social relationships (both

farmer-to-consumer and farmer-to-farmer) which are essential for spreading agroecological practices.

Political dimension

According to Wezel et al. (2009) agroecology embraces three dimensions: science, practice and social movement. In the latter dimension falls the political dimension of agroecology dealing with systems of governance, the associated institutions and consequent role of policies. The literature falling under this topic ($n=40$) comes mainly from emerging economies of the Global South, with a prevalence from Latin America. Only a few studies concern United States of America (USA) and European Union (EU) countries. Largely, case study approaches and qualitative surveying methods are common methodologies used to report real experiences, to outline policy design and to assess impacts of ongoing agri-food transformations towards agroecology. According to the specific objectives explored, the studies included in this topic were grouped into four sub-topics.

Food politics

The studies ($n=9$) encompasses food policy, legislation and institutions to food contentions and movements. Agroecology as a social movement draws from agrarian social thought focused primarily on campesino struggles over land. The Via Campesina has been among the first grassroot actions undertaken in Latin America. Acevedo-Osorio and Chohan (2020) report the experience of Peasant Reserve Zones as a legal tool for territorial ordering, created in 1994 in Colombia, to guarantee campesino access to land and to stop agribusiness land concentration. Peasant-led agricultural cooperative formation of Movimento dos Trabalhadores Rurais Sem Terra and its political effects in the established agrarian reform settlements in Brazil is analysed in Robles (2019).

Agroecology as a social movement aims at achieving food sovereignty. To gain this objective is crucial rethinking the current industrial food system, i.e. how we currently produce and distribute food. Harvie (2019) explores the case study of Fresno (California) by tracing early lessons from a new economic system, called The Food Commons, based on agroecological approach to local and regional food. The takeaways from The Food Commons are (1) the key role of local and regenerative capital formation, (2) the need of find, build and support human capital, and (3) to promote the ecological model of health.

The social and political claims of agroecology are further stressed by Giraldo and McCune (2019). Giraldo and Rosset (2022), using case study methodology of worldwide agroecology experiences, propose seven principles for a truly transformative agroecology. Along the same line is the politic thought that arises in the essay of Holt-Giménez and Altieri (2013). Indeed, agroecologists face important choices between reformism (the way agribusiness attempts to co-opt agroecology into the Green Revolution) and radical versions of agroecology within a politically transformative peasant movement for food sovereignty. Cadieux et al. (2019) using the frame of populism try to cross current right-wing populisms in USA over the food sovereignty, environment governance arguments of agroecology. The dichotomy of land sparing vs. land sharing is exemplified by de la Vega-Leinert and Clausing (2016) who argue on the technocratic vision of agriculture conservation. The paper concludes that technocratic sustainable intensification

does not address unequal access to land natural resources, bypassing political issues of food autonomy. The autonomy concept within the agroecology scope is critically revised in a theoretical essay by Jansen et al. (2022).

Gender equality

Agroecology aims to build food systems based on social and gender equality of local communities (HLPE 2019). The studies under this sub-topic ($n=6$) focus on the enhancement women's empowerment (e.g. participation in farm decision-making and control over income). How the gender-specific aspects facilitate female participation and leadership in farming households and communities is reported in Benítez et al. (2020). For instance, Valencia et al. (2021) analyse how Brazil's targeted public food procurement program influenced women's empowerment in southern Brazil. Other experiences from Brazil (Feitosa and Yamaoka 2020; Ferreira et al. 2020) demonstrate that higher involvement of women as active agents of transformation results in strengthening social ties and in more participatory forms of governance. Ferreira et al. (2020) investigate the engagement of women in agroecological farms with animal husbandry in Minas Gerais State (Brazil), highlighting that women's work is essential both in terms of quantity and variety of tasks performed. Both studies conclude that although agroecological principles explicitly include women's emancipation and gender equality as essential conditions for the sustainability of agri-food systems, relevant inequalities continue to characterise the condition of women even in agroecological contexts. As a matter of fact, Larrauri et al. (2016) use an original indicators framework to perform a comparative analysis on the level of women's equity and empowerment in two different cacao-producing peasant families in Ecuador, one adopting agroecological practices, and the other one adopting conventional practices. Results show that in both cases women were under situations of inequality with respect to their husbands, but agroecological farming guaranteed a higher level of inclusion compared to conventional farming. Mestmacher and Braun (2021) call for the feminist theory perspectives to create conditions for peasant organisation to bloom in Chile. According to their results, a policy in favour of agroecology would also have to take a feminist perspective.

Policy design and implementation

In the studies ($n=11$), the adoption and diffusion of agroecological farming practices is the core of scientific literature from developed economies (USA and EU). By contrast, family farming and food security are the political priority given by Brazilian Government to AET.

One common point across literature is that the agroecological approach tries to replace farming management based on intensive use of fossil fuel and chemicals with knowledge-intensive practices. To this regard, measures such as training facilities and education initiatives for enabling an agroecologically skilled workforce have been proposed for AET in the USA (Carlisle et al. 2019) and in EU (Miller et al. 2022). Some papers concern the EU Common Agricultural Policy (CAP). For instance, in De Sartre et al. (2019) a comparative analysis is carried out on two French policy measures, one inspired by ecosystem services as recognised under the second pillar of the CAP, and the other by agroecology principles based on local farmers' networks and on social,

economic, and ecological changes to farming practices. Gava et al. (2022) report findings from 15 European countries of CAP instruments to support AET in Europe. They used participatory research methods, based on the involvement of multiple actors, for exploring the potential of policy design to remove relevant barriers to AET. According to their findings, although agroecological farming practices already benefit from CAP support, the main challenge for agroecological food systems transition is strengthening the value chains. To this regard, Guareschi et al. (2023) outline strategies for the valorisation of organic products under the social and economic principle of agroecology, by analysing the Italian case of Parma organic district. Morris and Bucini (2016) propose to reshape the current agricultural policies and economic incentives in California (USA) applying an agroecological approach to spread adaptive farming practices to drought.

DeLonge et al. (2016) assessed the amount of federal funding in the USA since 2014 devoted to sustainable agriculture, including agroecology. The limited role of USA's research founding program in agroecology is also argued by Miles et al. (2017), who outline how policy tools could be shifted to better support the development of more resilient and equitable food systems.

Strakos and Sanches (2017) discuss the role of public policy to promote agroecological practices for the progressive realisation of the human right to food by the Brazilian State. According to the authors, in a country with a major social inequality gap like Brazil, agroecology might represent a decisive strategy for social and economic inclusion of smallholder farmers. Diesel and Miná Dias (2016) carry out a critical analysis of the pros and cons of agroecological extension service PNATER (Rural Extension and Technical Assistance National Policy), implemented in Brazil between 2004 and 2015. Finally, policies addressing family farming in Brazil are analysed by Petersen and Silveira (2017). Major policy impact derives from land reform by which family farming achieved food autonomy, job, and income opportunity integrated into the local community.

Policy impact

This sub-topic embraces studies ($n=14$) whose attempt is to assess impacts of past and ongoing policies. A first group of research attempts to evaluate the potential of agroecological practices for reducing the use of chemical inputs. Palmisano (2023) carries out an analysis of in-depth interviews and ethnographic notes on farming families that are constructing alternatives to pesticides in Latin America. Findings point to the existence of nuances between technical components, economic balance, and cultural elements that influence low-pesticide production strategy. Bernal Hoyo et al. (2022) explore through a simulation model the effect of agrochemical subsidies on the lives of farming families. Findings report that chemical inputs deployment leads to decrease long-term economic and ecological balance of farming, while agroecological practices reverse such impacts. According to Röös et al. (2022), who scenario analysis conducted with local food supply stakeholders, representing knowledge and views from 13 EU countries, agroecological practices can help to meet EU food system policy targets only in combination with healthy diets. Economic impact assessment of recent regulation in Mexico to ban GM maize along with glyphosate, while replacing it with agroecology maize production practices, has been carried out by Macall et al. 2022. The authors found that this political choice will result in higher domestic retail food prices for animal-based products.

A second group of research is framed into the sustainable development framework and offers lessons derived from several public policies worldwide. By analysing the public policies that Cuba enacted since the early 1990s for leading AET, Machado (2022) highlights the role that smallholders play in development discourse and practice. Moseley (2022) reports the personal experience of a cooperation project carried out in Burundi, a State with political instability and international market isolation. He shows how the "Crop Livestock Integration Project" succeeded in enhancing wealth and nutrition of smallholder farmers. Veluguri et al. (2021) conducted political analysis of a pioneering program for up-scaling agroecology practices in India. They revised the main policy measures and institutional changes over the last 20 years within the "Community Managed Natural Farming" program. Barbanti (2013) analyses the "Pilot Programme to Conserve the Brazilian Rainforests", intended to promote sustainable development in the Amazon Forest area, with a key component being community-based agroecological and agroforestry production. Gómez-Ceballos et al. (2021) based on qualitative and quantitative research methods try to outline main factors that are limiting the impact of food policy in Ecuador. The main constraint is the lack of involvement of family farming within the local governance process. The agrarian reform carried out in Venezuela in 1998 and the role played by structures and incumbent state agents are discussed in Enríquez (2013).

