

Agroecological Transformation and Sustainable Food Systems as Foundations for Resilient, Inclusive and Territorially Integrated Rural Development

Dramane Dembélé¹ and Bakary Tangara

¹ Université de Ségou - Mali

² Université de Kayes - Mali

Citation : Dembélé, D., & Tangara, B. (2026). Agroecological transformation and sustainable food systems as foundations for resilient, inclusive and territorially integrated rural development. *Journal of Agricultural & Rural Economics*, 1(1), 196–214.

<https://doi.org/10.5281/zenodo.22972813>

Copyright: © This work is licensed under a Creative Commons Attribution 4.0 International License.

Abstract

This paper examines the contribution of agroecology and sustainable food-system transformation to the future of rural development. It adopts a multidimensional perspective in which ecological performance, food security, economic viability, social inclusion, territorial organization, governance and innovation are treated as interconnected components of rural transformation. The literature shows that agroecology extends beyond the substitution of conventional inputs and involves the redesign of production systems, markets, institutions and relationships among actors. Agricultural diversification, biodiversity conservation and ecological management can improve ecosystem services, strengthen climate resilience and reduce dependence on external inputs while maintaining productive capacity. However, their rural-development effects depend on market access, labor requirements, institutional support and the distribution of benefits among households and social groups. Sustainable food systems also require stronger connections between agricultural production, nutrition, local markets, territorial identity and short food supply chains. At the same time, gender relations, farmer knowledge, collective organization and food sovereignty influence the social sustainability of transition processes. The paper further shows that economic viability and innovation depend on coordinated institutional change rather than isolated technological adoption. The future of rural development therefore requires integrated governance capable of combining ecological objectives with livelihoods, territorial development, participation and locally embedded innovation systems.

Keywords: Agroecology; Sustainable food systems; Rural development; Agricultural diversification; Territorial governance

JEL classification: Q01; Q12; Q18; O13; R11

Introduction

Agricultural and rural development increasingly confront a combination of environmental degradation, climate instability, food-security pressures and persistent socioeconomic inequalities. These challenges have questioned development models based primarily on agricultural specialization, intensive external-input use and the expansion of output without equivalent consideration of ecological and social consequences. Agroecology has consequently emerged as a broader framework for reconsidering the relationships among agricultural production, ecosystems, food systems and rural territories. Gliessman (2016) conceptualizes agroecological transformation



as a progression from input efficiency toward agroecosystem redesign and wider food-system restructuring, while Wezel et al. (2020) associate agroecology with ecological principles alongside fairness, participation, connectivity and responsible governance. This broader interpretation implies that agricultural sustainability cannot be achieved exclusively through technical changes at farm level. Farmer autonomy, collective organization and territorial relationships also influence the capacity of agroecological practices to become durable components of rural development, as emphasized by Dumont et al. (2016) and Mier y Terán Giménez Cacho et al. (2018). The literature reviewed in this paper accordingly treats agroecology as an approach connecting environmental performance with socioeconomic restructuring, institutional coordination and the long-term capacity of rural territories to sustain productive and social functions. This perspective also requires consideration of the wider food system within which rural producers operate. Biodiversity, nutrition, markets, gender relations, knowledge systems and innovation influence whether ecological changes in production generate broader developmental effects. Evidence reviewed in the paper indicates that agricultural diversification can improve ecosystem services and support production, although outcomes remain dependent on local ecological and economic conditions. Sustainable diets and food security similarly depend not only on farm-level production diversity but also on household income, functioning markets, resource access and wider food environments. Meanwhile, short food supply chains and territorial products can reinforce producer-consumer relationships and local economies, but their durability depends on logistics, institutional coordination, consumer demand and credible product differentiation. The purpose of this paper is therefore to examine how agroecological principles, sustainable food systems and rural-development processes interact. Particular attention is given to ecological resilience, food and nutrition, territorial markets, social justice, livelihood viability, governance and innovation in order to identify the institutional conditions under which agroecological transition can contribute to sustainable rural transformation.

1. Agroecological Foundations of Sustainable Agricultural and Food-System Transformation

1.1. Agroecological principles, concepts and transition frameworks

Gliessman (2016) presents agroecological transformation as a progressive process moving from greater input efficiency and substitution toward agroecosystem redesign and, ultimately, the restructuring of food-system relationships and institutions. This perspective implies that rural development cannot be reduced to the adoption of environmentally improved techniques when prevailing market and institutional arrangements remain unchanged. Wezel et al. (2020) reinforce this broader interpretation by identifying principles that combine recycling, biodiversity and input reduction with economic diversification, fairness, participation, connectivity and responsible governance. Migliorini and Wezel (2017) similarly show that agroecology extends beyond organic certification because it places greater emphasis on systemic redesign and the relationships linking production, territories and food markets. Dumont et al. (2016) add that farmer autonomy depends on socioeconomic arrangements such as collective organization, market independence, territorial coordination and producer-consumer connections. Taken together, these contributions position agroecology as a rural-development framework integrating ecological change with economic and institutional restructuring. Policies promoting agroecological transition should therefore avoid measuring progress solely through the replacement of conventional inputs or compliance with certification standards. Greater attention is required to whether transitions strengthen diversification, farmer autonomy, collective organization and the capacity of rural territories to reorganize production and market relationships.



Mier y Terán Giménez Cacho et al. (2018) show that scaling agroecology depends on social organization, farmer-to-farmer learning, supportive public policies, territorial identity and access to alternative markets. Their findings imply that expansion cannot be understood as the simple replication of successful technologies across larger numbers of farms. Rivera-Ferre (2018) reinforces this political dimension by demonstrating that institutional recognition can simultaneously increase the visibility of agroecology and weaken its transformative content when rural communities lose influence over how it is defined and implemented. Sanderson Bellamy and Ioris (2017) further emphasize participation, local knowledge, equity and changing power relations as necessary components of agroecological transformation. Anderson and Maughan (2021) add that competing definitions of agricultural innovation influence which actors, technologies and transition pathways receive institutional and financial support. Together, these contributions imply that the future of agroecological rural development depends significantly on governance and participation. Scaling requires enabling institutions without converting farmer-led transformation into a narrowly technical intervention. Public policy should therefore support collective learning, territorial networks and alternative market arrangements while preserving meaningful participation by producers and rural communities in decisions concerning innovation priorities, resource allocation and the institutional direction of agricultural transition.

Mottet et al. (2020) provide a multidimensional framework for evaluating agroecological transitions through environmental, economic, social, health and governance indicators, implying that successful transformation must be assessed through a broader set of outcomes than environmental performance alone. Wezel et al. (2020) reinforce this requirement by conceptualizing agroecology through interconnected ecological and socioeconomic principles whose effects operate across farms and wider food systems. Dumont et al. (2016) add that socioeconomic dimensions such as collective capacity, territorial organization and market autonomy are integral to agroecological performance rather than secondary consequences of ecological change. Mier y Terán Giménez Cacho et al. (2018) further demonstrate that transition processes depend on institutional and social conditions that influence whether agroecological practices can persist and expand. Considered jointly, these contributions imply that rural development strategies require evaluation systems capable of capturing both productive and institutional transformation. Higher biodiversity or lower external-input use may represent meaningful progress, but they provide only a partial measure if farmer livelihoods, participation or market autonomy deteriorate. Multidimensional assessment can therefore help distinguish limited technical improvements from deeper agroecological transitions that simultaneously strengthen environmental sustainability, rural livelihoods, collective capacity and the long-term functioning of food systems.

