Agriculture and Human Values
https://doi.org/10.1007/s10460-024-10539-6

Sustainable farm work in agroecology: how do systemic factors matter?

Sandra Volken[1] · **Patrick Bottazzi**[1]

Accepted: 2 January 2024

Abstract
Agroecological farming is widely considered to reconcile improved working and living conditions of farmers while promoting social, economic, and ecological sustainability. However, most existing research primarily focuses on relatively narrow trade-offs between workload, economic and ecological outcomes at farm level and overlooks the critical role of contextual factors. This article conducts a critical literature review on the complex nature of agroecological farm work and proposes the holistic concept of sustainable farm work (SFW) in agroecology together with a heuristic evaluation framework. The latter was applied to ten case studies to test its relevance, affirming positive outcomes of agroecology on SFW, such as improved food sovereignty, biodiversity conservation, and social inclusiveness, but also showing trade-offs, including increased workload and potential yield reductions. Further, results show that contextual factors, such as policy support, market regulation, and access to resources, heavily influence the impact of agroecological practices on SFW. This article strongly argues for the importance of a holistic understanding of SFW and its contextualization within multiple socio-ecological system levels. The proposed framework establishes clear relationships between agroecology and SFW. An explicit recognition of these multidimensional relationships is essential for maximizing positive outcomes of agroecology in different contexts and fostering SFW. On a theoretical level, this research concludes that, from a holistic perspective, work is an entry point to studying the potential of agroecology to drive a sustainable agroecological transition in economic, social, and ecological terms.

Keywords Agroecology · Labor · Quality of work · Socio-ecological system · Trade-off · Sustainable farm work

Abbreviations
SFW sustainable farm work

Introduction

Conventional agriculture and food systems not only contribute to soil degradation and exacerbate ecological challenges, but also have significant impacts on farmers' working conditions (FAO 2014; FAO and IFAD 2019). These impacts are evident through the excessive use of harmful chemical inputs, the immense pressure on farmers' workload, their alienation through monotonous tasks, and inadequate financial and moral compensation, including the lack of social recognition, training support, and opportunities for capabilities development. The complexity of working conditions alongside ecological outcomes of conventional or alternative farming systems requires further critical and theoretical analysis.

Agroecology has been defined from both social and ecological criteria as a holistic concept of sustainable agriculture that combines issues of social justice with complex practices of agroecosystem management (Wezel et al. 2014). Defined as a set of farming practices, a science, and a social movement, agroecology is a holistic concept that includes an extensive collection of ecological, economic, and social characteristics brought forward by scientists and social movements over the past four decades (Wezel et al. 2009). This generic and universally accepted definition considers multiple dimensions and aspects of 'sustainability'.

✉ Sandra Volken
sandra.volken@unibe.ch

Patrick Bottazzi
pat.bottazzi@unibe.ch

[1] Institute of Geography, University of Bern, Hallerstrasse 12, Bern 3012, Switzerland

Published online: 15 February 2024

As a farming approach, agroecology emphasizes stimulating synergies between biotic and abiotic components of the agroecosystem by reducing external inputs and maintaining the regenerative capacity of the agroecosystems (Rosset and Altieri 1997). As a science, agroecology promotes the diversity of knowledge, indigenous and scientific, and defends most aspects of cognitive and contributive justice for farmers and other vulnerable food system actors (Coolsaet 2016; Timmermann and Felix 2015). As a social movement, agroecology emphasizes the necessity to preserve ecosystems to preserve human and non-human life in all its manifestations. It promotes the empowerment of farmers and rural societies in opposition to land and resource grabbing and the domination of transnational companies in imposing their inputs and products with unfair conditions. The agroecological movement supports farm workers' and other food system actors' engagement in preserving the broader agroecosystems, reinforcing food sovereignty, and strengthening solidarity networks (Altieri et al. 2011). agroecology is also a philosophical and spiritual attitude related to fundamental aspects of the nature-society relationship and the values of sufficiency for human well-being (Rabhi 2017; Toledo 2022). All these aspects, taken from critical literature on agroecology and social movements, have manifest and more hidden implications on working conditions and the construction of a holistic concept of *sustainable farm work (SFW)*.

Following these thoughts, agroecology has also been considered as means to reconciliate environmental integrity and decent working and living conditions. Several studies have attempted to conceptualize these links for the most vulnerable farmers. It has been widely suggested that agroecological farming is more demanding in terms of human labor input (e.g., Rosset and Altieri 1997) with significant impacts on workload or labor costs (Pearson 2007) while providing higher food prices, improving long-term yield stability, and decreasing fertilizer costs (Altieri et al. 2011; Van der Ploeg et al. 2019). As additional compensation for higher workloads, the literature suggests that agroecology provides a better quality of work by increasing motivation and work satisfaction (Mann and Besser 2017), empowering women, and creating more equitable gender relations (Bezner Kerr et al. 2019), quality of life and health of workers (Jansen 2000), social support (Dupre et al. 2017), or political expression (Dumont and Baret 2017). Moreover, agroecology is promising benefits beyond the farm level, including ecological benefits (e.g., Palomo-Campesino et al. 2018; Rosa-Schleich et al. 2019) and a potential increase in rural employment (Garibaldi and Pérez-Méndez 2019; Jansen 2000).

While it is crucial to understand these diverse dimensions of social, economic, and ecological conditions on agroecological farms, it is also essential to understand the contextual factors influencing them. Such factors might be related to the farm or its immediate surroundings or happen at broader social and ecological system levels (Jansen 2000; Orsini et al. 2018), such as the direct market context (Van der Ploeg et al. 2019), as well as any ecological, social, economic, and political aspects (Crowder and Reganold 2015; Jansen 2000). Although all these factors appear sporadically in the key literature on agroecology, little research has attempted to provide a systematic review of the leading direct and indirect factors enabling or influencing sustainable work in agriculture inspired by the agroecology literature. Considering such contextual factors is crucial to prevent drawing inaccurate conclusions regarding the true impact of agroecology on SFW. These factors, especially in combination, can significantly affect the impact of agroecology on various dimensions of SFW. For example, the availability of natural fertilizers such as green manure, which reduces input costs, combined with a high local demand for agroecological products could explain why agroecological farms might yield higher profits than conventional farms.

Moreover, most of the current debate on the effects of agroecological practices is around the trade-offs and synergies at the farm level and usually concerns labor input, economic outcomes (profits, yields), and ecological benefits. Several recent studies synthesized scientific evidence, indicating that agroecological practices can lead to synergistic outcomes but also trade-offs (D'Annolfo et al. 2017; Garibaldi et al. 2017; Orsini et al. 2018; Rosa-Schleich et al. 2019; Van der Ploeg et al. 2019). On the one hand, reducing working conditions to plot-based activities is a way to reduce agroecology to a simple technical innovation rather than a societal transformation (Rosset and Altieri 1997). On the other hand, approaches to sustainable work have started to raise concerns about workers' multiple psychological, social, and ecological needs to keep a satisfactory quality of life and remain productive in the longer term (Kira et al. 2010; Zink 2014; Timmermann and Felix 2015). In our view, despite multiple attempts to summarize the effects of agroecology on working conditions, these approaches remain too narrowed and limited to a productivist definition of farm work.

The purpose of this article is threefold: First, to present and discuss the holistic concept of SFW and its main dimensions in link with what is suggested in the literature on agroecology. Second, to propose a holistic and heuristic framework of SFW combining these dimensions and the multi-level factors potentially influencing its achievement. Third, to apply this framework to several empirical case studies selected from the literature, evaluating its applicability and relevance. Finally, the article provides a brief

discussion and overall conclusion, including potential directions for further research.

Sustainable farm work

This chapter explains the proposed concept of SFW and the holistic SFW framework, including relevant literature underpinning the concept. The first subchapter describes the dimensions of SFW, the second subchapter describes the contextual factors facilitating the sustainability of farm work driven by agroecology and introduces the SFW framework.

A qualitative literature review was conducted to develop the SFW concept, selectively including articles relevant to the developed framework and, for the most part, previously known or recommended to the research team. The process involved the deliberate selection and screening of theoretical works discussing sustainable work and agroecology, followed by identifying the connections between the concepts. The search continued until the core concept of SFW was established. The idea of the framework, that the context influences how agroecology affects SFW, was derived from previous works on agroecological transition and meta-analyses comparing agroecology and conventional farming. Reviews and applied research articles comparing conventional and sustainable agriculture were screened to refine the dimensions of SFW and the contextual layers until no substantially new concepts appeared.

Dimensions of sustainable farm work from an agroecological perspective

This article argues that analyzing trade-offs and synergies between environmental integrity and quality of work on agroecological farms requires an awareness of the multiple meanings of agroecology. Beyond a set of ecological farming practices, agroecology holds an equally important meaning as a social movement (Wezel et al. 2009), aiming to reinforce food sovereignty, preserve rural societies, and promote a diversity of knowledges (Coolsaet 2016), as well as a more fundamental attitude reviving the relationship between humans and nature (Rabhi 2017). These meanings imply the need for a more holistic and integrated concept of working conditions in agroecology - a concept that combines personal, farm-level, and broader social and ecological aspects.