A third group of research concerns policy experiences of public food procurement programs. Apart from Simón-Rojo et al. (2020) concerning a survey conducted in Spain, all other empirical studies analyse different food program procurement in Brazil. The "National School Feeding Program", which offers both a structured market for small-scale family farmers and a price premium for certified (organic) agroecological production systems is revised in Guerra et al. (2017) and Valencia et al. (2019). Success of policy is largely driven by external network linkages, such as participation in farmers' associations, cooperatives, and non-governmental agricultural extension programs that support agroecological practices. Through the perception of family farmers, an assessment of how food policies (e.g. Rural credit programs, Food Procurement Programme, Land regularisation) have impacted the food system in Brazil is carried out by Brandão et al. (2020).

Research and education agenda

The studies in this topic ($n = 14$) concern the research and education programs dealing with agroecology. Some articles focus on different innovative research approaches to grasp the complexity of the theme, including socio-economic aspects. Other articles focus on the potential socio-economic benefits of educational initiatives in producing and disseminating agroecological knowledge. Finally, other studies discuss the main knowledge gaps that scientists should address in agroecological research field.

New research approach

The papers in this sub-topic ($n = 6$) highlight the need for innovative research approaches to better study the implementation of agroecology in agri-food systems. The authors implemented several qualitative methodologies, including multi-actor evaluation, multivariate analysis, and SWOT analysis. In particular, some authors emphasise the need of

a participatory approach in strengthening relationships among different actors (Guzmán et al. 2013), allowing researchers and students to have a more holistic view of the agri-food systems (Francis et al. 2013; Guzmán et al. 2013). Likewise, in contrast to top-down research approaches, an action-oriented approach may enable the creation and sharing of bottom-up knowledge (Francis et al. 2013; Gaba and Bretagnolle 2020). Moreover, Castro et al. (2019) highlight the relevance of adopting a multi-actor transdisciplinary research approach to favour collaboration and shared responsibility among all actors, both researchers and stakeholders of the agri-food system. Similarly, Reynolds et al. (2014) and Gaba and Bretagnolle (2020) suggest incorporating in the research approach the social economic and ecological dimensions. Finally, Silva and Tchamitchian (2018) emphasise the role of long-term studies and research infrastructure that are essential for managing agroecological issues.

Knowledge gaps in agricultural research and policy

Basing on these studies ($n=3$), there are some major challenges related to agricultural research and policy that should be addressed to foster AET. For instance, van Hulst et al. (2020), by applying a novel mental modelling approach, found that farmers and scientists interpret the notion of agroecology differently. Specifically, farmers consider agroecology mainly as a set of farming practices that allow them to preserve the environment and satisfy the emerging needs of consumers. Differently, scientists deem agroecology as a discipline that studies ecological processes in agricultural systems.

Another crucial issue highlighted by DeLonge et al. 2020 refers to the public financing of research on agroecology. The content analysis applied by the authors shows that public funds in many cases have constraints in terms of duration and volume, which are not in line with the time required to investigate the AET. Finally, Andres and Bhullar (2016) emphasise the lack of economic methods for the assessment of ecosystem services generated by agricultural systems, in order to compare the true costs that farmers face for adopting more sustainable approaches, such as the agroecological one.

Educational initiatives

These studies ($n=5$) analyse some educational initiatives, such as master's and training courses, which are focused on the transfer and creation of knowledge in the agroecological field of study. Specifically, by applying a regression analysis Xu (2018) highlighted the key contribution of education programs in agricultural science for the growth of the agricultural economy and the formation of young talented researchers and technicians. Moreover, Wang et al. (2019) found that a system-oriented teaching model based on agroecology creates scientists and citizen aware of agroecology and able to collaborate with all food systems actors and stakeholders. Additionally, Hockin-Grant and Yasué (2017) with an analysis of variance (ANOVA) emphasise the role of educational programs in fostering the spread of agroecological practices. Other authors, by applying a social network analysis, investigated farmer-led educational initiatives, finding that farmers value social and autonomous learning more than institutional learning (Laforge and McLachlan 2018). Indeed, most agroecological knowledge is held by local farmers, basing on their on-field experiences. Such initiatives strengthen the relationships between actors and stakeholders, improve farmers' agroecological management skills

and promote socio-economic restoration of rural areas as shown by the LEISA systematisation method applied by Chavez-Miguel et al. (2022).

Rural and urban development

In this strain of literature ($n=9$), agroecology is considered as a foundational paradigm on which new models of rural and urban development can be established, with an emphasis on strengthening the urban–rural nexus and improving food system sustainability at local level. Also, the feasibility of incorporating agroecological principles into the territorial planning is investigated.

Planning

The papers under this sub-topic ($n=4$) refer to the potential role that the agroecological approach can play for addressing territorial planning. Addinsall et al. (2015) developed a framework for sustainable rural development, the Agroecology and Sustainable Rural Livelihoods Framework (ASRLF), that allows a more holistic approach and increases the ability to meet the needs of local contexts. Other authors implemented a critical analysis of case studies. In particular, Levidow et al. (2021) highlight the role of local actors in influencing each other and in the setting of various initiatives in rural development that could potentially challenge the dominant agri-food system. In particular, they focus on the relationship between local actors by considering three case studies of agroecological agroforestry farms. Tornaghi and Dehaene (2020) deepen how the dynamics of urbanisation may affect AET, and call for a radical refoundation of the planning agenda and agency, currently perpetuating food-disabling mechanisms, around the prefigurative concept of "agroecological urbanism". By exploring the case studies of London, Riga, Brussels, and Rosario, they suggest that such new urbanism model could build on urban–rural nutrients cycling, peri-urban land use, community food pedagogies, and empowering infrastructures. Finally, Bohn and Chu (2021) show how an attentive urban design drawing on landscape ecology can enable AET, by providing food productive spaces. Analysing the multiple services for nature and society provided by existing greenways in Shanghai and London, they discussed how traditional green infrastructures can be reoriented towards urban food system reshaping, under the design concept of Continuous Productive Urban Landscape (CPUL).

Urban agriculture

In this sub-topic some agroecological initiatives implemented in urban and peri-urban agriculture have been investigated ($n=5$). These initiatives are useful to address the challenges related to food security, cities quality of life, resource depletion, with positive effects on the nexus between rural and urban environment. These studies are based on several methodologies, including classification and regression trees (CART) analysis, content analysis, inductive and deductive analysis and critical analysis of case studies. Moreover, a variety of sustainability dimensions, such as technical-productive, territorial, and socio-political aspects, were used to assess the performances of the agroecological development of the cities.

Urban agricultural practices can be in line with agroecological principles and contribute to the sustainability of cities by providing a range of social, economic, and

environmental services to neighbouring communities (Alarcón-Rodríguez et al. 2019; Arnold 2022). Nagib and Nakamura (2020) emphasise the active role of urban agriculture initiatives in establishing new food paradigms by creating solidary economy networks and markets and stimulating the creation of supportive policies. Hammelman et al. (2022) found that devoting attention to the agricultural productivity of peri-urban areas has several benefits: increases the awareness about the value of agroecological products and the need to guarantee fair prices to producers, and encourages social inclusion and the emergence of social values. Bertran-Vilà et al. (2022) emphasise the relevance of social and cultural capital for peri-urban farmers in consolidating their economic-productive enterprises and establishing connections with city customers.

Discussion

The literature review succeeded in replying to our research questions. In detail, the review contributes to map the existing literature on socio-economic issues of agroecology by highlighting (1) the most explored socio-economic dimensions, and (2) the results achieved by scholars. Besides, the findings acknowledge an overview of the main methodologies applied to investigate the different economic issues.

By applying the PRISMA-ScR methodology a total of 183 papers were identified. The analysis of the literature allowed us to recognise seven main research topics: (1) agroecological transition, (2) assessment of production systems, (3) food security and food sovereignty, (4) market studies, (5) political dimension, (6) research and education agenda, and (7) rural and urban development. However, it is worth noting that many of the selected articles were multifaceted, often concerning more than one topic or sub-topic. The final classification was drawn by identifying the most relevant contribution of each article, without considering eventual overlapping among topics or subtopics.

Our literature review covers most of the research fields in the agricultural economics domain as outlined by Fresco et al. (2021), ranging from land and farm level to the entire food chain, including the consumers and the environment. One issue that has been under-investigated in the reviewed literature refers to climate change. Agroecology is often acknowledged as an approach that might mitigate the negative effects of climate change by developing more resilient systems. However, empirical studies aimed to address the challenges associated with climate change are scant.

Regarding the methodological insights, our analysis revealed that qualitative approaches were the most employed research methods. Even when quantitative methods were used, the sample size was often small, undervaluing statistical representativeness. This aspect can affect the external validity of the results and limit their ability to be generalised to the entire reference population.

A key methodological issue emerging from the literature is the need for bottom-up approaches instead of the traditional top-down scientific methods. This means working closely with farming communities to understand their needs and concerns and implementing a collaborative research approach. By creating networks of stakeholders and promoting shared responsibility, a culture of cooperation can be fostered, leading to more effective and sustainable agricultural practices (Méndez et al. 2013; Gaba and Bretagnolle 2020). In addition, when it comes to analysing the complexity of agroecological systems, an approach based on direct and participant observation may be more

effective than traditional theory-based approaches. Such an approach could better prepare researchers for the transdisciplinarity required for the study of agroecology. Also, multi-dimensional approaches should be preferred to gain a better understanding of the subject and to increase the relevance of outcomes. Another relevant methodological issue relates to the need of shifting from cross-sectional analysis to multi-temporal analysis, given that the impacts of AET should be looked over time. Finally, the level of analysis should be extended from the plot and farm scale to the territorial food system.