1.2. Biodiversity, ecosystem services and agricultural diversification

Tamburini et al. (2020) show that agricultural diversification generally improves multiple ecosystem services while maintaining crop production, challenging the assumption that ecological complexity necessarily reduces productivity. Their findings imply that rotations, intercropping and landscape diversification can contribute simultaneously to production and environmental performance. Ponisio et al. (2015) reinforce this conclusion by demonstrating that diversification practices substantially narrow the yield gap between organic and conventional agriculture, with rotations and polycultures playing an especially important role. Dainese et al. (2019) add that biodiversity itself performs productive functions, since greater richness of pollinators and natural enemies supports pollination, biological pest regulation and crop production. Palomo-Campesino et al. (2018) further show that diversified cropping, improved soil management and



reduced chemical dependence generate provisioning, regulating and supporting ecosystem services. Taken together, these contributions imply that biodiversity should not be treated as an objective separate from agricultural productivity. Agroecological rural development can instead use ecological functions as productive assets that reduce dependence on external inputs while sustaining yields. Policy should therefore promote diversified production systems and recognize that their contribution extends beyond individual crops to the ecological processes supporting long-term agricultural performance and the wider multifunctionality of rural landscapes.

Beillouin et al. (2021) demonstrate that crop diversification produces predominantly positive effects on biodiversity and ecosystem services, while emphasizing that results vary according to crop, practice and environmental context. This qualification implies that diversification should be adapted locally rather than implemented through uniform prescriptions. Rosa-Schleich et al. (2019) reinforce this perspective by showing that diversified farming can improve biodiversity, pest regulation and soil functions while potentially strengthening longer-term economic stability, although farmers may face short-term transition costs. Reganold and Wachter (2016) add that organic agriculture can combine environmental advantages with economic competitiveness when price premiums and broader ecosystem benefits are considered. Garibaldi et al. (2017) similarly show that environmentally favorable farming systems can achieve substantial yields and profits, while noting that socioeconomic outcomes require greater attention. Together, these contributions imply that agroecological transition should be evaluated through ecological and economic performance simultaneously. Diversification may create long-term benefits through reduced risk and stronger ecosystem functioning, but adoption can remain constrained when immediate costs fall disproportionately on farmers. Rural-development policy should therefore combine locally adapted ecological design with financial and institutional measures that help producers manage transition costs and receive recognition for the environmental services generated by diversified agricultural systems.

Kremen and Merenlender (2018) argue that biodiversity conservation, agricultural production and human well-being should be pursued through multifunctional landscapes rather than through isolated interventions at individual farm level. Their perspective implies that many ecological processes relevant to agriculture depend on coordination across property boundaries and wider territorial structures. Dainese et al. (2019) reinforce this landscape dimension by showing that simplification reduces the biodiversity responsible for pollination and natural pest control. Tamburini et al. (2020) further demonstrate that diversification can enhance several ecosystem services without systematically reducing crop production, while Rosa-Schleich et al. (2019) show that these ecological gains may also contribute to more stable economic outcomes over time. Considered jointly, these contributions imply that sustainable rural transformation requires collective management of ecological functions alongside farm-level changes. Individual producers may not be able to generate or capture all the benefits associated with habitat diversity, pollinator conservation or landscape complexity. Public institutions and rural communities therefore have an important role in coordinating land management, supporting collective action and rewarding ecosystem services whose benefits extend beyond the farm. Agroecological development consequently becomes a territorial process in which production, biodiversity and rural livelihoods are jointly organized across interconnected landscapes.

1.3. Climate resilience, productivity and environmental limits

Altieri et al. (2015) show that diversified farming systems, soil organic-matter management, water conservation and landscape complexity can increase the capacity of agriculture to withstand climatic disturbances. Their contribution implies that agroecology provides a resilience function by reducing dependence on external inputs and limiting production instability under



adverse conditions. Dittmer et al. (2023) reinforce this perspective by showing that smallholder agroecological interventions can support climate adaptation without systematically reducing yields, indicating that ecological management and productive performance need not be treated as opposing objectives. Bezner Kerr et al. (2023) broaden the argument by presenting agroecology as a response to interconnected climate, food and ecosystem crises in which diversification, knowledge co-production, equity and institutional change operate together. Madsen et al. (2025) further report predominantly positive agroecological outcomes across food-insecure African countries while identifying important social trade-offs, including potentially greater labor burdens for women. Taken together, these contributions imply that agroecological adaptation should be evaluated simultaneously through ecological, productive and social dimensions. Rural-development policies can strengthen resilience by supporting diversified farming and locally adapted ecological practices, but implementation must also consider how labor requirements, access to resources and decision-making power influence the distribution of benefits across rural households.

Rockström et al. (2017) argue that future agricultural development must remain within ecological limits associated with climate, water, nutrient cycles and biodiversity, implying that production growth can no longer be pursued independently of environmental constraints. Campbell et al. (2017) reinforce this position by showing that agriculture contributes substantially to several planetary-boundary transgressions, making food production a central component of broader environmental instability. Springmann et al. (2018) add that remaining within environmental limits requires combinations of agricultural improvement, technological change, dietary shifts and reductions in food loss and waste rather than reliance on a single intervention. Pretty et al. (2018) complement this systems perspective by demonstrating the importance of redesigning interactions among crops, soils, livestock and landscapes instead of focusing exclusively on input efficiency. Together, these contributions imply that agroecological rural development should be embedded within broader food-system transformation. Improving farm practices is necessary but insufficient when consumption patterns, resource governance and waste continue generating environmental pressures. Sustainable rural development therefore requires coordinated changes across production and food systems so that agricultural productivity can be maintained while reducing demands on ecosystems whose deterioration would ultimately undermine the long-term economic and ecological foundations of rural livelihoods.

Tscharntke et al. (2021) show that environmentally friendly practices implemented on individual farms may remain insufficient when surrounding landscapes are highly simplified, emphasizing the importance of ecological infrastructure and biodiversity-friendly landscape mosaics. This perspective implies that agroecological transformation must extend beyond the boundaries of individual holdings. Altieri et al. (2015) similarly identify landscape complexity as an important mechanism through which agricultural systems can increase resilience to climatic disturbances. Pretty et al. (2018) further demonstrate that sustainable agricultural redesign requires attention to interactions among crops, livestock, soils and landscapes, while Bezner Kerr et al. (2023) emphasize institutional change and knowledge co-production as conditions enabling broader agroecological transformation. Considered jointly, these contributions imply that climate-resilient rural development requires collective territorial coordination in addition to farm-level innovation. Ecosystem services such as water regulation, biodiversity conservation and ecological connectivity frequently depend on actions distributed across multiple farms and land uses. Public institutions, farmer organizations and rural communities therefore need mechanisms for coordinating landscape management and exchanging knowledge. Agroecology becomes more transformative when ecological practices are supported by institutions capable of organizing collective action across territories rather than leaving individual producers to manage environmental risks independently.



2. Sustainable Food Systems: Nutrition, Markets and Social Transformation

2.1. Food security, nutrition and sustainable diets

Sibhatu and Qaim (2018) show that greater farm-production diversity is often associated with improved dietary outcomes, but they also demonstrate that the strength of this relationship depends on how diversification is defined and on the functioning of markets. Their findings imply that increasing the number of crops produced for household consumption is not necessarily the most effective route to improved nutrition when commercialization can generate income used to purchase a wider range of foods. Jones (2017) reinforces this interpretation by identifying a modest but relatively consistent relationship between agricultural biodiversity and dietary diversity while emphasizing substantial contextual variation. Powell et al. (2015) broaden the concept of food-system diversity by showing that forests, fisheries, wild foods and landscape biodiversity can also contribute to dietary quality, although access depends on markets, knowledge and social norms. Dagunga et al. (2023) further demonstrate that diversified production can strengthen smallholder food-security resilience when combined with soil management, reduced dependence on purchased inputs and social learning. Taken together, these contributions imply that agroecological diversification is most effective when embedded within functioning markets and supportive rural institutions. Nutrition-sensitive rural development should therefore connect biological diversity with household income, market access, knowledge and the wider landscape resources available to rural communities.