The proposed concept of SFW builds on a combination of several theoretical backgrounds on sustainable work, quality of work in agriculture, and ecological sustainability of farming and incorporates the idea of a nexus between ecological, economic, and societal sustainability. For example, Kira et al. (2010) discuss the social aspects of sustainable work, while Bohnenberger (2022) and Zink (2014) add ecological elements to the sustainability of work, which is combined with the broad literature on ecological outcomes of sustainable agriculture (Palomo-Campesino et al. 2018; Rosa-Schleich et al. 2019). Addinsall et al. (2015) relate the concept of sustainable livelihoods to agroecology by adding food sovereignty as a critical outcome of sustainable livelihoods. The sustainable livelihoods framework (Scoones 1998) adds further aspects to the sustainable outcomes of work, including the sustainable use of natural assets to build a livelihood. Moreover, Gosetti (2017) defines the quality of working life as a critical aspect of the social sustainability of work. Various researchers investigated the diverse quality of work aspects in sustainable agriculture (e.g., Jansen 2000; Dumont and Baret 2017; Dupre et al. 2017; Orsini et al. 2018) and Timmermann and Felix (2015) and Gosetti (2017) include societal outcomes beyond the farm level. Following these multiple theoretical backgrounds and concepts, we propose a definition of SFW as *a particular productive experience that preserves human and non-human interconnections, wellbeing, and reproducibility*. In that perspective, human work is considered part of a broad social and agroecological system rather than a simple productive input which aligns with the fundamental principles of agroecological farming (Gliessman 2016). The subsequent paragraphs detail each dimension of SFW and their connections with the holistic conception of agroecology as stated in the literature.

Building on existing literature, we propose to subdivide the concept of SFW into four main *dimensions*: (1) Intrinsic quality of work (of the farmer, family, and farm workers), (2) Societal inclusiveness of work, (3) Respectful relationship with non-humans and the ecosystems, and (4) Sustainable livelihoods. Each dimension comprises one or several *categories*, further elaborated in the following paragraph and summarized in Table 1.

1) *Intrinsic quality of work*: Intrinsic quality of work means the direct physical and psychological experience of work as perceived by a person. It comprises the deep personal working and living conditions of the farmer, the farm family, and farm workers, including paid and unpaid work. The intrinsic quality of work prevents negative aspects of the working experience, such as the excessive workload and time dedicated to work, overtime, stress levels, physical and psychological pain, and physical integrity and health issues (Gosetti 2017). It underlines the importance of self-esteem, autonomy at work, and the appreciation of applying specific knowledge and skills (Dumont and Baret 2017). The literature on agroecology has emphasized the intrinsic motivations of farmers to go beyond the financial benefit. The

Table 1 Four dimensions and related categories of SFW

Dimension	Categories	Description	Main references
Dimension 1: Intrinsic Quality of Work	Workload and time at work	Time at work per person, labor productivity, appreciation of working hours, work-life balance, physical or psychological intensity but not physical or mental health effect	Gosetti (2017), Dumont and Baret (2017)
	Physical integrity and health	Health and safety, physical strain, and discomfort	
	Psychological wellbeing	Overtime, stress, tediousness, physical abuse, moral issues, or the importance of unpleasant tasks	
	Intrinsic satisfaction	Intrinsic benefits, including pride in one's own work, identification with the work, professional identity, tedious work, pleasure at work, work as experience, appreciation of the level of complexity, and knowledge intensity	
	Autonomy & independence	Autonomy during the working process, capacity to take decisions, off-farm work, flexibility in working schedule	
Dimension 2: Societal Inclusiveness of Work	Social relations & contribution to the public space	Gender relations and labor relations; Shared governance and democratic decision-making; Affiliation and relationships with peers and neighbors; Social engagement, participation of stakeholders in decision-making, and number and quality of community groups.	Timmermann and Felix (2015), Gheaus and Herzog (2016), Dumont and Baret (2017), Dupre et al. (2017), Gosetti (2017), Orsini et al. (2018), Bohnenberger (2022)
	Political inclusion & recognition	Social reward, political recognition, visibility, and the feeling of being supported by the government and society, capacity to influence society and political decisions, proximity between customer and producers	
	Social justice & equity	Social differentiation, cultural recognition, contributive justice	
	Employment and sustainable development	Availability of jobs on the farm or in related sectors, inter-sectorial synergies (e.g., with eco-tourism), inter-generational renewal	
Dimension 3: Relationship to Non-Humans and Ecosystems	Biodiversity conservation & Ecosystem services	Biodiversity, flora and fauna, water quality, reduced use of fossil fuels (for mechanization or agrochemicals), climate change mitigation	Timmermann and Felix (2015), Palomo-Campesino et al. (2018), Bohnenberger (2022)
	Environmental awarenessand experience	Relationship between people and non-human entities in their everyday life experience	
Dimension 4: Sustainable Livelihoods	Sustainable livelihood outcomes	Financial outcomes and security (market access, fair prices for the products, profits, long-term financial stability, salaries) and Food sovereignty (e.g., quantity, quality, diversity of foods, long-term production stability and resilience, capacity to decide which foods to produce and independence from commercial seeds)	Chambers and Conway (1991), Addinsall et al. (2015), Rosa-Schleich et al. (2019)
	Sustainable livelihood assets	Access to financial and physical capital, access to human capital, including capabilities and knowledge (development and application of knowledge and capabilities through agroecology, as well as sufficient experience to perform agroecology adequately), access to natural capital, including natural resources, such as land, and the ecological sustainability of farmland, including soil structure and fertility, soil biodiversity, water retention capacity, or prevention of erosion	

intrinsic quality of work must, therefore, be open to all these dimensions to conform with the monetary and non-monetary valuation of working experience.

2) *Societal inclusiveness of work*: Several theories argue that agroecology has implications for societies as a contribution to and relationships between farm workers, food system actors, and the surrounding community. The *social relations & contribution to the public space* category describes the quality of gender relations (Jansen 2000), shared governance and decision-making, worker's rights, and social engagement of the worker beyond the farm level (Gosetti 2017). The category of *political inclusion & recognition* considers political experience and capacity to influence the food system, including the proximity with consumers (Dumont and Baret 2017), social support (Dupre et al. 2017), and the experienced visibility and recognition (Gosetti 2017). Recognition among peers and other food system actors is vital for meaningful work and is affected by the type of social relations (Timmermann and Felix 2015). The *social justice & equity* category reflects on how different benefits of work are distributed within the labor market (Gheaus and Herzog 2016), shedding light on significant differences in the experienced work life between farmers, farm workers, and food system actors. It comprises concepts of social differentiation (Jansen 2000), contributive and distributive justice (Timmermann and Felix 2015), equity among farms and their possibility to

contribute to society and the fair distribution of tedious and unpleasant tasks. Finally, societal inclusiveness of work includes the contribution of agroecological farm work to rural *employment and sustainable development* (Orsini et al. 2018). Agroecological approaches to work keep a critical eye on increasing labor productivity, which might lead to pressure on workers, overproduction, and loss of employment (Bohnenberger 2022). Following the post-work paradigm, Bohnenberger (2022) also discusses the necessity to reduce individual workloads and dedicate more time and energy to non-commercial aims such as family care, collective action, or citizen engagement.

3) *Relationships to non-humans and ecosystems*: The human experience of work and the non-human ecosystem exist in mutual connection. Both aspects are intrinsically related within a social-ecological system, with SFW at their interface. On the one hand, agroecological farm work contributes to a healthy environment and the conservation of *biodiversity & ecosystem services* (Palomo-Campesino et al. 2018; Rosa-Schleich et al. 2019). Sustainable and meaningful work cannot be separated from the integrity of the ecosystems and other species (Bohnenberger 2022; Zink 2014). On the other hand, workers caring for the preservation of the natural agroecosystem and its biodiversity, for example, by reducing chemical inputs, improve at the same time their own health and, more generally, their working conditions. The experience of a healthy environment and *environmental awareness* of workers is an integral part of agroecology (Timmermann and Felix 2015).
4) *Sustainable livelihoods*: Chambers and Conway define livelihoods in its simplest sense as "a means of gaining a living" (Chambers and Conway 1991, p. 5). This definition could be attributed to the economic outcomes of work. Sustainable livelihoods were introduced later by the British Department for International Development (DFID) and comprised capabilities (what we can do with what we have), assets (such as various types of natural, social, physical, human, and financial capitals), strategies (or actions) and outcomes (Scoones 1998). A recent framework combined agroecology with the sustainable livelihood framework, focusing mainly on *sustainable livelihood assets* and *outcomes* (Addinsall et al. 2015). From an agroecological perspective, work outcomes should not be reduced to their simple financial dimension but instead considered from a more holistic perspective, considering the importance of non-monetary value, such as reduced vulnerability or improved food sovereignty, as well as the mutual contribution of work and natural assets (Addinsall et al. 2015). This is the case, for example, of the progressive establishment of a permaculture or agroforestry systems which creates synergies among multiple outcomes on the long run. Such a definition considers that agricultural production depends on natural capital, such as land and healthy soils or clean water. Farmers can only produce food and sustain their work and livelihoods through access to these capitals. Access to human capital, including skills and knowledge, is equally critical to sustaining livelihoods.