There are several research implications emerging from this literature review and they can be articulated for each topic identified (Table 5). Specifically, the literature on AET shows that systemic transition processes involve technological, organisational, societal, and institutional transformations. Besides, evidence-based insights suggest that AET requires a strong structural support, as well as much organisation. Despite the rise of an agroecological movement at global level, there is a wide recognition that transition dynamics, potential, barriers, and appropriate strategies are highly context specific. Thus, multiple transition pathways, rather than a unique uniform process, may take place even across a country. The adoption of specific agroecological practices and management strategies, the ways to adapt them, and the challenges for transitioning may vary from one farm to another. Because multiple transition pathways

Table 5 Future research avenues per topic analysed in the review

Topics	Future research avenues
Agroecological transition	Analysis of context-specific transition pathways Analysis of interactions between agroecology and other innovative approaches in the sustainable transition process Development of autonomy-supportive policies that leverage on farmers' behaviours and motivations
Assessment of production systems	Economic assessment of ecosystem services provided by agroecological farming Analysis of potential trade-off between social, economic and environmental sustainability dimensions Development of more appropriate methodologies based on comparable and robust evaluation of agroecological farming
Food security and food sovereignty	Analysis of potential socio-economic impacts of scaling up agroecology both in developing and in developed countries
Market studies	Identification of novel and effective market outlets for agroecological food products Assessment of the economic potential of developing a certification label to foster agroecological transition
Political dimension	Analysis of policy instruments aimed to increase the participation of stakeholders across the entire agri-food system, preferring a bottom-up strategy Assessing whether to implement ad hoc agroecological policies or to adapt the existing agricultural policies Analysis and design of payment policies that are based on results and ensure that the amount paid is proportional to the expected benefits Deepening the understanding of gender inequality in the Global North while also assessing the impact of agricultural policies on gender equity
Research and education agenda	Implementing research infrastructure for long-term research based on participative approaches Analysis of educational initiatives based on grassroot action
Rural and urban development	Development of urbanism models, planning agendas, and design tools that enable agroecological practices Assessing the impacts of including food productive spaces in urban and peri-urban areas

towards agroecology may result from the combination of elements from different sustainable models, policymaking and implementation process should be coherent with the value system that qualifies the agriculture models they aim to change or support. The prevalence of qualitative research is intrinsic to the aims and analytical frameworks of the studies dealing with transition processes. While providing thorough and rich insights, qualitative results are inevitability subject to authors' interpretation, depend on informants' involvement and perception and may present limitations when their representation is unbalanced. Besides, findings from the case study analysis are conditioned by the interplay of circumstantial factors, thus inferring generalisable evidence should be further corroborated by temporal and spatial comparison. A greater integration of qualitative and quantitative methods could generate more robust and complementary results.

The studies on the assessment of food production systems highlighted that the diffusion of agroecological practices is strictly dependent on their economic viability and attractiveness to farmers. This stream of literature emphasises that the negative effect on productivity and profitability in the short-term can discourage farmers from beginning or continuing to change their production system. The challenge is to strike a balance between short-term economic and long-term social and environmental goals. To foster AET, the role of agricultural policies should be to reduce the profitability gap during the early stages. There is a need to identify policy measures, such as paying for the ecosystem services provided by agroecological farming. However, the evidence supporting the contribution of agroecology to environmental, social, and economic sustainability is still fragmented. It could be related to the heterogeneity of methods and data, different scales (i.e. farm or territorial analysis) and knowledge gaps (Mottet et al. 2020). Therefore, to account for the complexity of agroecology, further research should aim to develop more appropriate methodologies based on objective evaluation of farming activities that will be widely accepted by the scientific community.

The studies on food security and food sovereignty demonstrated that agroecology has a strong potential in contributing to reach these important and ambitious goals. However, a research gap is related to the fact that this strain of literature focused on local communities essentially characterised by an economy of subsistence. So, further empirical studies are needed to investigate whether, and to what extent, agroecology may effectively contribute to improve the nutritional status of a wider population by considering more diversified socio-economic contexts, including those of developed countries.

Market studies demonstrated that the more suitable options for connecting the production and the consumption of agroecological food products are represented by AFNs which include a range of market organisations based on the partnership and social cooperation between consumers and small-scale farmers at local level. In particular, these studies emphasised the importance of the active role of consumers as a powerful force for driving the transition process towards agroecological food systems. However, these studies also identify a relevant weakness of AFNs, mainly related to their small dimension that, ultimately, represents an important obstacle for the spread of agroecology on a large scale. Therefore, there is a need of further studies aimed to identify complementary market solutions that would allow an effective and wider linkage between production and consumption of agroecological food products.

The studies concerning the political dimension embrace mainly qualitative analyses by using case study as the main research method. What is common in the literature is the attention paid for social movements that are intrinsically related to agroecology. Struggle for land access or food autonomy of family farms are key points. Nevertheless, it seems that in Global North the focus is on policies design and implementation, rather than questioning current food system. While some political arguments around food politics are recently emerging, the debate on agroecology with respect to the southern hemisphere is still in an initial stage.

Several studies emphasised the lack of knowledge about agroecology which hinder its adoption. Therefore, it becomes crucial to increase bottom-up initiatives aimed to promote the co-creation and sharing of knowledge. Yet, research and education agenda studies revealed the lack of public financing on these programs. In addition, the majority of teaching and research institutions have been oriented to single problem-solving solutions, rather than focusing on systemic and holistic approaches as the agroecological one. Therefore, farmer-led educational initiatives may represent an alternative path respect to the specific technical knowledge being generated through more formal scientific approaches. However, further research on this kind of educational initiatives based on grassroot action is needed.

Rural and urban development studies considered the inclusion of agroecology as a viable strategy to enact equitable food systems in rural and urban contexts, due to its potential to provide a suite of social, economic and environmental services to surrounding communities. These initiatives draw on agroecological approaches to offer more employment chances to young people, especially in low-income rural contexts, also curbing their exodus towards urban areas with higher population density, in search of better living opportunities. Furthermore, this path allows for the establishment of markets for local products, the development of agroecological ethics, and the sustainable productive use of public spaces. Finally, to support long-term, large-scale research and practice in agroecology for enabling urban design and landscape, a collaboration with funding organisations and policy makers is necessary.

Conclusions

The current scoping review on agroecology offers valuable insights into socio-economic aspects, methodologies, and outcomes in the field. The findings align with established socio-economic topics and reveal a noteworthy gap in addressing climate change challenges within agroecological studies. Methodologically, the review underscores the prevalence of qualitative approaches and emphasises the need for a shift towards bottom-up, participatory research methods. The call for direct observation, multi-dimensional analyses, and multi-temporal assessments highlights the complexity inherent in agroecological agri-food systems.

Research implications span various topics, emphasising the context-specific nature of agroecological transitions and the crucial role of structural support and coherent policymaking. The assessment of food production systems stresses the delicate balance required between short-term economic goals and long-term economic social and environmental objectives. Studies on food security and food sovereignty underscore the potential of agroecology while signalling the need for further exploration in diverse

socio-economic contexts. Market studies emphasise the role of AFNs and consumer engagement in driving agroecological transitions, recognising challenges related to scale. Political dimension studies shed light on social movements, land access, and policy focus, particularly noting a divide between the Global North and South. The review underscores knowledge gaps and advocates for bottom-up initiatives to promote agroecology in research and education agendas. Rural and urban development studies position agroecology as a strategy for equitable food systems, offering social, economic, and environmental benefits.

In summary, this review not only advances our understanding of agroecology but also highlights critical gaps and challenges that necessitate further exploration. The collaborative effort with stakeholders, policymakers, and funding organisations emerges as a key element in promoting context-specific, sustainable, and effective agroecological transition of agri-food systems.

Abbreviations

AET	Agroecological transition
AFNs	Alternative food networks
PRISMA-ScR	Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews
WoS	Web of Science core collection

Supplementary Information

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Supplementary Material 1.

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VF, MB, and LR contributed to the conceptualisation; VF, DC, MB, GG, SR, SS and LR assisted in writing—original draft; VF, DC, MB, GG, SR, SS, and LR contributed to writing—review and editing; VF and LR were involved in the visualisation; LR contributed to the supervision and project administration; LR acquired the funding. All authors read and approved the final manuscript.

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Availability of data and materials
The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests
The authors declare that they have no competing interests.