Stratton et al. (2020) demonstrate that agroecological practices can generate complementarities between ecological functioning and household nutrition, while certain market-oriented coping strategies may weaken ecological processes. Their contribution implies that livelihood strategies should be evaluated according to both nutritional and environmental consequences rather than through income or output alone. Owoputi et al. (2022) add an important distributional dimension by showing that crop diversity and household food security do not automatically translate into equivalent dietary improvements for individual household members, particularly when gendered access to resources shapes food allocation. Béné et al. (2019) reinforce this multidimensional perspective by emphasizing that food-system sustainability involves environmental, nutritional, economic and social objectives that may generate trade-offs across actors and places. Powell et al. (2015) similarly show that the nutritional contribution of diverse food environments depends on social norms, knowledge and access conditions rather than biological availability alone. Together, these contributions imply that agroecological rural development requires attention to who benefits from diversification and how ecological resources are converted into dietary outcomes. Policy should therefore combine support for diversified production with measures addressing gendered resource access, market conditions and nutritional knowledge so that ecological improvements translate more consistently into individual and household well-being.

Willett et al. (2019) link healthy diets with environmentally sustainable food production, implying that rural production strategies must respond simultaneously to nutritional demand and ecological constraints. Clark et al. (2019) reinforce this connection by showing that several foods associated with better health outcomes also tend to impose lower environmental burdens, suggesting potential alignment between dietary transition and more sustainable agricultural production. Béné et al. (2019), however, caution that food-system transformation remains multidimensional and that apparent synergies may coexist with economic or social trade-offs affecting producers and consumers differently. Sibhatu and Qaim (2018) add that market participation and cash income can sometimes contribute more to dietary quality than indiscriminate expansion of subsistence production diversity. Considered jointly, these contributions imply that nutrition-sensitive agroecology should not be designed exclusively from the production



side. Changes in consumption patterns alter crop demand, land use and livelihood opportunities, while market structures determine whether producers can respond profitably to these shifts. Sustainable rural development therefore requires coordination between agricultural diversification, dietary objectives and market incentives so that healthier consumption patterns support rather than undermine the economic viability of rural producers.

2.2. Local markets, short food supply chains and territorial economies

Chiffolleau and Dourian (2020) show that short food supply chains can generate substantial social benefits by strengthening producer-consumer relationships and territorial embeddedness, while their economic and environmental effects remain more heterogeneous. This implies that geographical proximity should not be treated as a sufficient indicator of sustainability. Jarzębowski et al. (2020) reinforce this interpretation by identifying potential contributions to local employment, farmer income, community trust and environmental improvement, but they also emphasize organizational and economic barriers that may limit these benefits. Chiaverina et al. (2023) further caution that participation in short chains does not systematically produce higher farm incomes, since outcomes vary according to geography, indicators and methodological choices. Doernberg et al. (2022) similarly demonstrate considerable variation in the environmental, economic, social and governance performance of short chains across different territorial contexts. Taken together, these contributions imply that localized food systems should be evaluated through multidimensional evidence rather than normative assumptions about proximity. Short chains can support rural multifunctionality and territorial development, but their performance depends on market conditions, organizational capacity and governance arrangements. Rural policy should therefore distinguish between socially attractive initiatives and economically durable models capable of generating stable benefits for producers and communities. Paciarotti and Torregiani (2021) demonstrate that logistics constitute a major constraint on the economic and environmental performance of short food supply chains, since fragmented transportation and inefficient distribution can offset some of the advantages associated with geographical proximity. Bayir et al. (2022) reinforce this operational perspective by identifying coordination, scale, information and organizational limitations as recurring barriers to sustainable local distribution. Rucabado-Palomar and Cuéllar-Padilla (2020) add that the development of territorial food networks requires sustained coordination, sufficient consumer demand and supportive institutional arrangements, meaning that local embeddedness alone does not ensure continuity. Jia et al. (2024) further show that infrastructure, regulation, information and market access can restrict the expansion of short chains beyond relatively small niches despite their potential benefits for producers and communities. Together, these contributions imply that the future of localized rural food systems depends as much on managerial and institutional innovation as on agricultural practices themselves. Efficient shared logistics, digital information systems, collective marketing and supportive regulation can help overcome scale disadvantages and reduce coordination costs. Policies promoting short chains should therefore invest in the organizational infrastructure required to connect dispersed producers with consumers rather than assuming that shorter physical distance automatically creates efficient or environmentally superior supply systems.

El Hamidi (2023) shows that purchase intentions toward products carrying the “Regional Product” label in Marrakech-Safi are positively associated with perceived quality, packaging, societal perceptions, certification and marketing. This finding implies that territorial products require credible differentiation and effective communication if local origin is to translate into market demand. Chiffolleau and Dourian (2020) complement this perspective by showing that short chains are particularly strong in their capacity to reinforce social relationships and territorial



connections, suggesting that regional identity can become an economic resource when consumers perceive value in proximity and provenance. Jarzębowski et al. (2020) further emphasize the roles of trust, local employment and farmer income in positioning short chains as components of territorial development. Jia et al. (2024) nevertheless show that such potential remains constrained by infrastructure, market and institutional barriers. Considered jointly, these contributions imply that territorial rural development requires more than local production itself. Certification, recognizable product attributes, marketing and consumer trust must be combined with functional distribution systems and enabling institutions. Regional labeling can strengthen market differentiation and producer-consumer connections, but its contribution to rural development depends on whether producers can convert territorial identity into sustained demand, reliable market access and economically viable supply-chain relationships.

2.3. Gender, justice, food sovereignty and rural knowledge

Zaremba et al. (2021) argue that agroecological transition must address gendered differences in knowledge, labor, access to resources and political representation, implying that ecological improvement alone does not guarantee socially inclusive rural development. Kansanga et al. (2024) reinforce this position by showing that women's participation in agroecological initiatives may remain insufficient when unequal control over land, labor and household decision-making continues to constrain autonomy. Trevilla Espinal et al. (2021) broaden the perspective by emphasizing care work, social reproduction and collective organization as dimensions that shape women's capacity to participate in and benefit from food-system transformation. Giraldo and Rosset (2018) further show that agroecology is also a field of political contestation in which institutional scaling can either preserve or weaken principles such as autonomy and food sovereignty. Taken together, these contributions imply that socially sustainable agroecology requires explicit attention to power relations rather than assuming that environmentally oriented interventions will automatically generate equitable outcomes. Rural-development strategies should therefore examine who controls productive resources, whose labor sustains transition processes and who participates in defining priorities. Gender-transformative agroecology becomes more substantive when ecological change is accompanied by greater decision-making capacity, resource access and political representation for groups that have historically occupied weaker positions within rural systems.

Khadse et al. (2018) show that large-scale agroecological expansion can emerge through farmer organizations, grassroots learning and political mobilization rather than through the standardized diffusion of a single technological package. Their findings imply that scaling should preserve local adaptability and collective capacity. Schiller et al. (2020) reinforce this institutional perspective by demonstrating that fragmented networks, weak institutional support and broader structural conditions can constrain agroecological transition even when farmers possess interest or knowledge. Meek and Tarlau (2016) add that transformative education can strengthen political learning and collective understanding of the social relations governing food systems, thereby contributing to capacities required for deeper transition. Giraldo and Rosset (2018) further caution that institutionalized scaling may detach agroecology from autonomy and political transformation when conventional development structures redefine it primarily as a technical program. Together, these contributions imply that the expansion of agroecology depends on the form of scaling as much as on its numerical extent. Rural policies should support farmer networks, collective learning and enabling institutions without eliminating the diversity of locally adapted practices. Agroecological development becomes more durable when producers remain active participants in shaping the knowledge, organizations and political arrangements through which transition occurs.