Contextual factors facilitating the sustainability of farm work driven by agroecology

Territorial approaches to Agroecology, as explored by recent literature (e.g., Duru et al. 2015; Wezel et al. 2016; Magrini et al. 2019), highlight the importance of considering the contextual factors surrounding farms in advancing the agroecological transition. Magrini et al. (2019) employ Geels et al.'s (2011) multi-level perspective to portray the agri-food system as a socio-technical system, either supporting or hindering the shift from agroecology as a niche practice to a dominant paradigm. Duru et al. (2015) emphasize stakeholder engagement and the need for coordinated changes in various contextual elements to effectively guide the agroecological transition. These discussions underscore the significance of the entire agri-food system, including institutions, consumer behavior, and farmers' values, in influencing the outcomes of agroecology. The importance of such contextual factors in either facilitating or hindering the positive effects of agroecology on SFW forms the core idea of the SFW framework presented here.

We grouped contextual factors into four *layers*: (A) the Farmer and Farming system, (B) the Agroecosystem landscape, (C) the proximate socioeconomic system, and (D) the broader market, institutional and political system. The layers are arranged to highlight the distance between each layer to the farm and the farmer, from proximate and personal factors to more distant national and international ones. Table 2 provides an overview of the four layers and the more detailed contextual *factors*. The following paragraphs describe the layers and provide examples of how contextual factors might influence the effects of agroecology on SFW. Some of these examples are highlighted in the framework in Fig. 1.

A) *Farmer and farming system*: Farmer and farming system factors are the most proximate factors influencing the sustainability of farm work created by agroecological practices. These include demographic aspects, personal characteristics, and preferences of the farmer, farm family and other farm workers. According to

Table 2 Four contextual layers and related factors that influence the effects of agroecology on SFW

Layer	Factors	Main references
Layer A: Farmer andFarming System	- Personal factors: Personal values, lifestyles, motivations, individual work culture, knowledge and training, and experience with AE - Gendered distribution of roles, including articulation between productive and reproductive work - Governance structure, position and control in the production process and ownership of means of production - Demographic factors of the farmer and the farm family (family size, age, gender) - Farming system characteristics include the type of land use, productive strategies, and its central productive infrastructure	Jansen (2000), Dumont and Baret (2017), Dupre et al. (2017), Gosetti (2017), Orsini et al. (2018), Dahlin and Rusinamhodzi (2019), Trevilla Espinal et al. (2021)
Layer B: Agroecosystem Landscape	- Biophysical factors (climate, rainfall, soil type, topography) and related ecosystem functions - Local flora and fauna, habitat quality, common local pests and related functions and services of the ecosystem - Environmental challenges and externalities from other human and non-human entities	Addinsall et al. (2015), Duru et al. (2015), Wezel et al. (2016), Rosa-Schleich et al. (2019), Van der Ploeg et al. (2019)
Layer C: Proximate Socioeconomic System	- Social dynamics and collective action focusing on farmers' working conditions and well-being - Market and consumers: Consumer preferences, short market chains, alternative markets, demand for agroecological products - Support structures: Farmers' organizations and farmers' unions, technological support structures - Prices and costs: Input and labor costs	Jansen (2000), Dupre et al. (2017), Garibaldi et al. (2017), Rosa-Schleich et al. (2019), Van der Ploeg et al. (2019)
Layer D: Broader Market, Institutions, And Politics	- Agricultural policies, trade liberalizations, subsidies, taxes - Land governance, access to loans and credits	Jansen (2000), Rosa-Schleich et al. (2019), Van der Ploeg et al. (2019)

Jansen (2000), farmers often convert to organic farming because certain lifestyles and *values* influence their farming approach, working relations, and personal satisfaction. Such values might differ between women and men. Women and men might also experience differences in the quality of work according to their position in the productive process, power relations (Jansen 2000) and discrimination, and the level of co-participation in productive and reproductive activities. The importance of the *position in the production process* and the degree of *ownership and control* can also be derived from Marx's theory of work (e.g., Milios and Dimoulis 2018). The *educational background* of a farmer, its implication in the knowledge-making processes and experience, capabilities, and capacity to innovate and adapt to different situations are crucial as well (Coolsaet 2016; Coquil et al. 2018). Gosetti (2017) brings up the notion of local *work cultures* and their relevance to how the quality of work is perceived. Farming system characteristics and practices are also crucial and include the type of land use, productive strategies, and main productive infrastructures (Orsini et al. 2018). *Specific practices* for fertility building, tillage, and weed and pest control are particularly labor-demanding (Wezel et al. 2014), and the type of cover crops might affect costs and ecological benefits (Rosa-Schleich et al. 2019). A literature review from 28 published papers on sub-Saharan Africa case studies has shown the complex trade-off between agroecological land use strategies, yield, and workload, where, in most cases, workload increased more than yields (Dahlin and Rusinamhodzi 2019). *On-farm processing* of products might generate additional value for agroecological products (Van der Ploeg et al. 2019), while it can also add to additional management demand (Dupre et al. 2017). Farm and farming systems include, therefore, a complex set of human, technical, and agronomic factors, leading to an infinite number of settings with a strong influence on the sustainability of farm work.

B) *Agroecosystem landscape*: Landscape approaches of agroecology have now gained momentum (García-Llorente et al. 2012; Wezel et al. 2016; Jeanneret et al. 2021). Agroecosystem resilience depends on the interconnectedness between other components such as forested areas, hydrological systems, biodiversity, and multiple farming systems. The landscape scale emphasizes the agroecosystem's capacity to generate farm resilience and provide natural resources such as biomass, soil fertility, pollination, and other ecosystem services. Such services are directly linked to farmers, their working experiences and conditions, and livelihood outcomes (Addinsall et al. 2015). Environmental challenges such as droughts, pollution, or low biodiversity increase the benefits of ecological and resilient agroecological practices. The total resilience capacity of the agroecosystem can considerably increase or alleviate the pressure on farmers' working conditions and their capacity to go through periods of higher pressure from others or benefit from positive externalities generated by proximate natural or human entities (Duru et al. 2015; Wezel et al. 2016).

C) *Proximate socioeconomic system*: Proximate socioeconomic and market-related aspects of the local or regional food system can directly and powerfully affect the working conditions of farmers and the sustainability of their work. Social norms and values and resulting consumer preferences and agricultural support structures such as farmers' organizations and technological support structures, social movements, or participatory schemes such as community-supported agriculture are essential aspects of the proximate societal factors. Van der Ploeg et al. (2019) highlight several cases in which short-value chains, local markets, consumer support, and demand for agroecological products significantly improve the benefit of agroecological farming in Europe. Also, they describe a case from Austria where a farmer cooperative made a critical difference in negotiating with other food system actors to build fair relationships based on trust and long-term collaborations. Such initiatives might alleviate price pressures and workload related to direct marketing activities. Dupre et al. (2017) discuss the multiple forms of social support, including technological and economic support and farmers' recognition by consumers. Proximate food networks can, to some extent, have a positive influence on food prices, input costs, or labor costs depending on the capacity of collective action of food system actors (Jansen 2000; Garibaldi et al. 2017; Rosa-Schleich et al. 2019; Van der Ploeg et al. 2019). Proximate socioeconomic system factors thus have substantial implications on the potential of agroecology to contribute to SFW. However, they are critically dependent on the broader market and politics and on asymmetric power relations with conventional food system operators.

D) *Broader market, institutions, and politics*: National and international market-related and political regulations, support structures, and constraints are less proximate to the everyday life of farmers but might have strong underlying effects and limitations on their working conditions (Jansen 2000; Van der Ploeg et al. 2019). Such broader factors include trade liberalizations, taxes, subsidies, price (de-)regulations, land governance and access to credits, production standards, and public information and education. An example of trade liberalization is given by Jansen (2000), who describes that imports of cheaper organic products from countries with low labor costs reduce prices for organic products in the importing country. Another example of regulations on the use of pesticides is given by Rosa-Schleich et al. (2019). If pesticides are prohibited, the benefits of biological control might be more substantial.

Together with the Tables 1 and 2; Fig. 1 depicts the SFW framework, more specifically, the links between contextual layers and SFW dimensions. Each field in the diagram in Fig. 1 represents the connection between a particular layer and a particular SFW dimension. For example, in quadrant 1, the innermost field represents the links between contextual factors of layer A and the SFW dimension 1. Each field contains two small circles, a plus and a minus circle. The small circle with a plus represents all positive links between the layer and the SFW dimension, while the size of the circle represents the number of these links. One positive effect of a specific contextual factor on a specific category of the respective SFW dimension is counted as one positive link. An effect of a different factor on the same or a different outcome category is counted as another link. The same link for two different case studies is counted as two links. Thus, the size of the circle depends on how many cases are analyzed and report a particular link and how detailed the list of factors identified in a certain context are. The size of the minus circle represents the number of adverse effects of contextual factors on SFW categories. If the same factor affects the same category once positively and once negatively, it is counted as two different links. The diagram thus provides an overview of the relevance of the local context in explaining the outcomes of agroecology. The size of the circles is a measure of how many factors affect a SFW dimension and how many categories are affected by each factor, thus highlighting the sensitivity of a particular dimension to the context. The diagram also provides an overview of the contextual layers most relevant in supporting or hindering beneficial outcomes of agroecology.