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References

Aare AK, Egmose J, Lund S, Hauggaard-Nielsen H (2021) Opportunities and barriers in diversified farming and the use of agroecological principles in the Global North-The experiences of Danish biodynamic farmers. Agroecol Sustain Food Syst 45:390–416. https://doi.org/10.1080/21683565.2020.1822980

Acevedo-Osorio Á, Chohan JK (2020) Agroecology as social movement and practice in Cabrera's peasant reserve zone, Colombia. Agroecol Sustain Food Syst 44:331–351. https://doi.org/10.1080/21683565.2019.1623359
Addinsall C, Glencross K, Scherrer P et al (2015) Agroecology and sustainable rural livelihoods: a conceptual framework to guide development projects in the Pacific Islands. Agroecol Sustain Food Syst 39:691–723. https://doi.org/10.1080/21683565.2015.1017785
Alarcón-Rodríguez ML, Chamy MD, Fernández-Castillo SV, Soto-Abarzúa J (2019) Agroecological practices in rururban lands of the Concepción metropolitan area. Contributions from social and solidarity economy to urban sustainability. Urbano 22:42–63. https://doi.org/10.22320/07183607.2019.22.39.03
Alexandre G, Cheval A, Perrette J et al (2021) Livestock activities in agroforestry systems in Guadeloupe: systems of production and functions. Agrofor Syst 95:1445–1458. https://doi.org/10.1007/s10457-021-00651-5
Alletto L, Vandewalle A, Debaeke P (2022) Crop diversification improves cropping system sustainability: an 8-year on-farm experiment in South-Western France. Agric Syst. https://doi.org/10.1016/j.agsy.2022.103433
Ameur F, Amichi H, Leauthaud C (2020) Agroecology in North African irrigated plains? Mapping promising practices and characterizing farmers' underlying logics. Reg Environ Change. https://doi.org/10.1007/s10113-020-01719-1
Andres C, Bhullar GS (2016) Sustainable intensification of tropical agro-ecosystems: need and potentials. Front Environ Sci. https://doi.org/10.3389/fenvs.2016.00005
Andrieu N, Blundo-Canto G, Chia E et al (2022) Scenarios for an agroecological transition of smallholder family farmers: a case study in Guadeloupe. Agron Sustain Dev. https://doi.org/10.1007/s13593-022-00828-x
Antonio GJY, De Assis RL, De Aquino AM et al (2019) The adoption of green manure processes applied to vegetable cultivation systems in mountainous environments of Rio de Janeiro State, Brazil. Open Agric 4:446–451. https://doi.org/10.1515/opag-2019-0042
Aparicio VC, Zamora M, Barbera A et al (2018) Industrial agriculture and agroecological transition systems: a comparative analysis of productivity results, organic matter and glyphosate in soil. Agric Syst 167:103–112. https://doi.org/10.1016/j.agsy.2018.09.005
Arnold JE (2022) On-farm spatial composition, management practices and estimated productivity of urban farms in the San Francisco Bay Area. Processes. https://doi.org/10.3390/pr10030558
Arroyo-Lambaer D, Zambrano L, Rivas MI et al (2022) Identifying urban agriculture needs and challenges for the implementation of Green Labeling in Xochimilco, Mexico. Front Sustain Cities. https://doi.org/10.3389/frsc.2022.892341
Auffhammer M, Carleton TA (2018) Regional crop diversity and weather shocks in India. Asian Dev Rev 35:113–130. https://doi.org/10.1162/adev_a_00116
Awazi NP, Tchamba MN, Temgoua LF (2021) Climate-smart practices of smallholder farmers in Cameroon confronted with climate variability and change: the example of agroforestry. Agric Res 10:83–96. https://doi.org/10.1007/s40003-020-00477-0
Balamatti A, Uphoff N (2017) Experience with the system of rice intensification for sustainable rainfed paddy farming systems in India. Agroecol Sustain Food Syst 41:573–587. https://doi.org/10.1080/21683565.2017.1308898
Barbanti O (2013) From peasants to 'project beneficiaries': the case of the Brazilian Amazon PPG7 demonstration projects. Agrar South 2:71–92. https://doi.org/10.1177/2277976013477182
Barrios Latorre SA, Sadovska V, Chongtham IR (2023) Perspectives on agroecological transition: the case of Guachetá municipality, Colombia. Agroecol Sustain Food Syst 47:382–412. https://doi.org/10.1080/21683565.2022.2163449
Belmain SR, Tembo Y, Mkindi AG et al (2022) Elements of agroecological pest and disease management. Elementa. https://doi.org/10.1525/elementa.2021.00099
Benítez B, Nelson E, Romero Sarduy MI et al (2020) Empowering women and building sustainable food systems: a case study of Cuba's local agricultural innovation project. Front Sustain Food Syst. https://doi.org/10.3389/fsufs.2020.554414
Bernal Hoyo D, Giraldo OF, Rosset PM et al (2022) Building an agroecological model to understand the effects of agrochemical subsidies on farmer decisions. Agroecol Sustain Food Syst 46:712–735. https://doi.org/10.1080/21683565.2022.2039837
Bertran-Vilà M, Pasquier Merino AG, Villatoro Hernández JG (2022) Food producers in the peri-urban area of Mexico City. A study on the linkages between social capital and food sustainability. Sustainability (switzerland). https://doi.org/10.3390/su142315960
Beudou J, Martin G, Ryschawy J (2017) Cultural and territorial vitality services play a key role in livestock agroecological transition in France. Agron Sustain Dev. https://doi.org/10.1007/s13593-017-0436-8
Bezner Kerr R, Madsen S, Stüber M et al (2021) Can agroecology improve food security and nutrition? A review. Glob Food Sec 29:10054
Bjørnåvold A, David M, Bohan DA et al (2022) Why does France not meet its pesticide reduction targets? Farmers' socio-economic trade-offs when adopting agro-ecological practices. Ecol Econ. https://doi.org/10.1016/j.ecolecon.2022.107440
Bohn K, Chu D (2021) Food-productive green infrastructure: enabling agroecological transitions from an urban design perspective. Urban Agric Reg Food Syst. https://doi.org/10.1002/uar2.20017
Bonaudo T, Bendahan AB, Sabatier R et al (2014) Agroecological principles for the redesign of integrated crop-livestock systems. Eur J Agron 57:43–51. https://doi.org/10.1016/j.eja.2013.09.010
Bonnet C, Gaudio N, Alletto L et al (2021) Design and multicriteria assessment of low-input cropping systems based on plant diversification in southwestern France. Agron Sustain Dev. https://doi.org/10.1007/s13593-021-00719-7
Boulestreau Y, Casagrande M, Navarrete M (2021) Analyzing barriers and levers for practice change: a new framework applied to vegetables' soil pest management. Agron Sustain Dev 41:44. https://doi.org/10.1007/s13593-021-00700-4
Brandão EAF, da Santos TR, Rist S (2020) Family farmers' perceptions of the impact of public policies on the food system: findings from Brazil's semi-arid region. Front Sustain Food Syst. https://doi.org/10.3389/fsufs.2020.556732
Cabanillas C, Tablada M, Ferreyra L et al (2017) Sustainable management strategies focused on native bio-inputs in *Amaranthus cruentus* L. in agro-ecological farms in transition. J Clean Prod 142:343–350. https://doi.org/10.1016/j.jclepro.2016.06.065