Coolsaet (2016) argues that farmers' experiential knowledge should be recognized not only for its practical contribution to agricultural innovation but also as a matter of cognitive justice, challenging institutions that privilege standardized scientific expertise over locally produced knowledge. Enloe et al. (2021) reinforce this position by showing how participatory methods can enable rural communities to identify problems and construct solutions as active researchers rather than passive recipients of extension advice. Meek and Tarlau (2016) further emphasize that education can contribute to food-system transformation when it develops collective capacity and critical understanding rather than merely transmitting technical information. Khadse et al. (2018) add that farmer-to-farmer pedagogy and grassroots organization can diffuse agroecological knowledge across extensive territories while retaining local adaptability. Considered jointly, these contributions imply that knowledge governance is a central component of rural transformation. Agroecological policies should therefore move beyond one-directional technology transfer and create institutional spaces in which scientific, experiential and community knowledge can interact. Recognizing farmers as knowledge producers can strengthen locally appropriate innovation, improve collective problem-solving and increase ownership of transition processes, while participatory learning networks provide a means of scaling agroecology without reducing it to uniform technical prescriptions.

3. Rural Development and the Future Governance of Agroecological Food Systems

3.1. Rural livelihoods, economic viability and entrepreneurship

Sánchez et al. (2022) show that diversified farming systems can be at least as profitable as simplified systems, with higher labor costs frequently accompanied by increased gross income. Their findings challenge the assumption that ecological diversification necessarily weakens farm economic performance. Van der Ploeg et al. (2019) reinforce this interpretation by demonstrating that reduced dependence on purchased inputs, diversification and greater reliance on endogenous resources can strengthen farm economic autonomy and improve performance. D'Annolfo et al. (2021) similarly find that the push-pull system generates social and ecological benefits among Kenyan smallholders without evidence of reduced profitability, indicating that agroecological practices can support livelihood development as well as environmental objectives. Mouratiadou et al. (2024) broaden this perspective by identifying generally favorable socioeconomic outcomes from agroecology while emphasizing substantial variation in labor requirements, markets and local conditions. Taken together, these contributions imply that agroecology should not be evaluated through a presumed trade-off between ecological sustainability and farm profitability. Economic outcomes depend on how reduced input costs, labor requirements, product diversification and market opportunities interact within particular farming systems. Rural policy should therefore facilitate transitions through market development, labor-sensitive support and mechanisms enabling farmers to capture the economic benefits generated by diversified production.

Kangmennaang et al. (2017) provide direct evidence that participatory agroecological interventions can improve household welfare, reporting increased wealth and reduced food insecurity among participating Malawian households. Their findings imply that agroecology can contribute to rural development when technical practices are combined with experimentation, farmer-to-farmer learning, nutrition and attention to equity. McCune et al. (2019) reinforce the importance of locally grounded capacities by showing that agroecological recovery after hurricanes in Puerto Rico depends on peasant labor, local knowledge and the reconstruction of diversified farming systems. Kansime et al. (2021) add that ecological intensification pathways differ according to farm characteristics, livelihood strategies, knowledge access and extension



relationships, meaning that uniform intervention packages are unlikely to suit heterogeneous rural households. D'Annolfo et al. (2021) further demonstrate the value of assessing agroecology through multiple livelihood capitals rather than through yield alone. Considered jointly, these contributions imply that agroecological rural development depends on adaptive combinations of ecological practices, local knowledge and livelihood resources. Effective programs should therefore provide space for farmer experimentation and differentiated pathways rather than imposing standardized models, while evaluating success through food security, household assets, resilience and economic viability alongside conventional production indicators.

El Azhari et al. (2026) show that integrative literacy programs can strengthen rural Moroccan women's attitudes, subjective norms and perceived behavioral control toward income-generating activities, suggesting that human-capital development can expand the perceived feasibility of livelihood diversification. Ed-Dib and El Hamidi (2019) complement this perspective by demonstrating that formal support may remain constrained when sociocultural institutions restrict women's access to resources and entrepreneurial opportunities. Mouratiadou et al. (2024) add that agroecological transitions can generate employment and social benefits but may also create labor-related trade-offs that should be considered explicitly. Van der Ploeg et al. (2019) further show that greater reliance on endogenous resources and diversification can strengthen autonomous rural livelihoods. Together, these contributions imply that the economic potential of agroecology depends partly on whether rural households possess the capabilities and institutional conditions required to convert diversified production into broader livelihood opportunities. For women in particular, technical agricultural support may have limited effects when literacy, decision-making power or sociocultural restrictions constrain participation. Rural-development policy should therefore combine agroecological support with education, entrepreneurship opportunities and gender-sensitive institutional reform so that diversification strengthens both farm sustainability and wider economic inclusion.

3.2. Policy integration, governance and territorial transformation

Caron et al. (2018) position the renewal of rural territories as one of the principal objectives of food-system transformation alongside healthy diets, sustainable production, climate mitigation and resilience. Their framework implies that rural development should be treated as an integral outcome of food policy rather than as a secondary consequence of agricultural growth. Candel and Pereira (2017) reinforce this systems perspective by showing that fragmented governance is poorly equipped to address food-related problems that cross agricultural, environmental, health, trade and regional policy domains. Termeer et al. (2018) add that effective food-system governance requires system-oriented problem framing, connectivity across institutional boundaries, adaptability, inclusiveness and transformative capacity. Hebinck et al. (2021) further demonstrate that policy makers must navigate explicit trade-offs among environmental, economic, social and health objectives rather than assuming that all goals can be maximized simultaneously. Taken together, these contributions imply that sustainable rural transformation requires coordinated governance capable of integrating multiple policy domains and territorial objectives. Agricultural interventions should therefore be embedded within broader institutional arrangements that connect production, livelihoods, ecosystem services and food security while providing mechanisms for resolving conflicts among competing objectives and groups.

Leeuwis et al. (2021) argue that food-system transformation is fundamentally a governance process shaped by competing interests, power relations and negotiation, meaning that technical evidence alone cannot determine socially legitimate transition pathways. This perspective is reinforced by Vignola and Oosterveer (2025), who emphasize the difficulty of coordinating actors, scales and policy domains in complex food-system transformations. Gaitán-Cremaschi et al.



(2019) add that food systems differ considerably in their organizational, technological and institutional configurations, making uniform transition pathways inappropriate across rural territories. Termeer et al. (2018) further show that ambitious transformation goals may fail when institutional capacity is weak or vulnerable populations remain insufficiently represented. Together, these contributions imply that agroecological rural development requires context-sensitive and deliberative governance rather than standardized policy packages. Institutions must be capable of recognizing territorial diversity, negotiating trade-offs and ensuring that different forms of knowledge and interest are represented in decision-making. Rural transformation becomes more durable when policy design responds to existing production structures, markets and social relations while retaining enough adaptive capacity to revise strategies as conditions change. Governance quality therefore becomes as important as the technical content of agricultural interventions.

Sonnino (2023) shows that food-system transformation increasingly occurs through interactions among local initiatives, national institutions and global agendas, highlighting the importance of polycentric governance. This has direct implications for rural development because urban procurement and food policies can reshape demand, market access and producer-consumer relationships. Moragues-Faus and Morgan (2015) reinforce this territorial perspective by demonstrating that emerging urban food-governance arrangements create new spaces of interaction among governments, civil society and private actors, potentially strengthening political and economic connections between cities and surrounding producing regions. Caron et al. (2018) further emphasize that sustainable food-system transformation should contribute directly to a renaissance of rural territories, while Candell and Pereira (2017) show that such outcomes require coordination across administrative sectors and levels. Considered jointly, these contributions imply that rural and urban food policies should not be designed independently. Territorial transformation depends on creating institutional links through which urban demand, procurement and consumption strategies can support rural production, livelihoods and ecological objectives. Polycentric governance can therefore strengthen agroecological development when municipalities, rural authorities, producer organizations and national institutions coordinate market development and territorial planning across conventional administrative boundaries.