Application of the framework to literature: insights from a qualitative meta-analysis

We applied the developed SFW framework to empirical literature on outcomes of sustainable agriculture published in academic journals. We systematically searched for literature to see how relevant the local context and the different categories of SFW were. We first describe the method for searching and analyzing this literature and then present the results.

Method

Our research approach was inspired by the qualitative meta-analysis approach described by Schnepf and Groeben (2019). This approach allows the systematic identification and analysis of qualitative and quantitative research. Mozzato et al. (2018) have applied a similar approach to analyze

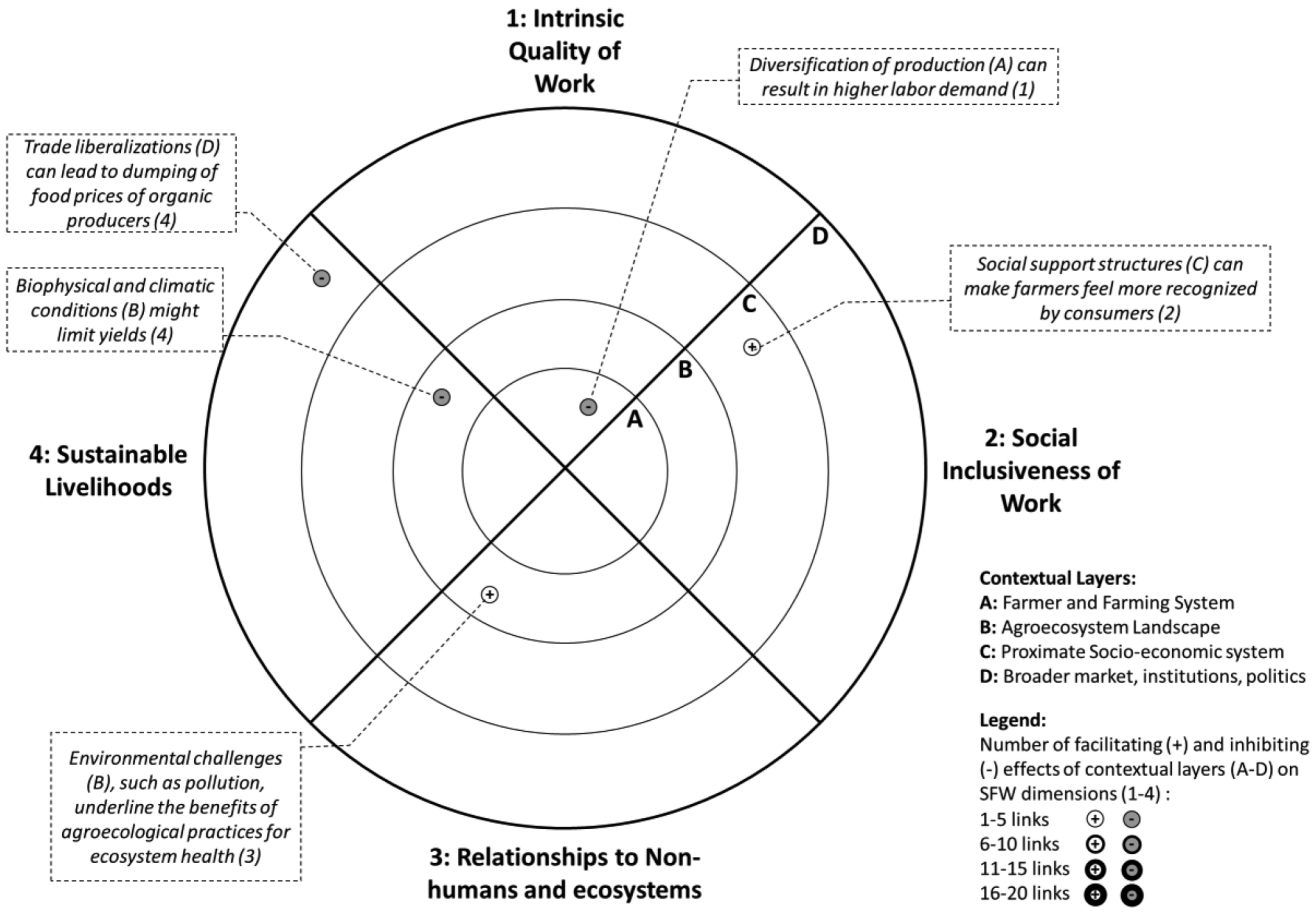

Fig. 1 SFW Framework linking the four contextual layers **A-D**, represented as concentric circles, with the overlapping SFW dimensions **1–4**, represented as the four quadrants of the circle

the influence of local and spatial context on the adoption of sustainable farming practices.

We developed a search query (Appendix) and searched the Scopus database for empirical literature on labor-related and other socioeconomic and ecological outcomes of sustainable farming approaches. This search led to 711 initial results after removing two duplicates. Then, we selected relevant articles according to the following criteria, applied first on the title and abstract level and then on the full-text level. We included studies that: (1) provided primary data and empiric results, (2) were conducted in a real-life situation, not in an experiment station or by researchers, (3) looked at outcomes on the whole farm- or regional-level, not on plot-level, but also not aggregated over multiple farms, (4) compared agroecological farms with conventional farms, or using some kind of before-after evaluation method, (5) focused on smallholder arable farms (no sole livestock), (6) focused on labor-related outcomes, and (7) analyzed farms that applied a holistic approach to sustainable farming, not, for example, mere substitution of synthetic fertilizers with organic fertilizers. Because of the limited number of peer-reviewed articles using the term 'agroecology', we also considered other holistic approaches to sustainable agriculture (organic farming, permaculture, and conservation agriculture) or applications of at least two central agroecological *re-design* practices as described in Wezel et al. (2014)[1]. About 5% of articles were double-screened by a second person to refine the exclusion criteria. To facilitate the screening process of abstracts and titles, we used the online tool Rayyan (Ouzzani et al. 2016) (https://rayyan-prod.qcri.org/welcome). We selected and exported 79 articles to EndNote Reference Manager for full-text eligibility screening.

Finally, ten articles (Table 3) were exported to MAXQDA software for coding and content analysis (Bryman 2012). We applied the framework described in the previous

[1] Agroecological *re-design* practices as described in Wezel et al. (2014) include: (1) organic fertilizers (compost or manure; not only partly reduction or higher efficiency of chemical fertilizer use; not substitution with biofertilizers), (2) crop rotation (different crops in rotations at the same plot over a particular rotation time, including cover crops), (3) intercropping (different crops at the same time at the same plot) and agroforestry (alley intercropping with trees), and (4) direct seeding into living cover crops or mulch, residues (no-tillage) or reduced tillage (only shallow tillage without soil inversion).

Table 3 Studies included in the analysis

Nr	Author and publication year	Journal	Country	Main cultivation	Approach or practices
1	Alonso Mielgo et al. (2001)	Journal of Environmental Policy and Planning	Los Pedroches, Spain	Mountain olive groves	OA[a] (Compost, manure, manual pest control)
2	Mendoza (2004)	Journal of Sustainable Agriculture	Island of Mindoro (Oriental), Philippines	Rice	OA (residues, compost, manual weeding)
3	Oelofse et al. (2010)	Ecological Economics	Tai'an in Shandong, China	Cauliflower	OA (certified)
4	Komatsuzaki and Syuaib (2010)	Sustainability	West Java, Indonesia	Rice	OA (residues and manure fertilizer, hand weeding, and manual weeding)
5	Medland (2016)	Agroecology and Sustainable Food Systems	El Ejido, Spain	Diverse vegetables	OA (EU regulations)
6	Bruce and Som Castellano (2017)	Renewable Agriculture and Food Systems	Ohio, USA	Diverse vegetables, crops	AE[b] (crop rotation, diversity, cover crops, compost) and Alternative food network (AFN)
7	Dumont and Baret (2017)	Journal of Rural Studies	Wallonia, Belgium	Diverse vegetable	AE (socioeconomic principles) and OA
8	Dhar et al. (2018)	Soil and Tillage Research	Jamalpur and Bogra district, Bangladesh	Wheat and beans	CA[c]
9	Bezner Kerr et al. (2019)	Journal of Peasant Studies	Malawi	Diverse vegetables, crops	AE (intercropping legumes, compost/manure, and residues)
10	Spaling and Vander Kooy (2019)	Agriculture and Human Values	Tigania West, Meru County, Kenya	Maize, beans, sorghum	CA (FGW[d])

[a] OA = organic agriculture, [b] AE = agroecological practices, [c] CA = conservation agriculture, [d] FGW = farming god's way

chapter as coding structure. A second coder double-coded the codes on the outcomes for part of the articles to confirm the coding structure. All codes were labeled closely to what the authors explained, reducing the degree of interpretation as much as possible. In other words, nothing was coded as a *contextual factor* if the authors did not explicitly use it to explain an aspect of SFW. For example, livestock or organic material availability was not interpreted as a contextual factor for reduced *input costs* if the authors did not describe it that way, e.g., "availability of livestock provided manure *which reduced* input costs." We did so because we believe that most interpretations would be close to speculation due to the complexity and diversity of individual situations.