Cadieux KV, Carpenter S, Liebman A et al (2019) Reparation ecologies: regimes of repair in populist agroecology. Ann Am Assoc Geogr 109:644–660. https://doi.org/10.1080/24694452.2018.1527680
Calderón CI, Jerónimo C, Praun A et al (2018) Agroecology-based farming provides grounds for more resilient livelihoods among smallholders in Western Guatemala. Agroecol Sustain Food Syst 42:1128–1169. https://doi.org/10.1080/21683565.2018.1489933
Calvário R (2017) Food sovereignty and new peasantries: on re-peasantization and counter-hegemonic contestations in the Basque territory. J Peasant Stud 44:402–420. https://doi.org/10.1080/03066150.2016.1259219
Capellesso AJ, Cazella AA, Schmitt Filho AL et al (2016) Economic and environmental impacts of production intensification in agriculture: comparing transgenic, conventional, and agroecological maize crops. Agroecol Sustain Food Syst 40:215–236. https://doi.org/10.1080/21683565.2015.1128508
Carlisle L, Montenegro de Wit M, DeLonge MS et al (2019) Transitioning to sustainable agriculture requires growing and sustaining an ecologically skilled workforce. Front Sustain Food Syst. https://doi.org/10.3389/fsufs.2019.00096
Castellanos-Navarrete A, Jansen K (2018) Is oil palm expansion a challenge to agroecology? Smallholders practising industrial farming in Mexico. J Agrar Change 18:132–155. https://doi.org/10.1111/joac.12195
Castelo Branco Brasileiro-Assing A, Wironen M, Adams A et al (2021) Sustainable intensification of livestock as a means to achieve forest conservation and food production in the Brazilian Southern Atlantic forest. Agroecol Sustain Food Syst 45:817–842. https://doi.org/10.1080/21683565.2021.1896617
Castilla Carrascal IT (2021) Intercultural economic solidarity circuits: the case of Utopia Basket and participative consumer profile in Ecuador's outskirts. J Rural Stud 85:91–97. https://doi.org/10.1016/j.jrurstud.2021.03.002
Castro AJ, López-Rodríguez MD, Giagnocavo C et al (2019) Six collective challenges for sustainability of Almería greenhouse horticulture. Int J Environ Res Public Health. https://doi.org/10.3390/ijerph16214097
Catarino R, Therond O, Berthomier J et al (2021) Fostering local crop-livestock integration via legume exchanges using an innovative integrated assessment and modelling approach based on the MAELIA platform. Agric Syst. https://doi.org/10.1016/j.agsy.2021.103066
Cechin A, da Silva AV, Amand L (2021) Exploring the synergy between Community Supported Agriculture and agroforestry: institutional innovation from smallholders in a Brazilian rural settlement. J Rural Stud 81:246–258. https://doi.org/10.1016/j.jrurstud.2020.10.031
Chaparro-Africano AM (2019) Toward generating sustainability indicators for agroecological markets. Agroecol Sustain Food Syst 43:40–66. https://doi.org/10.1080/21683565.2019.1566192
Chaparro Africano A, Calle Collado Á (2017) Peasant economy sustainability in peasant markets, Colombia. Agroecol Sustain Food Syst 41(2):204–225. https://doi.org/10.1080/21683565.2016.1266069
Chavez-Miguel G, Bonatti M, Ácevedo-Osorio Á et al (2022) Agroecology as a grassroots approach for environmental peacebuilding strengthening social cohesion and resilience in post-conflict settings with community-based natural resource management. GAIA Ecol Perspect Sci Soc 31:36–45. https://doi.org/10.14512/GAIA.31.1.9
Colquhoun HL, Levac D, O'Brien KK et al (2014) Scoping reviews: time for clarity in definition, methods, and reporting. J Clin Epidemiol 67:1291–1294
D'Annolfo R, Gemmill-Herren B, Graeub B, Garibaldi LA (2017) A review of social and economic performance of agroecology. Int J Agric Sustain 15:632–644. https://doi.org/10.1080/14735903.2017.1398123
Dalgaard T, Hutchings NJ, Porter JR (2003) Agroecology, scaling and interdisciplinarity. Agric Ecosyst Environ 100:39–51
Darolt MR, Lamine C, Brandenburg A et al (2016) Alternative food networks and new producer-consumer relations in France and Brazil. Ambiente Soc 19:1–22
de Araújo HM, Marjotta-Maistro MC (2023) Profiling the consumer of agroecological products using cluster analysis. Rev Econ Sociol Rural. https://doi.org/10.1590/1806-9479.2021.243394
De La Cruz SM, Dessein J (2021) Beyond institutional bricolage: an 'intertwining approach' to understanding the transition towards agroecology in Peru. Ecol Econ. https://doi.org/10.1016/j.ecolecon.2021.107091
de la Vega-Leinert AC, Clausing P (2016) Peasant agroecological systems as new frontiers of exploitation? Environ Soc Adv Res 7:50–70. https://doi.org/10.3167/ares.2016.070104
De Leijster V, Verburg RW, Santos MJ et al (2020) Almond farm profitability under agroecological management in southeastern Spain: accounting for externalities and opportunity costs. Agric Sys. https://doi.org/10.1016/j.agsy.2020.102878
De Sartre XA, Charbonneau M, Charrier O (2019) How ecosystem services and agroecology are greening French agriculture through its reterritorialization. Ecol Soc. https://doi.org/10.5751/ES-10711-240202
Deaconu A, Berti PR, Cole DC et al (2021) Agroecology and nutritional health: a comparison of agroecological farmers and their neighbors in the Ecuadorian highlands. Food Policy. https://doi.org/10.1016/j.foodpol.2021.102034
DeLonge MS, Miles A, Carlisle L (2016) Investing in the transition to sustainable agriculture. Environ Sci Policy 55:266–273. https://doi.org/10.1016/j.envsci.2015.09.013
DeLonge M, Robbins T, Basche A, Haynes-Mawlow L (2020) The state of sustainable agriculture and agroecology research and impacts: a survey of U.S. scientists. J Agric Food Syst Community Dev. https://doi.org/10.5304/jafscd.2020.092.009
Diaz II, Hunsberger C (2018) Can agroecological coffee be part of a food sovereignty strategy in Puerto Rico? Geoforum 97:84–94. https://doi.org/10.1016/j.geoforum.2018.10.016
Diesel V, Miná Dias M (2016) The Brazilian experience with agroecological extension: a critical analysis of reform in a pluralistic extension system. J Agric Educ Ext 22:415–433. https://doi.org/10.1080/1389224X.2016.1227058
Domínguez-Hernández ME, Domínguez-Hernández E, Martínez-Barrera G et al (2022) Transdisciplinary interventions to improve the sustainability of maize agroecosystems: a case study from Mexico. Transdiscipl J Eng Sci 13:85–89. https://doi.org/10.22545/2022/00196
Dorin B (2022) Theory, practice and challenges of agroecology in India. Int J Agric Sustain 20:153–167. https://doi.org/10.1080/14735903.2021.1920760
Dumont AM, Gasselin P, Baret PV (2020) Transitions in agriculture: three frameworks highlighting coexistence between a new agroecological configuration and an old, organic and conventional configuration of vegetable production in Wallonia (Belgium). Geoforum 108:98–109. https://doi.org/10.1016/j.geoforum.2019.11.018

Dupré M, Michels T, Le Gal PY (2017) Diverse dynamics in agroecological transitions on fruit tree farms. Eur J Agron 90:23–33. https://doi.org/10.1016/j.eja.2017.07.002
Durand MH, Désilles A, Saint-Pierre P et al (2017) Agroecological transition: a viability model to assess soil restoration. Nat Resour Model. https://doi.org/10.1111/nrm.12134
Einbinder N, Morales H, Terán-Giménez MY, Cacho M et al (2019) Agroecology on the periphery: a case from the Maya-Achí territory, Guatemala. Agroecol Sustain Food Syst 43:744–763. https://doi.org/10.1080/21683565.2019.1585401
Enríquez LJ (2013) The paradoxes of Latin America's "pink Tide": Venezuela and the project of agrarian reform. J Peasant Stud 40:611–638. https://doi.org/10.1080/03066150.2012.746959
Epule TE, Bryant CR (2017) The adoption of agroecology and conventional farming techniques varies with socio-demographic characteristics of small-scale farmers in the fako and meme divisions of cameroon. GeoJournal 82:1145–1164. https://doi.org/10.1007/s10708-016-9734-y
Escobar N, Romero NJ, Jaramillo CI (2019) Typology of small producers in transition to agroecological production. Agron Res 17:2242–2259. https://doi.org/10.15159/AR.19.221
Escobar Cazal EA, Ahmadi T, Fabián D et al (2021) Organic fertilizers: an agroecological and commercial bet on smallholders in the Sumapaz Region. Int J Econ Manag Syst 6:212–219
Espelt R (2020) Agroecology prosumption: the role of CSA networks. J Rural Stud 79:269–275. https://doi.org/10.1016/j.jrurstud.2020.08.032
Espelt R, Peña-López I, Miralbell O et al (2019) Impact of information and communication technologies in agroecological cooperativism in Catalonia. Agric Econ (czech Repub) 65:59–66. https://doi.org/10.17221/171/2018-AGRICECON
Fanchone A, Alexandre G, Hostiou N (2022) Work organization as a barrier to crop-livestock integration practices: a case study in Guadeloupe. Agron Sustain Dev 42:54. https://doi.org/10.1007/s13593-022-00782-8/Published
Feitosa C, Yamaoka M (2020) Strengthening climate resilience and women's networks: Brazilian inspiration from agroecology. Gend Dev 28:459–478. https://doi.org/10.1080/13552074.2020.1840149
Ferreira EL, Barros RA, Bevilacqua PD (2020) Women working in animal husbandry: a study in the agroecological transition context. Cienc Rural. https://doi.org/10.1590/0103-8478cr20190149
Francis C, Breland TA, Østergaard E et al (2013) Phenomenon-based learning in agroecology: a prerequisite for transdisciplinarity and responsible action. Agroecol Sustain Food Syst 37:60–75. https://doi.org/10.1080/10440046.2012.717905
Fresco LO, Geerling-Eiff F, Hoes AC et al (2021) Sustainable food systems: do agricultural economists have a role. Eur Rev Agric Econ 48:694–718. https://doi.org/10.1093/erae/jbab026
Gaba S, Bretagnolle V (2020) Social–ecological experiments to foster agroecological transition. People Nat 2:317–327. https://doi.org/10.1002/pan3.10078
Gargano G, Licciardo F, Verrascina M, Zanetti B (2021) The agroecological approach as a model for multifunctional agriculture and farming towards the European green deal 2030: some evidence from the Italian experience. Sustainability (switzerland) 13:1–23. https://doi.org/10.3390/su13042215
Garini CS, Vanwindekens F, Scholberg JMS et al (2017) Drivers of adoption of agroecological practices for winegrowers and influence from policies in the province of Trento, Italy. Land Use Policy 68:200–211. https://doi.org/10.1016/j.landusepol.2017.07.048
Gava O, Povellato A, Galioto F et al (2022) Policy instruments to support agroecological transitions in Europe. EuroChoices 21:13–20. https://doi.org/10.1111/1746-692X.12367
Gil J, Alter E, La Rota MJ et al (2022) Towards an agroecological transition in the Mediterranean: a bioeconomic assessment of viticulture farming. J Clean Prod. https://doi.org/10.1016/j.jclepro.2022.134999
Giraldo OF, McCune N (2019) Can the state take agroecology to scale? Public policy experiences in agroecological territorialization from Latin America. Agroecol Sustain Food Syst 43:785–809. https://doi.org/10.1080/21683565.2019.1585402
Giraldo OF, Rosset PM (2018) Agroecology as a territory in dispute: between institutionality and social movements. J Peasant Stud 45:545–564. https://doi.org/10.1080/03066150.2017.1353496
Giraldo OF, Rosset PM (2022) Emancipatory agroecologies: social and political principles. J Peasant Stud. https://doi.org/10.1080/03066150.2022.2120808
Gliessman S (2018) Defining agroecology. Agroecol Sustain Food Syst 42:599–600
Gómez-Ceballos G, Vázquez-Loaiza JP, Herrera-Torres DP, Vega-Luna AJ (2021) Popular and solidarity economy: policies and realities in the local context—the case of the agricultural productive associations of El Valle, Ecuador. Sustainability (switzerland). https://doi.org/10.3390/su132313469
Gonzalez de Molina M (2013) Agroecology and politics. How to get sustainability? About the necessity for a political agroecology. Agroecol Sustain Food Syst 37:45–59. https://doi.org/10.1080/10440046.2012.705810
Guareschi M, Mancini MC, Lottici C, Arfini F (2023) Strategies for the valorization of sustainable productions through an organic district model. Agroecol Sustain Food Syst 47:100–125. https://doi.org/10.1080/21683565.2022.2134270
Guerra J, Blesh J, Schmitt Filho AL, Wittman H (2017) Pathways to agroecological management through mediated markets in Santa Catarina, Brazil. Elementa. https://doi.org/10.1525/elementa.248
Gütschow M, Feola G (2022) Laying the foundations of a more conscious society? How vendors, consumers and organizers socially construct farmers' markets in Bogotá, Colombia. Rev Colombiana Cienc Soc 13:455–476. https://doi.org/10.21501/22161201.3726
Guzmán GI, López D, Román L, Alonso AM (2013) Participatory action research in agroecology: building local organic food networks in Spain. Agroecol Sustain Food Syst 37:127–146. https://doi.org/10.1080/10440046.2012.718997
Hammelman C, Shoffner E, Cruzat M, Lee S (2022) Assembling agroecological socio-natures: a political ecology analysis of urban and peri-urban agriculture in Rosario, Argentina. Agric Hum Values 39:371–383. https://doi.org/10.1007/s10460-021-10253-7
Harvie J (2019) Early lessons from the food commons: a new economic whole system approach for regional food. J Agric Food Syst Community Dev. https://doi.org/10.5304/jafscd.2019.091.045