3.3. Innovation, learning and future transition pathways

Klerkx and Begemann (2020) argue that agricultural innovation systems should be organized around explicit societal missions rather than assuming that technological change is inherently desirable. Their framework implies that rural innovation should be directed toward clearly defined agroecological, nutritional and territorial objectives. Herrero et al. (2020) reinforce this position by showing that technological innovation requires supportive incentives, regulation, stakeholder dialogue and social legitimacy if it is to contribute to sustainable food-system transformation. Rose and Chilvers (2018) add that digital and smart-farming technologies must be governed through participation and social responsibility because their effects on rural development depend on who controls them and how benefits are distributed. El Bilali (2019) further shows that research on sustainability transitions has often underemphasized agency, power, civil society and the spatial dimensions of change. Taken together, these contributions imply that the future of rural innovation cannot be assessed through adoption rates or technological sophistication alone. The direction, governance and distributional consequences of innovation are equally important. Agroecological transformation therefore requires innovation policies that define broader social and environmental purposes, involve rural actors in decision-making and evaluate whether new technologies strengthen local capabilities rather than increasing dependence or reproducing existing inequalities.



Meynard et al. (2017) show that agrifood transformation requires coupled innovations linking technological, genetic, organizational and institutional change, implying that farm-level innovation cannot succeed when markets, processing systems or governance arrangements remain unchanged. Pigford et al. (2018) complement this perspective through an innovation-ecosystem framework that emphasizes interactions among ecological actors, institutions, civil society and innovation niches. Iyabano et al. (2022) provide a concrete organizational dimension by showing that farmers' organizations can act as intermediaries connecting grassroots experimentation with extension, advocacy and broader innovation processes. Klerkx and Begemann (2020) further indicate that these networks become more transformative when they are coordinated around explicit missions rather than fragmented technological objectives. Together, these contributions imply that agroecological innovation depends on institutional connectivity across the wider food system. New production practices need complementary changes in value chains, organizational structures and policy environments if they are to persist and expand. Rural-development strategies should therefore strengthen intermediary organizations and cross-sector networks capable of linking producers, researchers, markets and public institutions. Such arrangements can enable local experimentation to move beyond isolated niches while preserving the territorial and ecological specificities upon which agroecological practices often depend. Šūmane et al. (2018) demonstrate that experiential and local farmer knowledge remains indispensable for sustainable and resilient agriculture and should be combined with formal scientific knowledge through multi-actor learning processes. This implies that farmers should be treated as co-producers of innovation rather than as passive recipients of standardized technologies. Iyabano et al. (2022) reinforce this interpretation by showing that farmers' organizations can provide the institutional infrastructure through which agroecological knowledge is exchanged, combined and progressively developed over time. El Bilali (2019) adds that sustainability-transition research requires greater attention to agency and to the actors who actually drive transformation in particular places. Meynard et al. (2017) further show that successful innovation must be coordinated with organizational and institutional change beyond the farm. Considered jointly, these contributions imply that rural innovation systems should be built around interactive learning and locally embedded organizational capacity. Extension systems oriented mainly toward one-directional technology transfer may therefore be insufficient for agroecological transformation. More effective approaches would connect scientific expertise with farmer experimentation, collective learning and organizational intermediation, allowing innovations to respond to territorial conditions while also linking grassroots knowledge with markets, institutions and broader sustainability objectives.

4. Discussion

The literature reviewed first demonstrates that the environmental contribution of agroecology cannot be separated from the organization of agricultural production and rural landscapes. Tamburini et al. (2020) show that agricultural diversification can improve several ecosystem services without systematically reducing crop production, while Dainese et al. (2019) demonstrate that biodiversity contributes directly to pollination, biological pest regulation and agricultural productivity. Ponisio et al. (2015) similarly show that diversification practices can reduce yield differences between organic and conventional systems. These findings question interpretations in which biodiversity conservation and agricultural productivity are necessarily competing objectives. At the same time, Beillouin et al. (2021) and Rosa-Schleich et al. (2019) demonstrate that the performance of diversification varies according to farming practices, environmental conditions and transition costs. The climate-resilience literature reaches a comparable conclusion. Altieri et al. (2015) associate diversified farming, soil management and landscape complexity with greater resilience, whereas Bezner Kerr et al. (2023) place agroecology



within a wider response to climate, food and ecosystem pressures. The implication is that ecological transformation requires coordinated action extending beyond individual farms. Landscape management, collective institutions and locally adapted practices become necessary when biodiversity, water regulation and climatic resilience depend on ecological interactions operating across territorial boundaries.

A second finding concerns the relationship between agroecological production and the social and economic functioning of food systems. Sibhatu and Qaim (2018) demonstrate that production diversity can support dietary outcomes, but market access and commercialization may also play an important role in improving household diets. Jones (2017) and Powell et al. (2015) reinforce the importance of agricultural and landscape diversity while showing that its nutritional effects depend on contextual and social conditions. The paper therefore supports an interpretation of food security in which production, income, markets and resource access interact rather than operate independently. This interpretation also applies to territorial markets. Chiffolleau and Dourian (2020) identify important social contributions from short food supply chains, particularly through stronger producer-consumer relationships, while Jarzębowski et al. (2020) associate these chains with potential improvements in employment, income and community trust. However, Paciarotti and Torregiani (2021) and Jia et al. (2024) show that logistics, infrastructure and coordination can restrict their expansion. El Hamidi (2023) further demonstrates in Marrakech-Safi that perceived quality, packaging, certification, marketing and societal perceptions influence purchase intentions toward regional products. Territorial identity therefore becomes economically meaningful when supported by credible differentiation, effective organization and reliable access to markets.

A third dimension concerns the institutional and political conditions determining whether agroecological transformation can contribute to durable rural development. Zaremba et al. (2021), Kansanga et al. (2024) and Trevilla Espinal et al. (2021) demonstrate that gender relations influence access to resources, labor allocation, knowledge and decision-making, meaning that ecological improvements cannot be assumed to produce socially equitable outcomes. Farmer participation and knowledge are equally important. Khadse et al. (2018) show that agroecological scaling can develop through grassroots organizations and farmer-to-farmer learning, while Šūmane et al. (2018) emphasize the complementarity between experiential and scientific knowledge. Governance therefore becomes central to the direction of transformation. Caron et al. (2018), Candel and Pereira (2017) and Termeer et al. (2018) emphasize the need to coordinate agricultural, environmental, health and territorial policies, while Leeuwis et al. (2021) underline the role of negotiation and competing interests. Innovation must consequently be evaluated within this institutional environment. Klerkx and Begemann (2020) propose mission-oriented agricultural innovation systems, and Meynard et al. (2017) show that technical innovations require complementary organizational and institutional changes. Agroecological transition thus depends less on isolated adoption than on coordinated learning, governance and territorial capacity.

Conclusion

This paper shows that agroecology provides a broad framework for reconsidering the future of rural development through the combined transformation of production systems, food systems and territorial institutions. The literature does not support reducing agroecological transition to the replacement of conventional technologies with environmentally preferable practices. Rather, the transition involves biodiversity, diversification, ecosystem services, resilience, farmer autonomy, markets, nutrition and institutional organization. Ecological diversification can contribute to agricultural productivity and environmental performance, while improved soil management and landscape complexity can reinforce resilience under climatic pressure. However,



these effects remain influenced by farm characteristics, transition costs, access to resources and collective territorial arrangements. Sustainable food systems similarly depend on relationships extending beyond agricultural production. Dietary outcomes are shaped by markets, income and household resource allocation, while local and short food chains require logistics, coordination and sufficient demand to become economically sustainable. Rural development must therefore connect ecological objectives with economic viability and market organization. The reviewed literature consequently supports a multidimensional interpretation in which environmental sustainability is reinforced when rural producers possess the institutional, economic and organizational capacity to maintain agroecological practices and capture the benefits associated with them.