Results

This chapter describes the findings from applying the SFW framework to ten empirical case studies, highlighting the contribution of agroecological practices to SFW, explicitly focusing on the interfering role of contextual factors. In the following, the outcomes of each dimension of SFW are described with a focus on the most important contextual factors affecting them. Figure 2 shows the big picture of these links between contextual factors and outcome categories.

Agroecology generally contributed to improving *sustainable livelihoods (Dimension 4)* in most of the case studies, in particular aspects such as food sovereignty, financial outcomes, as well as quality of land, which is one of the most critical assets to SFW. While yields only improved in about half of the cases, *food sovereignty* is consistently evaluated positively. A simple example of this is the reduction of sprayed chemicals, which significantly improved the quality of food and the environmental health in the Philippine case (Mendoza 2004). A healthy environment provides a home to more abundant fauna, such as fish, which in turn serve as an additional food source, complementing and diversifying food sovereignty. We were able to identify strong ties between *financial outcomes* and the proximate socioeconomic context, the market, and the support from society or NGOs. Organic olive growers in Spain benefit from mutual exchange with sheep herders, who provided organic inputs that saved costs (Alonso Mielgo et al. 2001). Farmers producing wheat and beans under conservation agriculture in Bangladesh report that they benefit from the high demand for ecological products and a cooperative's support to access markets (Dhar et al. 2018). In contrast, in Belgium, agroecological farms offering a vegetable box subscription, because of their diverse and small production output,

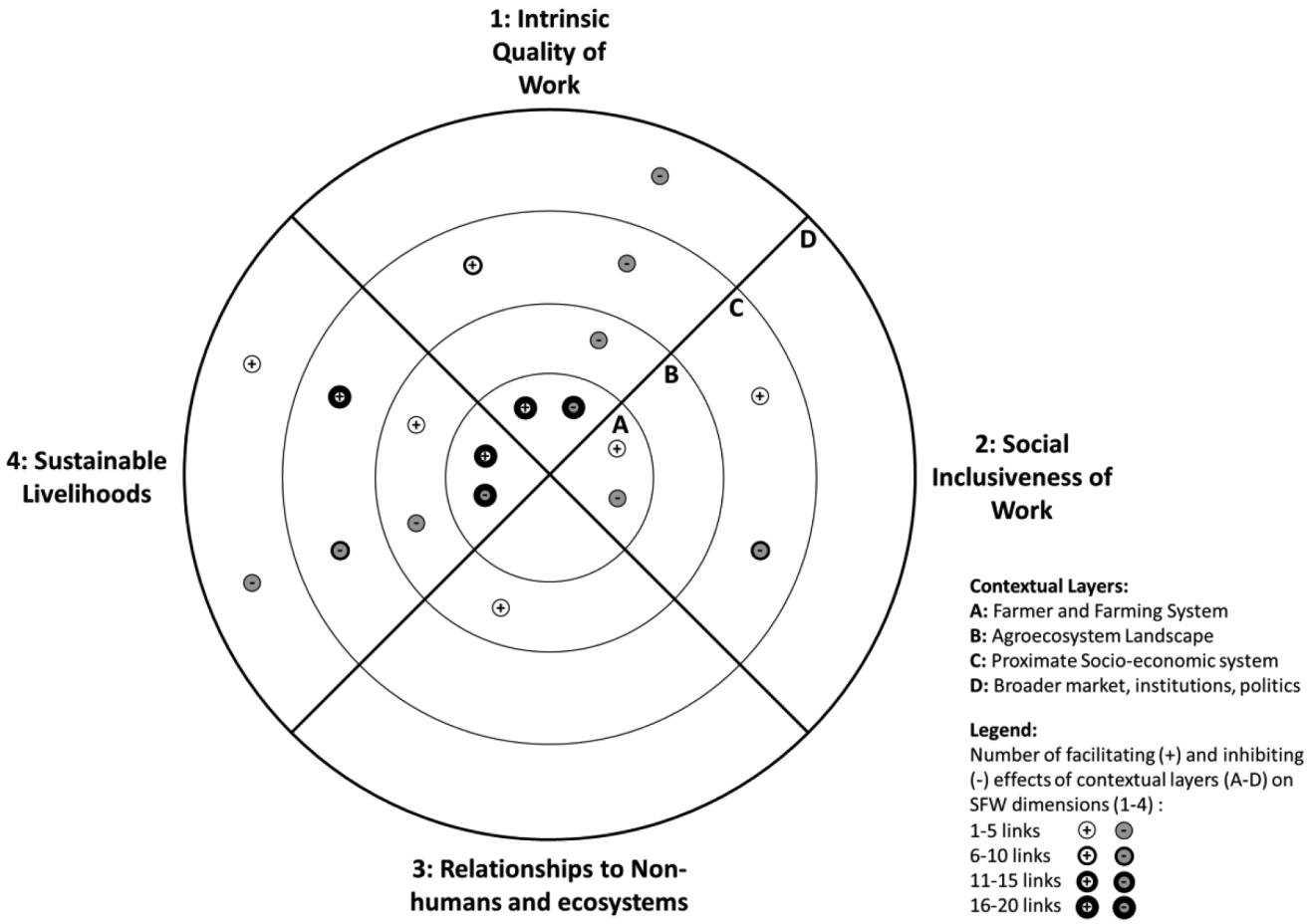

Fig. 2 SFW framework highlighting the positive and negative effects of contextual factors of each layer on outcome categories of each dimension from the ten case studies analyzed

experience high competition in supply (Dumont and Baret 2017). Organic vegetable farmers in Spain similarly prefer direct marketing, which provides slightly higher prices, but they experience a lack of demand and thus depend on supermarket channels offering low prices (Medland 2016). Finally, *agroecological sustainability*, mainly the quality of land, is directly improved depending on the right combination of agroecological practices. Farmers in Kenya report improved soil quality due to crop rotations with legumes and the application of compost and mulch. The improved soil moisture significantly increased their resilience to droughts (Spaling and Vander Kooy 2019).

Intrinsic quality of work (Dimension 1) is critical for farmers to sustain a meaningful work life and motivate the younger generation to continue their efforts in agriculture. The *time spent at work* is a major category of the intrinsic quality of work. While agroecology tends to increase the overall human workload at the farm level, depending on specific agroecological practices and strategies, the workload per person depends on further factors. Indonesian rice farmers had to apply much more organic fertilizers, which required much time despite saving money. Moreover, these organic farmers spent much more time with weeding and pest management than conventional farmers (Komatsuzaki and Syuaib 2010). Alternative marketing channels, such as the vegetable box scheme of the Belgian farmers, require much time for marketing, although it helps producers anticipate the demand and distribute the time slightly better over the year (Dumont and Baret 2017). Agroecological farmers in Ohio, USA, also experienced higher workload for direct marketing and managing complex systems. They relied on labor exchange with neighbors or the help of family to reduce the workload per person, especially during peak period (Bruce and Som Castellano 2017). The possibility of hiring skilled workers reduced the workload in some of the case studies analyzed. However, as discussed in the next paragraph, this depends on financial outcomes, which are not necessarily higher in agroecological farming than conventional. *Intrinsic satisfaction* with work can affect the acceptance of a higher workload. Although agroecology is generally associated with intrinsic motivations, the excessive workload can become conflictive with adequate

family care, leading to crowding out work motivations in the long run (Dumont and Baret 2017). Intrinsic satisfaction is highly subjective. This is shown by some Malawi farmers finding the search for alternative organic material tedious. In contrast, others find it challenging and associate pride with innovative solutions (Bezner Kerr et al. 2019). The quality of work is also determined by improved *physical integrity and health*, as well as *autonomy and independence*, which might compensate for a higher workload. While we found many positive effects of agroecology on farmers' *autonomy* from synthetic inputs and markets, this depends on the local food system and availability of alternative food supply chains (e.g., Medland 2016). While agroecology can potentially increase the intrinsic quality of work, this aspect remains extremely subjective and dependent on multiple trade-offs and limitations due to the local context.