Hernández MY, Macario PA, López-Martínez JO (2017) Traditional agroforestry systems and food supply under the food sovereignty approach. Ethnobiol Lett 8:125–141. https://doi.org/10.14237/ebl.8.1.2017.941
Hirata AR, Rocha LCD, Assis TRP et al (2019) The contribution of the participatory guarantee system in the revival of agroecological principles in southern Minas Gerais, Brazil. Sustainability (switzerland). https://doi.org/10.3390/su11174675
HLPE (2019) Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome
Hockin-Grant KJ, Yasué M (2017) The effectiveness of a permaculture education project in Butula, Kenya. Int J Agric Sustain 15:432–444. https://doi.org/10.1080/14735903.2017.1335570
Holt-Giménez E, Altieri MA (2013) Agroecology, food sovereignty, and the new green revolution. Agroecol Sustain Food Syst 37:90–102. https://doi.org/10.1080/10440046.2012.716388
Iles A (2021) Can Australia transition to an agroecological future? Agroecol Sustain Food Syst 45:3–41. https://doi.org/10.1080/21683565.2020.1780537
Intriago R, Gortaire Amézcua R, Bravo E, O'Connell C (2017) Agroecology in Ecuador: historical processes, achievements, and challenges. Agroecol Sustain Food Syst 41:311–328. https://doi.org/10.1080/21683565.2017.1284174
Isgren E (2016) No quick fixes: four interacting constraints to advancing agroecology in Uganda. Int J Agric Sustain 14:428–447. https://doi.org/10.1080/14735903.2016.1144699
Islam MR, Hossain MF, Hossain J, Mohammad H (2021) Productivity and profitability of turmeric (*Curcuma longa*) + Okra (*Abelmoschus esculentus*) intercropping system for marginal farmers in North-Western Part of Bangladesh. Philipp Agric Sci 104:114–123
Iyabano A, Klerkx L, Faure G, Toillier A (2022) Farmers' Organizations as innovation intermediaries for agroecological innovations in Burkina Faso. Int J Agric Sustain 20:857–873. https://doi.org/10.1080/14735903.2021.2002089
Jansen K, Vicol M, Nikol L (2022) Autonomy and repeasantization: conceptual, analytical, and methodological problems. J Agrar Change 22:489–505. https://doi.org/10.1111/joac.12468
Kleemann L, Abdulai A (2013) Organic certification, agro-ecological practices and return on investment: evidence from pineapple producers in Ghana. Ecol Econ 93:330–341. https://doi.org/10.1016/j.ecolecon.2013.06.017
Kocira S, Szparaga A, Hara P et al (2020) Biochemical and economical effect of application biostimulants containing seaweed extracts and amino acids as an element of agroecological management of bean cultivation. Sci Rep. https://doi.org/10.1038/s41598-020-74959-0
Kowalski AM (2020) Global south-global north differences. In: Filho WL et al (eds) No poverty. Springer, Cham, pp 1–12
Laforge JML, McLachlan SM (2018) Learning communities and new farmer knowledge in Canada. Geoforum 96:256–267. https://doi.org/10.1016/j.geoforum.2018.07.022
Lalani B, Dorward P, Holloway G (2017) Farm-level economic analysis: is conservation agriculture helping the poor? Ecol Econ 141:144–153. https://doi.org/10.1016/j.ecolecon.2017.05.033
Landert J, Pfeifer C, Carolus J et al (2020) Assessing agro-ecological practices using a combination of three sustainability assessment tools. Landbauforschung (braunschw) 70:129–144. https://doi.org/10.3220/LBF1612794225000
Larrauri OM, Neira DP, Montiel MS (2016) Indicators for the analysis of peasant women's equity and empowerment situations in a sustainability framework: a case study of cacao production in Ecuador. Sustainability (switzerland). https://doi.org/10.3390/su8121231
Larson BP, Chung KC (2012) A systematic review of peer review for scientific manuscripts. Hand 7:37–44
Laske E (2022) Characterizing agroecology's practice in the Niayes, Senegal: a typology of agricultural models on family farms. Int J Sustain Dev World Ecol. https://doi.org/10.1080/13504509.2022.2147597
Levidow L, Sansolo D, Schiavinatto M (2021) Agroecological practices as territorial development: an analytical schema from Brazilian case studies. J Peasant Stud 48:827–852. https://doi.org/10.1080/03066150.2019.1683003
Levidow L, Sansolo D, Schiavinatto M (2022) EcoSol-agroecology networks respond to the Covid-19 crisis: building an economy of proximity in Brazil's Baixada Santista region. J Peasant Stud 49:1409–1445. https://doi.org/10.1080/03066150.2022.2096447
Little M, Sylvester O (2022) Agroecological producers shortening food chains during Covid-19: opportunities and challenges in Costa Rica. Agric Hum Values 39:1133–1140. https://doi.org/10.1007/s10460-022-10298-2
Lucantoni D (2020) Transition to agroecology for improved food security and better living conditions: case study from a family farm in Pinar del Río, Cuba. Agroecol Sustain Food Syst 44:1124–1161. https://doi.org/10.1080/21683565.2020.1766635
Lucantoni D, Sy MR, Goïta M et al (2023) Evidence on the multidimensional performance of agroecology in Mali using TAPE. Agric Syst. https://doi.org/10.1016/j.agsy.2022.103499
Macall DM, Kerr WA, Smyth SJ (2022) Economic surplus implications of Mexico's decision to phaseout genetically modified maize imports. GM Crops Food 13:388–401. https://doi.org/10.1080/21645698.2021.2020028
Machado MR (2022) Smallholder farming for sustainable development: lessons on public policy from the Cuban agroecological transition. J Peasant Stud. https://doi.org/10.1080/03066150.2022.2072214
Machado-Vargas MM, Nicholls-Estrada CI, Ríos-Osorio LA (2018) Social-ecological resilience of small-scale coffee production in the Porce River Basin, Antioquia (Colombia). Idesia (arica) 36:141–151. https://doi.org/10.4067/S0718-34292018005001801
Martinet VV, Roques L (2022) An ecological-economic model of land-use decisions, agricultural production, and biocontrol. R Soc Open Sci 9:16. https://doi.org/10.1098/rsos.220169ï
Matthews A (2022) Prospects for agroecology in Europe. EuroChoices 21:80–83
McGreevy SR, Tamura N, Kobayashi M et al (2021) Amplifying agroecological farmer lighthouses in contested territories: navigating historical conditions and forming new clusters in Japan. Front Sustain Food Syst. https://doi.org/10.3389/fsufs.2021.699694