The future of agroecological rural development also depends strongly on governance, participation and the distribution of opportunities generated by food-system transformation. Gender inequalities, unequal control over productive resources and limited political representation can restrict the capacity of particular groups to benefit from ecological transition. At the same time, farmer organizations, participatory learning and recognition of experiential knowledge can strengthen locally adapted innovation and collective capacity. These dimensions indicate that public policy should not rely exclusively on incentives for individual technology adoption. More comprehensive approaches are required to coordinate ecological management, rural entrepreneurship, market development, education, food policy and territorial planning. The contributions of Caron et al. (2018), Termeer et al. (2018), Klerkx and Begemann (2020) and Meynard et al. (2017) particularly indicate that such transformation depends on governance systems capable of connecting different sectors, actors and forms of innovation. Future rural-development strategies should consequently evaluate agroecological transitions through environmental, economic, social and institutional outcomes simultaneously. Their long-term contribution will depend on whether they strengthen ecological resilience while improving livelihood opportunities, participation, local organizational capacity and the ability of rural territories to shape their own development trajectories.

References

1. Altieri, M. A., Nicholls, C. I., Henao, A., & Lana, M. A. (2015). Agroecology and the design of climate change-resilient farming systems. *Agronomy for Sustainable Development*, 35(3), 869–890. doi: 10.1007/s13593-015-0285-2.
2. Anderson, C. R., & Maughan, C. (2021). “The innovation imperative”: The struggle over agroecology in the international food policy arena. *Frontiers in Sustainable Food Systems*, 5, Article 619185. doi: 10.3389/fsufs.2021.619185.
3. Bayir, B., Charles, A., Sekhari, A., & Ouzrout, Y. (2022). Issues and challenges in short food supply chains: A systematic literature review. *Sustainability*, 14(5), Article 3029. doi: 10.3390/su14053029.
4. Beillouin, D., Ben-Ari, T., Malézieux, E., Seufert, V., & Makowski, D. (2021). Positive but variable effects of crop diversification on biodiversity and ecosystem services. *Global Change Biology*, 27(19), 4697–4710. doi: 10.1111/gcb.15747.
5. Béné, C., Oosterveer, P., Lamotte, L., Brouwer, I. D., de Haan, S., Prager, S. D., Talsma, E. F., & Khoury, C. K. (2019). When food systems meet sustainability—Current narratives and implications for actions. *World Development*, 113, 116–130. doi: 10.1016/j.worlddev.2018.08.011.
6. Bezner Kerr, R., Postigo, J. C., Smith, P., Cowie, A., Singh, P. K., Rivera-Ferre, M. G., Tirado, M. C., Campbell, D., & Neufeldt, H. (2023). Agroecology as a transformative approach to tackle climatic, food, and ecosystemic crises. *Current Opinion in Environmental Sustainability*, 62, Article 101275. doi: 10.1016/j.cosust.2023.101275.



7. Campbell, B. M., Beare, D. J., Bennett, E. M., Hall-Spencer, J. M., Ingram, J. S. I., Jaramillo, F., Ortiz, R., Ramankutty, N., Sayer, J. A., & Shindell, D. (2017). Agriculture production as a major driver of the Earth system exceeding planetary boundaries. *Ecology and Society*, 22(4), Article 8. doi: 10.5751/ES-09595-220408.
8. Candel, J. J. L., & Pereira, L. (2017). Towards integrated food policy: Main challenges and steps ahead. *Environmental Science & Policy*, 73, 89–92. doi: 10.1016/j.envsci.2017.04.010.
9. Caron, P., Ferrero y de Loma-Osorio, G., Nabarro, D., Hainzelin, E., Guillou, M., Andersen, I., Arnold, T., Astralaga, M., Beukeboom, M., Bickersteth, S., Bwalya, M., Caballero, P., Campbell, B. M., Divine, N., Fan, S., Frick, M., Friis, A., Gallagher, M., Halkin, J.-P., ... Verburg, G. (2018). Food systems for sustainable development: Proposals for a profound four-part transformation. *Agronomy for Sustainable Development*, 38(4), Article 41. doi: 10.1007/s13593-018-0519-1.
10. Chiaverina, P., Drogué, S., Jacquet, F., Lev, L., & King, R. (2023). Does short food supply chain participation improve farm economic performance? A meta-analysis. *Agricultural Economics*, 54(3), 400–413. doi: 10.1111/agec.12764.
11. Chiffolleau, Y., & Dourian, T. (2020). Sustainable food supply chains: Is shortening the answer? A literature review for a research and innovation agenda. *Sustainability*, 12(23), Article 9831. doi: 10.3390/su12239831.
12. Clark, M. A., Springmann, M., Hill, J., & Tilman, D. (2019). Multiple health and environmental impacts of foods. *Proceedings of the National Academy of Sciences*, 116(46), 23357–23362. doi: 10.1073/pnas.1906908116.
13. Coolsaet, B. (2016). Towards an agroecology of knowledges: Recognition, cognitive justice and farmers' autonomy in France. *Journal of Rural Studies*, 47, 165–171. doi: 10.1016/j.jrurstud.2016.07.012.
14. D'Annolfo, R., Gemmill-Herren, B., Amudavi, D., Shiraku, H. W., Piva, M., & Garibaldi, L. A. (2021). The effects of agroecological farming systems on smallholder livelihoods: A case study on push-pull system from Western Kenya. *International Journal of Agricultural Sustainability*, 19(1), 56–70. doi: 10.1080/14735903.2020.1822639.
15. Dagunga, G., Ayamga, M., Laube, W., Ansah, I. G. K., Kornher, L., & Kotu, B. H. (2023). Agroecology and resilience of smallholder food security: A systematic review. *Frontiers in Sustainable Food Systems*, 7, Article 1267630. doi: 10.3389/fsufs.2023.1267630.
16. Dainese, M., Martin, E. A., Aizen, M. A., Albrecht, M., Bartomeus, I., Bommarco, R., Carvalheiro, L. G., Chaplin-Kramer, R., Gagic, V., Garibaldi, L. A., Ghazoul, J., Grab, H., Jonsson, M., Karp, D. S., Kennedy, C. M., Kleijn, D., Kremen, C., Landis, D. A., Letourneau, D. K., ... Steffan-Dewenter, I. (2019). A global synthesis reveals biodiversity-mediated benefits for crop production. *Science Advances*, 5(10), eaax0121. doi: 10.1126/sciadv.aax0121.
17. Dittmer, K. M., Rose, S., Snapp, S. S., Kebede, Y., Brickman, S., Shelton, S., & Wollenberg, E. (2023). Agroecology can promote climate change adaptation outcomes without compromising yield in smallholder systems. *Environmental Management*, 72(2), 333–342. doi: 10.1007/s00267-023-01816-x.
18. Doernberg, A., Piore, A., Zasada, I., Wascher, D., & Schmutz, U. (2022). Sustainability assessment of short food supply chains (SFSC): Developing and testing a rapid assessment tool in one African and three European city regions. *Agriculture and Human Values*, 39(3), 885–904. doi: 10.1007/s10460-021-10288-w.
19. Dumont, A. M., Vanloqueren, G., Stassart, P. M., & Baret, P. V. (2016). Clarifying the socioeconomic dimensions of agroecology: Between principles and practices. *Agroecology and Sustainable Food Systems*, 40(1), 24–47. doi: 10.1080/21683565.2015.1089967.
20. Ed-Dib, M., & El Hamidi, N. (2019). Duality of formal and informal institutions and women's entrepreneurship in rural areas. *Revue du Contrôle, de la Comptabilité et de l'Audit*, 3(1), 70–86. doi: 10.5281/zenodo.14279219.