Social inclusiveness of work (Dimension 2) is a crucial aspect explaining how agroecology could improve the social fabric of rural societies at multiple levels. It can enhance social relations within farm households or between farms, as evidenced by the positive outcomes for Malawian and Kenyan farmers (Bezner Kerr et al. 2019; Spaling and Vander Kooy 2019). Participatory agroecological research projects and church values that prioritize equity have led to shared decision-making, reduced women's workload, and mutual support. Spanish olive growers experienced high levels of peasant solidarity among organic farmers (Alonso Mielgo et al. 2001). Furthermore, the feeling of *political inclusion and recognition* is essential in creating a reciprocal relationship between farmers' power to affect society and politics, as well as society and politics' support for agroecological farms. However, the degree to which agroecological farmers can effect change may be limited, leading to disappointment for farmers with a strong vision for contributing to change. Belgian vegetable gardeners, for instance, felt supported by society through direct marketing activities, but felt that their support was not reflected in prices (Dumont and Baret 2017). Ensuring *social justice* is crucial for maintaining a peaceful and meaningful social fabric. Again, this happens at the farm level and between farms. Indonesian rice farmers, for example, increased the workload of sharecroppers by requesting the application of more organic fertilizers without paying them more (Komatsuzaki and Syuaib 2010). Considering justice between farms, Malawian farmers (Bezner Kerr et al. 2019) emphasized how agroecology is specifically for people with low incomes as well, while in other regions, only those who could pay a fee to participate in a cooperation would benefit from their support (Oelofse et al. 2010; Dhar et al. 2018). Finally, agroecology has the potential to contribute to the creation of *employment*, which is critical for a vibrant and sustainable rural society. In about half of the cases analyzed, employment increased, however, not always in concert with good working conditions for employees. The creation of employment depends on labor demand as well as financial outcomes. For example, farmers in the USA could not afford to hire workers or pay them an acceptable price due to low product prices (Bruce and Som Castellano 2017), while in some cases of organic rice farming in the Philippines, employment decreased because the children could take over tasks like weeding. These cases highlight the complex relationship between agroecology, SFW and the so-called labor market.

Relationships to non-humans and ecosystems (Dimension 3) is the second dimension of SFW that reaches beyond the farm level. Some of the case studies reported benefits of agroecology for *biodiversity conservation and ecosystem services*. For example, Indonesian farmers using organic practices to grow rice contribute strongly to higher carbon sequestration (Komatsuzaki and Syuaib 2010), leading to synergies between socioeconomic and environmental aspects of agroecology. Reduced demand for synthetic inputs produced from fossil fuels by organic farmers in the Philippines benefits the climate, while the abandonment of spraying at the same time supports a diverse fauna and improves air quality (Mendoza 2004). Abandonment of chemicals is also important for vegetable growers in Spain, who are aware of the critical conditions of the local aquifers (Medland 2016). Two studies mentioned an increase in *environmental awareness and experience* of agroecological farming families. The children of Filipino farmers became more environmentally conscious due to the change in their parent's farming practices, which increased their willingness to participate in farm activities (Mendoza 2004). Alonso Mielgo et al. (2001) conclude that the more significant environmental consciousness of organic farmers is one reason that justifies the additional subsidies they receive. These cases highlight the perceived quality of nature contributing to meaningful work and the further-reaching implications for the ecological consciousness of farmers and their families.

Discussion and conclusions

Our research builds upon critical agroecological literature to provide theoretical insights into a holistic concept of SFW. We aim to move beyond a narrow focus that limits farm work to inputs such as workload and financial incomes. Instead, we believe that work can be seen as an interface between society and complex ecological processes and transformations (Rabhi 2017; Toledo 2022). Agroecological scholars have long recognized the importance of social, psychological, and ethical aspects (Jansen 2000; Dumont and Baret 2017; Timmermann and Felix 2015) in sustainable farming, which contribute constructively and offer valuable insights for conceptualizing

SFW. We propose four dimensions of analysis: intrinsic quality of work, societal inclusiveness, relationships to non-humans and the ecosystems, and sustainable livelihoods. Furthermore, we have identified four layers of contextual factors and assessed their impact on SFW in a systemic manner. As recent holistic research in the field indicates, the sustainability of farm work is highly contextual and dependent on macro-economic and political drivers, as well as local social-ecological system dynamics (Bottazzi 2019; Dedieu 2022). To test the relevance of our framework in evaluating the role of agroecology on SFW, we analyzed ten empirical case studies from the literature. The findings discussed below indicate that agroecology has a high potential to contribute to SFW on multiple dimensions, while some cases exhibit critical trade-offs explained by their particular context. These results imply a strong link between agroecology and the holistic concept of SFW and demonstrate the necessity of a framework that guides the systematic consideration of the specific farming context.

Synergies and trade-offs between agroecological practices and sustainable farm work

One of the key positive outcomes is the enhancement of food sovereignty, which is one of the strongest arguments of scholars and social movements in favor of agroecology (Altieri et al. 2011; Addinsall et al. 2015). Agroecological practices can improve the quality, diversity, and accessibility of food, leading to a more resilient and self-sufficient food system. This improvement in food sovereignty can have significant implications for the overall well-being of farming communities and their ability to cope with external challenges (e.g., Mendoza 2004). Agroecological practices can also lead to better financial outcomes for farmers. By reducing input costs and enabling access to premium markets for ecological products, farmers can achieve more stable and secure income sources. This financial stability can provide a strong foundation for the long-term success and viability of farming operations (e.g., Dhar et al. 2018; Bezner Kerr et al. 2019). Conservation of soil and other ecosystem services improve sustainable livelihood assets. By adopting practices that focus on the long-term health and quality of the land, farmers can ensure that their operations remain productive and viable for generations to come. This focus on sustainability is essential for the overall resilience of farming systems and their ability to adapt to changing conditions and challenges (e.g., Spaling and Vander Kooy 2019). Agroecology can enhance environmental conservation and ecosystem services, benefiting farmers' health and ecological sustainability. It may also raise environmental awareness among farmers and food system workers and even promote ecological behaviors among tourists through agro-ecotourism (Choo and Jamal 2009).

However, despite these positive outcomes, there are trade-offs to consider. Previous reviews generally conclude that there is a trade-off between ecological benefits, similar or higher yields and profits, and higher workload (e.g., Jansen 2000; van der Ploeg et al. 2019; but see D'Annolfo et al. 2017). We found that workload at the farm level often increases with agroecological practices, and the workload per person may be affected by various factors like the specific practices employed or the availability of skilled workers. Excessive workload could conflict with family care, potentially undermining work motivations in the long run (Dumont and Baret 2017). How exciting or tedious work is can compensate for or aggravate high workloads (Bezner Kerr et al. 2019). Additionally, while agroecology can potentially improve farmers' autonomy from markets or synthetic inputs, this outcome depends on available marketing channels (Medland 2016). Social inclusiveness outcomes are also subject to trade-offs, as increased workload may sometimes result in the exploitation of certain workers, such as sharecroppers (Komatsuzaki and Syuaib 2010). Employment creation is a central aspect of fostering rural community development, but the extent to which sustainable agriculture contributes to permanent and healthy jobs is not sufficiently understood yet (Orsini et al. 2018). In most parts of the world, increased labor demand leads to an increased number of people with a sufficient income and access to food. Employment creation, however, also depends on the most proximate socioeconomic layers as well as broader political and institutional contexts. Our results indicate that agroecology can positively and negatively affect employment creation, depending on many factors, including labor demand (Dhar et al. 2018) and financial outcomes (Bruce and Som Castellano 2017). While a socially embedded farming system such as traditional farming societies could absorb peaks of labor demand through their family ties and multiple local operators (with sometimes increased pressure on women), a productive system made by larger farms might report additional workload on their employers looking for productivity gains.

The critical role of contextual factors and the complexity of sustainable farm work

The socioeconomic context, including market demand for ecological products and support from society or NGOs, plays a crucial role in shaping the financial outcomes of agroecological farms (Van der Ploeg et al. 2019). In the case studies, this support came in various forms, such as assistance from NGOs or cooperatives, which help agroecological farms to access markets more easily (e.g., Mendoza 2004) and capitalize on the high demand for ecological products. Proximity to markets and available marketing channels are other known significant factors (Dupre et al. 2017) that affected SFW in

complex ways in several of the case studies. Direct marketing, such as vegetable box subscriptions, can provide closer connections to customers and allow agroecological farmers to fetch higher prices. However, this approach can also increase competition and workload for marketing activities (Bruce and Som Castellano 2017). It has been found previously that political support for sustainable farming, for example in the form of subsidies (Crowder and Raganold 2015), can make a significant difference. Subsidies, price regulations, or access to credits or resources were essential in some of the case studies as well, significantly impacting felt political support and financial outcomes (Dumont and Baret 2017). Local food systems and demand also play a role in shaping the outcomes of SFW in agroecology. The demand for local organic products (Dhar et al. 2018) and the flexibility of marketing channels (Medland 2006) available to agroecological farms can critically affect their autonomy, financial outcomes, and overall sustainability. The recent COVID-19 pandemic has shown the importance of socioeconomic and political factors, such as the demand for organic products, which increased during the pandemic (Rosero et al. 2023), explaining short-term income benefits of organic farms. Labor availability and the presence of skilled workers are crucial for managing workload and determining the intrinsic quality of work in agroecological farms. The ability to hire skilled workers or engage in labor exchange with neighbors or family members can reduce the workload (e.g., Mendoza 2004), making it more manageable and ultimately affecting the overall success of agroecological practices. Finally, the local agroecosystem and agricultural practices employed can influence the effects on SFW, particularly in terms of food sovereignty and agroecological sustainability (Wezel et al. 2014; Addinsall et al. 2015; Rosa-Schleich et al. 2019). Our analysis showed that the specific agroecosystem and agroecological practices employed can considerably impact how these outcomes manifest.