Mehrabi S, Perez-Mesa JC, Giagnocavo C (2022) The role of consumer-citizens and connectedness to nature in the sustainable transition to agroecological food systems: the mediation of innovative business models and a multi-level perspective. Agriculture (switzerland). https://doi.org/10.3390/agriculture12020203
Mekuria W, Dessalegn M, Amare D et al (2022) Factors influencing the implementation of agroecological practices: lessons drawn from the Aba-Garima watershed, Ethiopia. Front Environ Sci. https://doi.org/10.3389/fenvs.2022.965408
Méndez VE, Bacon CM, Cohen R (2013) Agroecology as a transdisciplinary, participatory, and action-oriented approach. Agroecol Sustain Food Syst 37:3–18
Mestmacher J, Braun A (2021) Women, agroecology and the state: new perspectives on scaling-up agroecology based on a field research in Chile. Agroecol Sustain Food Syst 45:981–1006. https://doi.org/10.1080/21683565.2020.1837330
Miles A, DeLonge MS, Carlisle L (2017) Triggering a positive research and policy feedback cycle to support a transition to agroecology and sustainable food systems. Agroecol Sustain Food Syst 41:855–879. https://doi.org/10.1080/21683565.2017.1331179
Miller D, Legras S, Barnes A et al (2022) Creating conditions for harnessing the potential of transitions to agroecology in Europe and requirements for policy. EuroChoices 21:72–79. https://doi.org/10.1111/1746-692X.12374
Mohamad RS, Cardone G, Mimiola G et al (2018) Analysis of Mediterranean organic greenhouse production economics and the impact of introducing agro-ecological practices. Biol Agric Hortic 34:154–172. https://doi.org/10.1080/01448765.2017.1402705
Montalba R, Vieli L, Spirito F, Muñoz E (2019) Environmental and productive performance of different blueberry (*Vaccinium corymbosum* L.) production regimes: conventional, organic, and agroecological. Sci Hortic. https://doi.org/10.1016/j.scienta.2019.108592
Moreira S (2022) Communication for food commons: a comparative analysis of community supported agriculture in Portugal. Comun Soc (mex). https://doi.org/10.32870/cys.v2022.8155
Morris KS, Bucini G (2016) California's drought as opportunity: redesigning U.S. agriculture for a changing climate. Elem Sci Anthr. https://doi.org/10.12952/journal.elementa.000142
Morrison A, Polisena J, Husereau D et al (2012) The effect of English-language restriction on systematic review-based meta-analyses: a systematic review of empirical studies. Int J Technol Assess Health Care 28:138–144
Moseley WG (2022) Development assistance and Boserupian intensification under geopolitical isolation: the political ecology of a crop-livestock integration project in Burundi. Geoforum 128:276–285. https://doi.org/10.1016/j.geoforum.2021.01.010
Mosnier C, Duclos A, Agabriel J, Gac A (2017) Orfee: a bio-economic model to simulate integrated and intensive management of mixed crop-livestock farms and their greenhouse gas emissions. Agric Syst 157:202–215. https://doi.org/10.1016/j.agsy.2017.07.005
Mosnier C, Benoit M, Minviel JJ, Veysset P (2022) Does mixing livestock farming enterprises improve farm and product sustainability? Int J Agric Sustain 20:312–326. https://doi.org/10.1080/14735903.2021.1932150
Mottet A, Bicksler A, Lucantoni D et al (2020) Assessing transitions to sustainable agricultural and food systems: a tool for agroecology performance evaluation (TAPE). Front Sustain Food Syst. https://doi.org/10.3389/fsufs.2020.579154
Mouratiadou I, Wezel A, Kamilia K, Marchetti A, Paracchini ML, Barberi P (2024) The socio-economic performance of agroecology. A Review. Agron Sustain Dev 44:19. https://doi.org/10.1007/s13593-024-00945-9
Mugnier S, Husson C, Cournut S (2020) Why and how farmers manage mixed cattle-sheep farming systems and cope with economic, climatic and workforce-related hazards. Renew Agric Food Syst. https://doi.org/10.1017/S1742170520000037X
Munn Z, Peters MDJ, Stern C et al (2018) Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. BMC Med Res Methodol. https://doi.org/10.1186/s12874-018-0611-x
Muñoz EFP, Niederle PA, de Gennaro BC, Roselli L (2021) Agri-food markets towards agroecology: tensions and compromises faced by small-scale farmers in Brazil and Chile. Sustainability (switzerland). https://doi.org/10.3390/su13063096
Nagib G, Nakamura AC (2020) Urban agriculture in the city of São Paulo: new spatial transformations and ongoing challenges to guarantee the production and consumption of healthy food. Glob Food Sec. https://doi.org/10.1016/j.gfs.2020.100378
Nigh R, González Cabañas AA (2015) Reflexive consumer markets as opportunities for new peasant farmers in Mexico and France: constructing food sovereignty through alternative food networks. Agroecol Sustain Food Syst 39:317–341. https://doi.org/10.1080/21683565.2014.973545
Nilsson P, Bommarco R, Hansson H et al (2022) Farm performance and input self-sufficiency increases with functional crop diversity on Swedish farms. Ecol Econ. https://doi.org/10.1016/j.ecolecon.2022.107465
Nyantakyi-Frimpong H, Mambulu FN, Bezner Kerr R et al (2016) Agroecology and sustainable food systems: participatory research to improve food security among HIV-affected households in northern Malawi. Soc Sci Med 164:89–99. https://doi.org/10.1016/j.socscimed.2016.07.020
Padró R, Tello E (2022) Exploring agroecology transition scenarios: a Pfaundler's spectrum assessment on the relocation of agri-food flows. Land (basel). https://doi.org/10.3390/land11060824
Palmisano T (2023) Narratives and practices of pesticide removal in the Andean valleys of Chile and Argentina. Environ Sci Policy 139:149–156. https://doi.org/10.1016/j.envsci.2022.10.015
Parodi G (2018) Agroecological transition and reconfiguration of horticultural work among family farmers in Buenos Aires, Argentina. Cahiers Agric. https://doi.org/10.1051/cagri/2018020
Passaro A, Randelli F (2022) Spaces of sustainable transformation at territorial level: an analysis of biodistricts and their role for agroecological transitions. Agroecol Sustain Food Syst 46:1198–1223. https://doi.org/10.1080/21683565.2022.2104421