21. El Azhari, B., Lotfi, H., El Issi, A., El Hamidi, N., & Zaafrani, H. (2026). The impact of integrative literacy programs on rural people's intention to engage in income-generating activities: An analysis of motivational factors in light of the Theory of Planned Behavior. *Social Sciences & Humanities Open*, 13, Article 102253. doi: 10.1016/j.ssaho.2025.102253.
22. El Bilali, H. (2019). Research on agro-food sustainability transitions: A systematic review of research themes and an analysis of research gaps. *Journal of Cleaner Production*, 221, 353–364. doi: 10.1016/j.jclepro.2019.02.232.
23. El Hamidi, N. (2023). L'intention d'achat des produits avec label « Produit Régional »: Cas de la région Marrakech-Safi. *Revue Internationale des Sciences de Gestion*, 6(2), 1007–1025. doi: 10.5281/zenodo.7945107.
24. Enloe, S. K., Banda, D., Moyo, P., Dakishoni, L., Msachi, R., & Bezner Kerr, R. (2021). Photovoice as a method for co-constructing agroecological knowledge in northern Malawi. *Agroecology and Sustainable Food Systems*, 45(7), 1083–1103. doi: 10.1080/21683565.2021.1901831.
25. Gaitán-Cremaschi, D., Klerkx, L., Duncan, J., Trienekens, J. H., Huenchuleo, C., Dogliotti, S., Contesse, M. E., & Rossing, W. A. H. (2019). Characterizing diversity of food systems in view of sustainability transitions: A review. *Agronomy for Sustainable Development*, 39, Article 1. doi: 10.1007/s13593-018-0550-2.
26. Garibaldi, L. A., Gemmill-Herren, B., D'Annolfo, R., Graeub, B. E., Cunningham, S. A., & Breeze, T. D. (2017). Farming approaches for greater biodiversity, livelihoods, and food security. *Trends in Ecology & Evolution*, 32(1), 68–80. doi: 10.1016/j.tree.2016.10.001.
27. Giraldo, O. F., & Rosset, P. M. (2018). Agroecology as a territory in dispute: Between institutionalization and social movements. *The Journal of Peasant Studies*, 45(3), 545–564. doi: 10.1080/03066150.2017.1353496.
28. Gliessman, S. R. (2016). Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems*, 40(3), 187–189. doi: 10.1080/21683565.2015.1130765.
29. Hebinck, A., Zurek, M., Achterbosch, T., Forkman, B., Kuijsten, A., Kuiper, M., Nørrung, B., van 't Veer, P., & Leip, A. (2021). A Sustainability Compass for policy navigation to sustainable food systems. *Global Food Security*, 29, Article 100546. doi: 10.1016/j.gfs.2021.100546.
30. Herrero, M., Thornton, P. K., Mason-D'Croz, D., Palmer, J., Benton, T. G., Bodirsky, B. L., Bogard, J. R., Hall, A., Lee, B., Nyborg, K., Pradhan, P., Bonnett, G. D., Bryan, B. A., Campbell, B. M., Christensen, S., Clark, M., Cook, M. T., de Boer, I. J. M., Downs, C., ... West, P. C. (2020). Innovation can accelerate the transition towards a sustainable food system. *Nature Food*, 1(5), 266–272. doi: 10.1038/s43016-020-0074-1.
31. Iyabano, A., Klerkx, L., Faure, G., & Toillier, A. (2022). Farmers' Organizations as innovation intermediaries for agroecological innovations in Burkina Faso. *International Journal of Agricultural Sustainability*, 20(5), 857–873. doi: 10.1080/14735903.2021.2002089.
32. Jarzębowski, S., Bourlakis, M., & Bezat-Jarzębowska, A. (2020). Short food supply chains (SFSC) as local and sustainable systems. *Sustainability*, 12(11), Article 4715. doi: 10.3390/su12114715.
33. Jia, F., Shahzadi, G., Bourlakis, M., & John, A. (2024). Promoting resilient and sustainable food systems: A systematic literature review on short food supply chains. *Journal of Cleaner Production*, 435, Article 140364. doi: 10.1016/j.jclepro.2023.140364.
34. Jones, A. D. (2017). Critical review of the emerging research evidence on agricultural biodiversity, diet diversity, and nutritional status in low- and middle-income countries. *Nutrition Reviews*, 75(10), 769–782. doi: 10.1093/nutrit/nux040.
35. Kangmennaang, J., Bezner Kerr, R., Lupafya, E., Dakishoni, L., Katundu, M., & Luginaah, I. (2017). Impact of a participatory agroecological development project on household wealth and food security in Malawi. *Food Security*, 9(3), 561–576. doi: 10.1007/s12571-017-0669-z.



36. Leeuwis, C., Boogaard, B. K., & Atta-Krah, K. (2021). How food systems change (or not): Governance implications for system transformation processes. *Food Security*, 13(4), 761–780. doi: 10.1007/s12571-021-01178-4.
37. Madsen, S., Bezner Kerr, R., Kamilia, K., Cevallos, M. F., Bazille, C., Paracchini, M. L., & Wezel, A. (2025). Agroecology supports sustainable development in Africa: A review. *Agronomy for Sustainable Development*, 45, Article 34. doi: 10.1007/s13593-024-00976-2.
38. McCune, N., Perfecto, I., Avilés-Vázquez, K., Vázquez-Negrón, J., & Vandermeer, J. (2019). Peasant balances and agroecological scaling in Puerto Rican coffee farming. *Agroecology and Sustainable Food Systems*, 43(7–8), 810–826. doi: 10.1080/21683565.2019.1608348.
39. Meek, D., & Tarlau, R. (2016). Critical food systems education (CFSE): Educating for food sovereignty. *Agroecology and Sustainable Food Systems*, 40(3), 237–260. doi: 10.1080/21683565.2015.1130764.
40. Meynard, J.-M., Jeuffroy, M.-H., Le Bail, M., Lefèvre, A., Magrini, M.-B., & Michon, C. (2017). Designing coupled innovations for the sustainability transition of agrifood systems. *Agricultural Systems*, 157, 330–339. doi: 10.1016/j.agsy.2016.08.002.
41. Mier y Terán Giménez Cacho, M., Giraldo, O. F., Aldasoro, M., Morales, H., Ferguson, B. G., Rosset, P., Khadse, A., & Campos, C. (2018). Bringing agroecology to scale: Key drivers and emblematic cases. *Agroecology and Sustainable Food Systems*, 42(6), 637–665. doi: 10.1080/21683565.2018.1443313.
42. Migliorini, P., & Wezel, A. (2017). Converging and diverging principles and practices of organic agriculture regulations and agroecology: A review. *Agronomy for Sustainable Development*, 37, Article 63. doi: 10.1007/s13593-017-0472-4.
43. Moragues-Faus, A., & Morgan, K. (2015). Reframing the foodscape: The emergent world of urban food policy. *Environment and Planning A*, 47(7), 1558–1573. doi: 10.1177/0308518X15595754.
44. Mottet, A., Bicksler, A., Lucantoni, D., De Rosa, F., Scherf, B., Scopel, E., López-Ridaura, S., Gemmill-Herren, B., Bezner Kerr, R., Sourisseau, J.-M., Petersen, P., Chotte, J.-L., Loconto, A., & Tiftonell, P. (2020). Assessing transitions to sustainable agricultural and food systems: A Tool for Agroecology Performance Evaluation (TAPE). *Frontiers in Sustainable Food Systems*, 4, Article 579154. doi: 10.3389/fsufs.2020.579154.
45. Mouratiadou, I., Wezel, A., Kamilia, K., Marchetti, A., Paracchini, M. L., & Bàrberi, P. (2024). The socio-economic performance of agroecology: A review. *Agronomy for Sustainable Development*, 44, Article 19. doi: 10.1007/s13593-024-00945-9.
46. Owoputi, I., Booth, N., Luginaah, I., Nyantakyi-Frimpong, H., Shumba, L., Dakishoni, L., Lupafya, E., Hickey, C., & Bezner Kerr, R. (2022). Does crop diversity influence household food security and women's individual dietary diversity? *Food and Nutrition Bulletin*, 43(4), 395–411. doi: 10.1177/03795721221126787.
47. Paciarotti, C., & Torregiani, F. (2021). The logistics of the short food supply chain: A literature review. *Sustainable Production and Consumption*, 26, 428–442. doi: 10.1016/j.spc.2020.10.002.
48. Palomo-Campesino, S., González, J. A., & García-Llorente, M. (2018). Exploring the connections between agroecological practices and ecosystem services: A systematic literature review. *Sustainability*, 10(12), Article 4339. doi: 10.3390/su10124339.
49. Pigford, A.-A. E., Hickey, G. M., & Klerkx, L. (2018). Beyond agricultural innovation systems? Exploring an agricultural innovation ecosystems approach for niche design and development in sustainability transitions. *Agricultural Systems*, 164, 116–121. doi: 10.1016/j.agsy.2018.04.007.
50. Ponisio, L. C., M'Gonigle, L. K., Mace, K. C., Palomino, J., de Valpine, P., & Kremen, C. (2015). Diversification practices reduce organic to conventional yield gap. *Proceedings of the Royal Society B: Biological Sciences*, 282(1799), Article 20141396. doi: 10.1098/rspb.2014.1396.