Concluding remarks

In conclusion, the analysis of ten empirical case studies applying the SFW framework indicates that agroecological practices are strongly linked to SFW across various dimensions and categories, with contextual factors crucial in determining outcomes. This highlights the relevance of the SFW concepts and framework. Addressing critical themes and exploring future research directions will advance our understanding of agroecological practices and their role in fostering sustainable farming and rural livelihoods. Future research should focus on identifying ways to maximize the positive outcomes of agroecological practices in different contexts and addressing potential trade-offs between various SFW dimensions. Investigating the role of the broader agroecosystem, policies, and support systems in promoting agroecological practices that improve SFW and exploring factors influencing intrinsic quality of work and social inclusiveness in diverse agricultural communities are also essential steps to enhance our understanding of agroecological practices and their role in promoting sustainable farming and rural livelihoods.

It is important to emphasize that considering the collection of contextual factors in a systemic manner is crucial. For instance, factors such as the lack of societal and political support, market competition, and limited distribution channels can collectively have significant impacts on the outcomes of agroecology that go beyond the effects of individual factors. When this interplay is better understood, targeted measures can be developed to support a sustainable agroecological transition. We hope that the framework contributes to initiating more comprehensive empirical studies. Such data can enable more robust comparisons between agroecology and conventional agriculture, potentially strengthening political support for a sustainable agroecological transformation.

Furthermore, the SFW concept was initially designed to assess the quality of work specifically for farm workers[2], with considerations for other food system workers limited to social relations, justice, and rural employment. Expanding the framework to illuminate the quality of work for other food system workers, encompassing both economic and non-monetary aspects, would represent a valuable advancement of the framework. This expansion may require examining whether additional categories are needed and if different contextual factors are relevant.

Similarly, we would like to emphasize that a significant aspect of sustainability lies in ensuring that all farm workers experience the positive outcomes of agroecology (Gheaus and Herzog 2016; Timmermann 2018). As depicted in the results, the quality of work within farms varies between individuals and their roles, including the farmers, their families, various employees, or volunteers. Literature also suggests that a worker's position in the agricultural production process and ownership of a farm or production factors are critical determinants of the quality of work (e.g., Milios and Dimoulis 2018). Dimension 2 of the SFW framework accounts for potential inequalities in the quality of work among workers within a farm and layer A considers the roles played by governance structures and the gendered distribution of tasks in such inequalities. Future research might want to account for differences among workers' quality of work in more detail. The framework could differentiate the

[2] Farm workers encompass the farm owner, family members, hired workers, and volunteers engaged in core agricultural tasks on the farm or under direct farm owner control, contributing to the early stages of food production. Their roles center on the farm's premises and the production of raw agricultural goods, differentiating them from workers involved in broader food supply chain activities (food system workers).

SFW outcomes for different groups of workers or individuals and consider factors like a worker's position, ownership, personal characteristics, and values to explain these differences. Taking into account such personal characteristics and values is also essential to prevent self-selection bias when comparing agroecological and conventional farms. This bias can occur when agroecological practices are systematically applied by farmers that share particular values and the potential differences in quality of work among farms are inaccurately attributed to the farming approach when, in fact, the different values are the underlying reasons for variations.

Finally, we agree with D'Annolfo et al. (2017) and draw attention to the influence of individual values on the subjective weighting of all dimensions and categories of SFW. Future studies could consider this by assigning weights to categories (e.g., using the Q-method) when comparing SFW between agroecological and conventional farms to develop more robust policy recommendations.

Appendix: Search query

Search term category	Search terms
Farming approach	TITLE-ABS-KEY ("agroecology" OR "conservation farm*" OR "conservation agriculture" OR "organic farm*" OR "organic agriculture" OR permaculture OR "Alternative agricult*" OR "Alternative farm*" OR "Integrated agricult*" OR "Integrated farm*" OR "Natural agricult*" OR "Natural farm*" OR "Sustainable agricult*" OR "Sustainable farm*") AND
Research methods	("empirical" OR "survey*" OR "qualitative" OR "interview*" OR "focus group*" OR "observation*" OR "field work" OR "case stud*" OR "study" OR "participa*") AND
Work	(labor* OR labour* OR "working condition*" OR "workload" OR "workforce" OR "employee*" OR "employment" OR "unemployment" OR "job*") AND NOT
Excluded terms	(laboratory) AND
Document Type	(LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (DOCTYPE, "ar")) AND
Publication year	(LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010) OR LIMIT-TO (PUBYEAR, 2009) OR LIMIT-TO (PUBYEAR, 2008) OR LIMIT-TO (PUBYEAR, 2007) OR LIMIT-TO (PUBYEAR, 2006) OR LIMIT-TO (PUBYEAR, 2005) OR LIMIT-TO (PUBYEAR, 2004) OR LIMIT-TO (PUBYEAR, 2003) OR LIMIT-TO (PUBYEAR, 2002) OR LIMIT-TO (PUBYEAR, 2001) OR LIMIT-TO (PUBYEAR, 2000))

Acknowledgements The authors are thankful for the constructive comments from the reviewers and the support of the editor. They are also grateful to members of the AgroWork team for their valuable feedback. Special thanks also go to the Institute of Geography (GIUB) members at the University of Bern and the Centre for Development and Environment (CDE) - to Jeannine Winzer, Christoph Oberlack, and Aline Frank - for early general inputs related to the methodological approach. They would also like to thank Eva Hubschmid for contributing to the paper as a double-coder and second screener. However, none of these persons reviewed the finished manuscript. The final study design, the analysis, and all discussions remain thus solely within the responsibility of the two authors. The analysis of the ten research articles included in the review did occur without contact with the original authors. This research was fully funded by the Swiss National Science Foundation (SNSF), Grants Number 176736 and Number 206127 "AgroWork".

Funding Open access funding provided by University of Bern

References

Addinsall, C., K. Glencross, P. Scherrer, B. Weiler, and D. Nichols. 2015. Agroecology and ustainable rural livelihoods: a conceptual framework to guide development projects in the Pacific Islands. *Agroecology and Sustainable Food Systems* 39(6): 691–723.

Alonso Mielgo, A. M., E. Sevilla Guzmán, M. Jiménez, Romera, and G. Guzmán Casado. 2001. Rural development and ecological management of endogenous resources: the case of mountain olive groves in Los Pedroches Comarca (Spain). *Journal of Environmental Policy and Planning* 3(2): 163–175.

Altieri, M. A., F. R. Funes-Monzote, and P. Petersen. 2011. Agroecologically efficient agricultural systems for smallholder farmers: contributions to food sovereignty. *Agronomy for Sustainable Development* 32(1): 1–13.

Bezner Kerr, R., C. Hickey, E. Lupafya, and L. Dakishoni. 2019. Repairing rifts or reproducing inequalities? Agroecology, food sovereignty, and gender justice in Malawi. *Journal of Peasant Studies* 46(7): 1499–1518.

Bohnenberger, K. 2022. Is it a green or brown job? A taxonomy of sustainable employment. *Ecological Economics* 200: 107469.

Bottazzi, P. 2019. Work and social-ecological transitions: a critical review of five contrasting approaches. *Sustainability* 11(14): 3852.

Bruce, A. B., and R. L. Som Castellano. 2017. Labor and alternative food networks: challenges for farmers and consumers. *Renewable Agriculture and Food Systems* 32(5): 403–416.

Bryman, A. 2012. *Social Research Methods*. 4 ed. Oxford: Oxford University Press.

Chambers, R., and G. R. Conway. 1991. Sustainable rural livelihoods: practical concepts for the 21st century. Institute for Development Studies. https://www.ids.ac.uk/download.php?file=files/Dp296.pdf. Accessed 22 December 2023.

Choo, H., and T. Jamal. 2009. Tourism on organic farms in South Korea: a new form of ecotourism? *Journal of Sustainable Tourism* 17(4): 431–454.

Coolsaet, B. 2016. Towards an agroecology of knowledges: Recognition, cognitive justice and farmers' autonomy in France. *Journal of Rural Studies* 47: 165–171.

Coquil, X., M. Cerf, C. Auricoste, A. Joannon, F. Barcellini, P. Cayre, and L. Prost. 2018. Questioning the work of farmers, advisors, teachers and researchers in agro-ecological transition. A review. *Agronomy for Sustainable Development* 38(5): 12.

Crowder, D. W., and J. P. Reganold, J. P. 2015. Financial competitiveness of organic agriculture on a global scale. *Proceedings of the National Academy of Sciences of the United States of America* 112(24): 7611–7616.

D'Annolfo, R., B. Gemmill-Herren, B. Graeub, B., and L. A. Garibaldi. 2017. A review of social and economic performance of agroecology. *International Journal of Agricultural Sustainability* 15(6): 632–644.

Dahlin, A. S., and L. Rusinamhodzi. 2019. Yield and labor relations of sustainable intensification options for smallholder farmers in sub-saharan Africa. A meta-analysis. *Agronomy for Sustainable Development* 39(3).

Dedieu, B. 2022. Le futur du travail en agriculture. *Cah. Agric* 31(27).