Pépin A, Morel K, van der Werf HMG (2021) Conventionalised vs. agroecological practices on organic vegetable farms: investigating the influence of farm structure in a bifurcation perspective. Agric Syst. https://doi.org/10.1016/j.agsy.2021.103129
Perez-Castillo D (2021) Impact evaluation based on benefit indicators (IEBBI): methodological proposal for agroecological farmers' markets. Sustain Debate 12:219–235. https://doi.org/10.18472/SUSTDEB.V12N2.2021.36070
Petersen PF, Silveira LM (2017) Agroecology, public policies and labor-driven intensification: alternative development trajectories in the Brazilian semi-arid region. Sustainability (switzerland). https://doi.org/10.3390/su9040535
Pissonnier S, Dufils A, Le Gal PY (2019) A methodology for redesigning agroecological radical production systems at the farm level. Agric Syst 173:161–171. https://doi.org/10.1016/j.agsy.2019.02.018
Plateau L, Roudart L, Hudon M, Maréchal K (2021) Opening the organisational black box to grasp the difficulties of agroecological transition. An empirical analysis of tensions in agroecological production cooperatives. Ecol Econ. https://doi.org/10.1016/j.ecolecon.2021.107048
Plumecocq G, Debril T, Duru M et al (2018) The plurality of values in sustainable agriculture models: diverse lock-in and coevolution patterns. Ecol Soc. https://doi.org/10.5751/ES-09881-230121
Pronti A, Coccia M (2020a) Agroecological and conventional agricultural systems: comparative analysis of coffee farms in Brazil for sustainable development. Int J Sustain Dev 23:223. https://doi.org/10.1504/ijsd.2020.10037660
Pronti A, Coccia M (2020b) Multicriteria analysis of the sustainability performance between agroecological and conventional coffee farms in the East Region of Minas Gerais (Brazil). Renew Agric Food Syst. https://doi.org/10.1017/S1742170520000332
Puech C, Brulaire A, Paraiso J, Faloya V (2021) Collective design of innovative agroecological cropping systems for the industrial vegetable sector. Agric Syst. https://doi.org/10.1016/j.agsy.2021.103153
Punzano AP, Rahmani D, Delgado MDMC (2021) Adoption and diffusion of agroecological practices in the horticulture of Catalonia. Agronomy. https://doi.org/10.3390/agronomy11101959
Rakotovao NH, Chevallier T, Chapuis-Lardy L et al (2021) Impacts on greenhouse gas balance and rural economy after agroecology development in Itasy Madagascar. J Clean Prod. https://doi.org/10.1016/j.jclepro.2020.125220
Resare Sahlin K, Carolus J, von Greyerz K et al (2022) Delivering "less but better" meat in practice—a case study of a farm in agroecological transition. Agron Sustain Dev. https://doi.org/10.1007/s13593-021-00737-5
Revollo-Fernández D (2016) Is there willingness to buy and pay a surcharge for agro-ecological products? Case study of the production of vegetables in Xochimilco, Mexico. J Sci Food Agric 96:2265–2268. https://doi.org/10.1002/jsfa.7333
Revoyron E, Le Bail M, Meynard JM et al (2022) Diversity and drivers of crop diversification pathways of European farms. Agric Syst. https://doi.org/10.1016/j.agsy.2022.103439
Reynolds HL, Smith AA, Farmer JR (2014) Think globally, research locally: paradigms and place in agroecological research. Am J Bot 101:1631–1639. https://doi.org/10.3732/ajb.1400146
Rice AM, Einbinder N, Calderón CI (2023) 'With agroecology, we can defend ourselves': examining campesino resilience and economic solidarity during pandemic-era economic shock in Guatemala. Agroecol Sustain Food Syst 47:273–305. https://doi.org/10.1080/21683565.2022.2140378
Robles W (2019) The politics of agricultural cooperativism in Brazil: a case study of the landless rural worker movement (MST). J Co-Oper Organ Manag 7:10–25. https://doi.org/10.1016/j.jcom.2019.02.001
Rodriguez C, Dimitrova Mårtensson LM, Zachrison M, Carlsson G (2021) Sustainability of diversified organic cropping systems—challenges identified by farmer interviews and multi-criteria assessments. Front Agron. https://doi.org/10.3389/fagro.2021.698968
Röös E, Mayer A, Muller A et al (2022) Agroecological practices in combination with healthy diets can help meet EU food system policy targets. Sci Total Environ. https://doi.org/10.1016/j.scitotenv.2022.157612
Ryschawy J, Martin G, Moraine M et al (2017) Designing crop–livestock integration at different levels: toward new agroecological models? Nutr Cycl Agroecosyst 108:5–20. https://doi.org/10.1007/s10705-016-9815-9
Ryschawy J, Moraine M, Péquignot M, Martin G (2019) Trade-offs among individual and collective performances related to crop–livestock integration among farms: a case study in southwestern France. Org Agric 9:399–416. https://doi.org/10.1007/s13165-018-0237-7
Ryschawy J, Tiffany S, Gaudin A et al (2021) Moving niche agroecological initiatives to the mainstream: a case-study of sheep-vineyard integration in California. Land Use Policy. https://doi.org/10.1016/j.landusepol.2021.105680
Sabourin E, Le Coq J-F, Freguin-Gresh S et al (2018) Public policies to support agroecology in Latin America and the Caribbean. Perspective. https://doi.org/10.19182/agritrop/00020
Sanderson Bellamy A, Ioris AAR (2017) Addressing the knowledge gaps in agroecology and identifying guiding principles for transforming conventional agri-food systems. Sustainability (switzerland) 9:1. https://doi.org/10.3390/su9030330
Santos CFD, Siqueira ES, Araújo ITD, Maia ZMG (2014) Agroecology as a means of sustainability for family-based agriculture. Ambiente Soc 17:33–52. https://doi.org/10.1590/S1414-753X2014000200004
Schader C, Heidenreich A, Kadzere I et al (2021) How is organic farming performing agronomically and economically in sub-Saharan Africa? Glob Environ Change. https://doi.org/10.1016/j.gloenvcha.2021.102325
Segnon AC, Achigan-Dako EG, Gaoue OG, Ahanchédé A (2015) Farmer's knowledge and perception of diversified farming systems in sub-humid and semi-arid areas in Benin. Sustainability (switzerland) 7:6573–6592. https://doi.org/10.3390/su7066573
Silva EM, Tchamitchian M (2018) Long-term systems experiments and long-term agricultural research sites: tools for overcoming the border problem in agroecological research and design. Agroecol Sustain Food Syst 42:620–628. https://doi.org/10.1080/21683565.2018.1435434
Simón-Rojo M, Couceiro A, del Valle J, Tojo JF (2020) Public food procurement as a driving force for building local and agroecological food systems: farmers' skepticism in Vega Baja del Jarama, Madrid (Spain). Land (basel). https://doi.org/10.3390/LAND9090317
Soldi A, Meza MJA, Guareschi M et al (2019) Sustainability assessment of agricultural systems in Paraguay: a comparative study using FAO's SAFA framework. Sustainability (switzerland). https://doi.org/10.3390/su11133745

Sourisseau J-M (2014) Family farming and the worlds to come, 2014th edn. Springer, Dordrecht
Strakos PF, Sanches MBB (2017) Statés international responsibility for the human right to food: Implementation in Brazil through agroecology. Braz J Int Law 14:36–53. https://doi.org/10.5102/rdi.v14i1.4366
Stratton AE, Wittman H, Blesh J (2021) Diversification supports farm income and improved working conditions during agroecological transitions in southern Brazil. Agron Sustain Dev. https://doi.org/10.1007/s13593-021-00688-x
Surchat M, Wezel A, Tolon V et al (2021) Soil and pest management in french polynesian farming systems and drivers and barriers for implementation of practices based on agroecological principles. Front Sustain Food Syst. https://doi.org/10.3389/fsufs.2021.708647
Swagemakers P, Schermer M, Domínguez García MD et al (2021) To what extent do brands contribute to sustainability transition in agricultural production practices? Lessons from three European case studies. Ecol Econ. https://doi.org/10.1016/j.ecolecon.2021.107179
Tama RAZ, Ying L, Yu M et al (2021) Assessing farmers' intention towards conservation agriculture by using the extended theory of planned behavior. J Environ Manag. https://doi.org/10.1016/j.jenvman.2020.111654
Tornaghi C, Dehaene M (2020) The prefigurative power of urban political agroecology: rethinking the urbanisms of agroecological transitions for food system transformation. Agroecol Sustain Food Syst 44:594–610. https://doi.org/10.1080/21683565.2019.1680593
Trabelsi M, Mandart E, Le Grusse P, Bord JP (2016) How to measure the agroecological performance of farming in order to assist with the transition process. Environ Sci Pollut Res 23:139–156. https://doi.org/10.1007/s11356-015-5680-3
Tricco AC, Lillie E, Zarin W et al (2018) PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med 169:467–473
Valencia V, Wittman H, Blesh J (2019) Structuring markets for resilient farming systems. Agron Sustain Dev. https://doi.org/10.1007/s13593-019-0572-4
Valencia V, Wittman H, Jones AD, Blesh J (2021) Public policies for agricultural diversification: implications for gender equity. Front Sustain Food Syst. https://doi.org/10.3389/fsufs.2021.718449
van der Ploeg JD (2020) The political economy of agroecology. J Peasant Stud 48:274–297. https://doi.org/10.1080/03066150.2020.1725489
van der Ploeg JD, Barjolle D, Bruil J et al (2019) The economic potential of agroecology: empirical evidence from Europe. J Rural Stud 71:46–61. https://doi.org/10.1016/j.jrurstud.2019.09.003
van Hulst F, Ellis R, Prager K, Msika J (2020) Using co-constructed mental models to understand stakeholder perspectives on agro-ecology. Int J Agric Sustain 18:172–195. https://doi.org/10.1080/14735903.2020.1743553
van Zutphen KG, van den Berg S, Gavin-Smith B et al (2022) Nutrition as a driver and outcome of agroecology. Nat Food 3:990–996. https://doi.org/10.1038/s43016-022-00631-7
Veluguri D, Bump JB, Venkateshmurthy NS et al (2021) Political analysis of the adoption of the Zero-Budget natural farming program in Andhra Pradesh, India. Agroecol Sustain Food Syst 45:907–930. https://doi.org/10.1080/21683565.2021.1901832
Vermunt DA, Wojtynia N, Hekkert MP et al (2022) Five mechanisms blocking the transition towards 'nature-inclusive' agriculture: a systemic analysis of Dutch dairy farming. Agric Syst. https://doi.org/10.1016/j.agsy.2021.103280
Vidal A, Lurette A, Nozières-Petit MO et al (2020) The emergence of agroecological practices on agropastoral dairy farms in the face of changing demand from dairies. Biotechnol Agron Soc Environ 24:163–183. https://doi.org/10.25518/1780-4507.18645
Volkmer G, Pedrozo EÁ (2019) Agroecological farm analysis based on the 3D sustainability model approach. Agrofor Syst 93:1001–1013. https://doi.org/10.1007/s10457-018-0195-9
Wang SL, Caldwell CD, Kilyanek SL, Smukler SM (2019) Using agroecology to stimulate the greening of agriculture in China: a reflection on 15 years of teaching and curriculum development. Int J Agric Sustain 17:298–311. https://doi.org/10.1080/14735903.2019.1633901
Wezel A, Bellon S, Doré T et al (2009) Agroecology as a science, a movement and a practice. A review. Agron Sustain Dev 29:503–515. https://doi.org/10.1051/agro/2009004
Xu M-L (2018) Agroecological study: environmental effect of scientific technology and education input on agricultural economic growth. Ekoloji 27:969–974
Wezel A, Soldat V (2009) A quantitative and qualitative historical analysis of the scientific discipline of agroecology. Int J Agr Sustain 7(1):3–18. https://doi.org/10.3763/ijas.2009.0400
Wezel A, David C (2020) Policies for agroecology in France: implementation and impact in practice, research and education. In: Landbauforschung. Johann Heinrich of Thuenen Institute Bundesforschungsanstalt Fuer Landwirtschaft Braunschweig Voelkenrode, pp 66–76

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