51. Powell, B., Thilsted, S. H., Ickowitz, A., Termote, C., Sunderland, T., & Herforth, A. (2015). Improving diets with wild and cultivated biodiversity from across the landscape. *Food Security*, 7(3), 535–554. doi: 10.1007/s12571-015-0466-5.
52. Pretty, J., Benton, T. G., Bharucha, Z. P., Dicks, L. V., Flora, C. B., Godfray, H. C. J., Goulson, D., Hartley, S., Lampkin, N., Morris, C., Pierzynski, G., Prasad, P. V. V., Reganold, J., Rockström, J., Smith, P., Thorne, P., & Wratten, S. (2018). Global assessment of agricultural system redesign for sustainable intensification. *Nature Sustainability*, 1(8), 441–446. doi: 10.1038/s41893-018-0114-0.
53. Reganold, J. P., & Wachter, J. M. (2016). Organic agriculture in the twenty-first century. *Nature Plants*, 2(2), Article 15221. doi: 10.1038/nplants.2015.221.
54. Rivera-Ferre, M. G. (2018). The resignification process of agroecology: Competing narratives from governments, civil society and intergovernmental organizations. *Agroecology and Sustainable Food Systems*, 42(6), 666–685. doi: 10.1080/21683565.2018.1437498.
55. Rockström, J., Williams, J., Daily, G., Noble, A., Matthews, N., Gordon, L., Wetterstrand, H., DeClerck, F., Shah, M., Steduto, P., de Fraiture, C., Hatibu, N., Unver, O., Bird, J., Sibanda, L., & Smith, J. (2017). Sustainable intensification of agriculture for human prosperity and global sustainability. *Ambio*, 46(1), 4–17. doi: 10.1007/s13280-016-0793-6.
56. Rosa-Schleich, J., Loos, J., Mußhoff, O., & Tschardtke, T. (2019). Ecological-economic trade-offs of diversified farming systems—A review. *Ecological Economics*, 160, 251–263. doi: 10.1016/j.ecolecon.2019.03.002.
57. Rose, D. C., & Chilvers, J. (2018). Agriculture 4.0: Broadening responsible innovation in an era of smart farming. *Frontiers in Sustainable Food Systems*, 2, Article 87. doi: 10.3389/fsufs.2018.00087.
58. Rucabado-Palomar, T., & Cuéllar-Padilla, M. (2020). Short food supply chains for local food: A difficult path. *Renewable Agriculture and Food Systems*, 35(2), 182–191. doi: 10.1017/S174217051800039X.
59. Sánchez, A. C., Kamau, H. N., Grazioli, F., & Jones, S. K. (2022). Financial profitability of diversified farming systems: A global meta-analysis. *Ecological Economics*, 201, Article 107595. doi: 10.1016/j.ecolecon.2022.107595.
60. Sanderson Bellamy, A., & Ioris, A. A. R. (2017). Addressing the knowledge gaps in agroecology and identifying guiding principles for transforming conventional agri-food systems. *Sustainability*, 9(3), Article 330. doi: 10.3390/su9030330.
61. Schiller, K. J., et al. (2020). Exploring barriers to the agroecological transition in Nicaragua: A Technological Innovation Systems Approach. *Agroecology and Sustainable Food Systems*, 44(1), 88–132. doi: 10.1080/21683565.2019.1602097.
62. Sibhatu, K. T., & Qaim, M. (2018). Farm production diversity and dietary quality: Linkages and measurement issues. *Food Security*, 10(1), 47–59. doi: 10.1007/s12571-017-0762-3.
63. Sonnino, R. (2023). Food system transformation: Urban perspectives. *Cities*, 134, Article 104164. doi: 10.1016/j.cities.2022.104164.
64. Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B. L., Lassaletta, L., de Vries, W., Vermeulen, S. J., Herrero, M., Carlson, K. M., Jonell, M., Troell, M., DeClerck, F., Gordon, L. J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., ... Willett, W. (2018). Options for keeping the food system within environmental limits. *Nature*, 562(7728), 519–525. doi: 10.1038/s41586-018-0594-0.
65. Stratton, A. E., Kuhl, L., & Blesh, J. (2020). Ecological and nutritional functions of agroecosystems as indicators of smallholder resilience. *Frontiers in Sustainable Food Systems*, 4, Article 543914. doi: 10.3389/fsufs.2020.543914.
66. Šūmane, S., Kunda, I., Knickel, K., Strauss, A., Tisenkopfs, T., des Ios Rios, I., Rivera, M., Chebach, T., & Ashkenazy, A. (2018). Local and farmers' knowledge matters! How integrating informal



- and formal knowledge enhances sustainable and resilient agriculture. *Journal of Rural Studies*, 59, 232–241. doi: 10.1016/j.jrurstud.2017.01.020.
67. Tamburini, G., Bommarco, R., Wanger, T. C., Kremen, C., van der Heijden, M. G. A., Liebman, M., & Hallin, S. (2020). Agricultural diversification promotes multiple ecosystem services without compromising yield. *Science Advances*, 6(45), eaba1715. doi: 10.1126/sciadv.aba1715.
 68. Termeer, C. J. A. M., Drimie, S., Ingram, J., Pereira, L., & Whittingham, M. J. (2018). A diagnostic framework for food system governance arrangements: The case of South Africa. *NJAS—Wageningen Journal of Life Sciences*, 84, 85–93. doi: 10.1016/j.njas.2017.08.001.
 69. Trevilla Espinal, D. L., et al. (2021). Feminist agroecology: Analyzing power relationships in food systems. *Agroecology and Sustainable Food Systems*, 45(7), 1029–1049. doi: 10.1080/21683565.2021.1888842.
 70. Tscharnatke, T., Grass, I., Wanger, T. C., Westphal, C., & Batáry, P. (2021). Beyond organic farming—Harnessing biodiversity-friendly landscapes. *Trends in Ecology & Evolution*, 36(10), 919–930. doi: 10.1016/j.tree.2021.06.010.
 71. van der Ploeg, J. D., et al. (2019). The economic potential of agroecology: Empirical evidence from Europe. *Journal of Rural Studies*, 71, 46–61. doi: 10.1016/j.jrurstud.2019.09.003.
 72. Vignola, R., & Oosterveer, P. (2025). Conceptualizing the governance challenges for food system transformation. *Frontiers in Sustainable Food Systems*, 9, Article 1397574. doi: 10.3389/fsufs.2025.1397574.
 73. Wezel, A., Gemmill-Herren, B., Kerr, R. B., Barrios, E., Gonçalves, A. L. R., & Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food systems: A review. *Agronomy for Sustainable Development*, 40(6), Article 40. doi: 10.1007/s13593-020-00646-z.
 74. Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Sibanda, L. M., ... Murray, C. J. L. (2019). Food in the Anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. doi: 10.1016/S0140-6736(18)31788-4.
 75. Zaremba, H., et al. (2021). Toward a feminist agroecology. *Sustainability*, 13(20), Article 11244. doi: 10.3390/su132011244.

Note: All statements, opinions, and data presented in the publications are the sole responsibility of the respective author(s) and contributor(s) and do not reflect the views of *Journal of Agricultural & Rural Economics*.