Dhar, A. R., M. M. Islam, A. Jannat, and J. U. Ahmed. 2018. Adoption prospects and implication problems of practicing conservation agriculture in Bangladesh: a socioeconomic diagnosis. *Soil and Tillage Research* 176: 77–84.

Dumont, A. M., and P. V. Baret. 2017. Why working conditions are a key issue of sustainability in agriculture? A comparison between agroecological, organic and conventional vegetable systems. *Journal of Rural Studies* 56: 53–64.

Dupre, L., C. Lamine, and M. Navarrete. 2017. Short food supply chains, long working days: active work and the construction of professional satisfaction in French diversified organic market gardening. *Sociologia Ruralis* 57(3): 396–414.

Duru, M., O. Therond, O., and M. Fares. 2015. Designing agroecological transitions; a review. *Agronomy for Sustainable Development* 35(4): 1237–1257.

FAO. 2014. Building a common vision for sustainable food and agriculture. Principles and approaches. https://www.fao.org/documents/card/en/c/I3940E. FAO. Accessed 22 December 2023.

FAO and IFAD. 2019. United Nations Decade of Family Farming 2019–2028. Global Action Plan. https://www.fao.org/publications/card/en/c/CA4672EN/. Accessed 22 December 2023.

García-Llorente, M., B. Martín-López, I. Iniesta-Arandia, C. A. López-Santiago, P. A. Aguilera, and C. Montes. 2012. The role of multi-functionality in social preferences toward semi-arid rural landscapes: an ecosystem service approach. *Environmental Science & Policy* 19(20): 136–146.

Garibaldi, L. A., and N. Pérez-Méndez. 2019. Positive outcomes between crop diversity and agricultural employment worldwide. *Ecological Economics* 164.

Garibaldi, L. A., B. Gemmill-Herren, R. D'Annolfo, B. E. Graeub, S. A. Cunningham, and T. D. Breeze. 2017. Farming approaches for greater biodiversity, livelihoods, and food security. *Trends in Ecology & Evolution* 32(1): 68–80.

Gheaus, A., and L. Herzog. 2016. The Goods of Work (other Than Money!). *Journal of Social Philosophy* 47(1): 70–89.

Gliessman, S. 2016. Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems* 40(3): 187–189.

Gosetti, G. 2017. Sustainable agriculture and quality of working Life: Analytical perspectives and confirmation from Research. *Sustainability* 9(10): 23.

Jansen, K. 2000. Labour, livelihoods and the quality of life in organic agriculture in Europe. *Biological Agriculture & Horticulture* 17(3): 247–278.

Jeanneret, P., S. Aviron, A. Alignier, C. Lavigne, J. Helfenstein, F. Herzog, and S. Petit. 2021. Agroecology landscapes. *Landscape Ecology* 36(8): 2235–2257.

Kira, M., F. M. van Eijnatten, and D. B. Balkin. 2010. Crafting sustainable work: development of personal resources. *Journal of Organizational Change Management* 23(5): 616–632.

Komatsuzaki, M., and M. F. Syuaib. 2010. Comparison of the farming system and carbon sequestration between conventional and organic rice production in West Java, Indonesia. *Sustainability* 2(3): 833–843.

Magrini, M.-B., G. Martin, M.-A. Magne, M. Duru, N. Couix, L. Hazard, and G. Plumecocq. 2019. Agroecological Transition from farms to Territorialised Agri-Food systems: issues and drivers. In *Agroecological transitions: from theory to practice in local Participatory Design*, eds. J.-E. Bergez, E. Audouin, and O. Therond. 69–98. Cham, CH: Springer International Publishing.

Mann, S., and T. Besser, T. 2017. Diversification and work satisfaction: testing a claim by Marx and Engels for farmers. *Rural Sociology* 82(2): 349–362.

Medland, L. 2016. Working for social sustainability: insights from a Spanish organic production enclave. *Agroecology and Sustainable Food Systems* 40(10): 1133–1156.

Mendoza, T. C. 2004. Evaluating the benefits of organic farming in rice agroecosystems in the Philippines. *Journal of Sustainable Agriculture* 24(2): 93–115.

Milios, J., and D. Dimoulis. 2018. *Karl Marx and the classics. An essay on value, crises and the Capitalist Mode of production*. New York, NY: Routledge.

Mozzato, D., P. Gatto, E. Defrancesco, L. Bortolini, F. Pirotti, E. Pisani, and L. Sartori. 2018. The role of factors affecting the adoption of environmentally friendly farming practices: Can geographical context and time explain the differences emerging from literature? *Sustainability* 10(9).

Oelofse, M., H. Hogh-Jensen, L. S. Abreu, G. F. Almeida, Q. Y. Hui, T. Sultan, and A. de Neergaard. 2010. Certified organic agriculture in China and Brazil: market accessibility and outcomes following adoption. *Ecological Economics* 69(9): 1785–1793.

Orsini, S., S. Padel, and N. Lampkin. 2018. Labour use on organic farms: a review of research since 2000. *Organic Farming* 4(1).

Ouzzani, M., H. Hammady, Z. Fedorowicz, and A. Elmagarmid. 2016. Rayyan-a web and mobile app for systematic reviews. *Syst Rev* 5(1): 210.

Palomo-Campesino, S., J. A. Gonzalez, and M. Garcia-Llorente. 2018. Exploring the connections between agroecological practices and ecosystem services: A systematic literature review. *Sustainability* 10(12).

Pearson, C. 2007. Regenerative, semiclosed systems: a priority for twentyfirst-century agriculture. *BioScience* 57(5): 409–418.

Rabhi, P. 2017. *The power of restraint*. Éditions Actes Sud. https://www.actes-sud.fr/node/60776. Accessed 22 December 2023.

Rosa-Schleich, J., J. Loos, O. Mußhoff, and T. Tscharntke. 2019. Ecological-economic trade-offs of Diversified Farming systems– a review. *Ecological Economics* 160: 251–263.

Rosero, D., F. Soto Mas, L. Nervi, R. Sebastian, V. Casanova, and S. Guldan. 2023. Impact of COVID-19 on USDA-certified organic producers: exploring the role of sociodemographic and contextual factors. *Organic Agriculture* 13: 133–144.

Rosset, P. M., and M. A. Altieri, M. A. 1997. Agroecology versus input substitution: a fundamental contradiction of sustainable agriculture. *Society & Natural Resources* 10(3): 283–295.

Schnepf, J., and N. Groeben. 2019. Qualitative metaanalyse mithilfe computergestützter qualitativer inhaltsanalyse– am Beispiel Von Lokale-Agenda-21-Prozessen. *Forum Qualitative Sozialforschung* 20(3).

Scoones, I. 1998. Sustainable rural livelihoods: a framework for analysis. Institute of Development Studies. https://www.ids.ac.uk/

publications/sustainable-rural-livelihoods-a-framework-for-analysis/. Accessed 22 December 2023.
Spaling, H., and K. Vander Kooy. 2019. Farming God's way: agronomy and faith contested. *Agriculture and Human Values* 36(3): 411–426.
Timmermann, C. 2018. Contributive Justice: an exploration of a wider provision of meaningful work. *Social Justice Research* 31(1): 85–111.
Timmermann, C., and G. F. Felix, G. F. 2015. Agroecology as a vehicle for contributive justice. *Agriculture and Human Values* 32(3): 523–538.
Toledo, V. M. 2022. Agroecology and spirituality: reflections about an unrecognized link. *Agroecology and Sustainable Food Systems* 46(4): 626–641.
Trevilla Espinal, D. L., M. L. Soto Pinto, H. Morales, and E. I. J. Estrada-Lugo. 2021. Feminist agroecology: analyzing power relationships in food systems. *Agroecology and Sustainable Food Systems* 45: 1029–1049.
Van der Ploeg, J. D., D. Barjolle, J. Bruil, G. Brunori, L. M. Costa Madureira, J. Dessein, and A. Wezel. 2019. The economic potential of agroecology: empirical evidence from Europe. *Journal of Rural Studies*
Wezel, A., S. Bellon, T. Dore, C. Francis, D. Vallod, and C. David, C. 2009. Agroecology as a science, a movement and a practice. A review. *Agronomy for Sustainable Development* 29(4): 503–515.
Wezel, A., M. Casagrande, F. Celette, J. F. Vian, A. Ferrer, and J. Peigne. 2014. Agroecological practices for sustainable agriculture. A review. *Agronomy for Sustainable Development* 34(1): 1–20.
Wezel, A., H. Brives, M. Casagrande, C. Clement, A. Dufour, and P. Vandenbroucke. 2016. Agroecology territories: places for sustainable agricultural and food systems and biodiversity conservation. *Agroecology and Sustainable Food Systems* 40(2): 132–144.
Zink, K. J. 2014. Designing sustainable work systems: the need for a systems approach. *Applied Ergonomics* 45(1): 126–132.

Sandra Volken is a doctoral student at the Institute of Geography at the University of Bern since October 2018 under funding of the Swiss National Science Foundation (SNSF).

Patrick Bottazzi is an Assistant Professor funded by the Swiss National Science Foundation (SNSF), group leader of the LASET (Labor and socio-ecological transition) at the Institute of Geography, and member of the Centre for Development and Environment (CDE) both located at the University of Bern.