



Livestock farmers' working conditions in agroecological farming systems. A review

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Abstract

The livestock farming sector is under stress as fewer and fewer people are willing or able to become livestock farmers. Contributing to the decline in attractiveness of the profession are, among other factors, agricultural crises, higher consumer expectations, and difficult working conditions. Agroecology is a sustainable solution that can maintain livestock production and provide positive contributions to society without negatively affecting the environment. Moreover, in its search for social sustainability, agroecological farming could offer better working conditions to farmers and thus contribute to a sustainable future for the livestock farming sector. Here, we review research on livestock farmers' working conditions in agroecological farming systems. This paper aims to give a comprehensive overview of the available research findings and the dimensions used to describe farmers' working conditions. The major findings are the following: (i) relatively little published research is available; (ii) it is difficult to compare findings across studies as different dimensions are used to study working conditions and, in certain cases, detailed descriptions of the farming systems are not provided; (iii) certain dimensions were rarely addressed, such as farmers' health, or work organization; and (iv) in general, farmers' work is addressed as a component of environmental and economic analyses of the performance of agroecological livestock farming systems, using most often indicators on labor productivity and/or efficiency. Comprehensive multidimensional approaches to study working conditions are lacking, as are studies on the interactions and trade-offs between dimensions (e.g., workload, fulfillment, work organization). To study livestock farmers' working conditions in agroecological farming systems, we recommend to use a comprehensive approach assessing different dimensions contributing to working conditions, combined with the description of farmers' activities and work environment.

Keywords Agroecology · Labor conditions · Livestock farmers · Social sustainability

Contents

1. Introduction
 2. Methodology
 - 2.1 Search criteria for the database query
 - 2.2 Selection procedure of relevant papers
 - 2.3 Analysis of the selected papers
 3. A scarcity of studies specifically addressing farmers' work and working conditions in agroecological livestock farming systems
 4. Dimensions which are not addressed in the literature
 5. A need to get closer to the reality of farmers' working situations and activities
 6. Contrasting impacts on workload, work organization, and complexity of agroecological systems
 7. Skills, knowledge, norms, and values at the center of agroecological transitions
 8. A broader and multidimensional framework to study livestock farmers' working conditions
 9. Conclusions
- Acknowledgements and Declarations
References

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1 Introduction

The negative impacts of livestock production on the environment (e.g., loss of biodiversity, contribution to greenhouse gas emissions, and water pollution) are widely recognized.

However, the livestock sector also performs important positive functions for societies by contributing, for example, to agricultural economies, livelihoods, and human health (Steinfeld et al. 2006; Ryschawy et al. 2015). The livestock production sector is furthermore expected to grow to meet increasing global demand for food of animal origin (Steinfeld et al. 2006; Searchinger et al. 2018).

With a generation of farmers soon to retire, the farming sector is facing an additional challenge, namely, how to ensure that a new generation of farmers will step into their shoes. In Europe, just 7.5% of farmers are under 35 years of age, while 30% are over 65 (Council of the European Union 2014). A major obstacle to ensuring continuity is the perceived lack of attractiveness of farming in general and livestock farming in particular, as a profession (Servière et al. 2019b; Hostiou et al. 2020). The working conditions of livestock farmers are even more challenging than those of crop farmers; livestock farmers are known to have long working days, are concerned with work-related health problems (Hostiou et al. 2020), and must deal with the constraint posed by animals needing daily care and monitoring which cannot be postponed. Livestock farmers also have expressed the desire for working conditions that would enable them to achieve a better work-family balance and obtain greater financial rewards for their work (Servière et al. 2019b).

The challenge is thus to find sustainable solutions that would allow livestock production and its positive contributions to society to be maintained without negatively impacting the environment (Steinfeld et al. 2006), and possibly contributing to its protection (Stoate et al. 2009). Agroecology as a science is expected to draw on ecological concepts and principles to contribute to the design, development, and management of sustainable food systems (Gliessman 2007). Animals in farming systems are of interest as they can provide positive contributions to agroecosystems, e.g., by contributing to nutrient and energy cycles or more broadly by shaping the vegetation of ecosystems (Gliessman 2007; Dumont et al., 2013). In terms of farm work, agroecological farming offers people the promise of an opportunity to obtain honorable and fulfilling employment (Gliessman 2007). Reducing working time can be a reason for livestock farmers to adopt certain agroecological farming systems (Lusson and Coquil 2016). However, in other cases, agroecological practices can prove to be more time-consuming, leading to situations in which farmers abandon these practices (Aubron et al. 2016). Agroecology can increase demand for labor and creates employment (Van Der Ploeg et al. 2019). However, an improvement in farmers' working conditions is not guaranteed unless this is considered a starting point in the design of farming systems (Béguin and Pueyo 2011).

In general, a combination of different indicators related to environmental, productive, and socio-economic performance are used to assess the sustainability of agroecological farming

systems. A recent study showed that compared to other pillars, the social pillar of sustainability is less taken into account in the existing models used to study livestock production systems, and "job quality" and working conditions were rarely considered (van der Linden et al. 2020). Studying working conditions is complex as these conditions are themselves determined by multiple dimensions (e.g., work environment, nature of the job, balance between work and personal life, professional relations, health) (e.g., Kling-Eveillard et al. 2012; Dumont and Baret 2017; Servière et al. 2019b). Different indicators are used to analyze working conditions, for example, work duration, work organization (Courmut et al. 2018a), and labor productivity (Aubron et al. 2016). To understand farmers' working conditions, one must consider not only quantifiable dimensions (e.g., the length of working days) but also dimensions that can explain how working conditions are experienced by workers (e.g., by understanding farmer's reasons for acting) (Kling-Eveillard et al. 2012). Moreover, the interactions of the different dimensions determining working conditions need to be understood (Martel and Dupuis 2006).

Given the need to replace older farmers on the verge of retirement, the difficult work conditions of livestock farming, and the higher labor requirements of certain agroecological farming practices, the working conditions of livestock farmers and farm workers in agroecological farming systems need to be examined. Based on an exploratory review of the literature, this article therefore aims to describe what is currently known about livestock farmers' working conditions in agroecological farming systems and to analyze the dimensions used to describe these working conditions. We first describe how, through a search of the scientific literature, data on working conditions in agroecological livestock farms were obtained. We then describe the extent of existing knowledge of farmers' working conditions in agroecological livestock farms and the main dimensions used to study these (Fig. 1).

2 Methodology

2.1 Search criteria for the database query

Using a topic search, the Web of Science (all databases) was interrogated between the beginning of January and on May 15, 2020. Agroecology at the farm level can be defined as a set of agricultural practices that privilege the biological interactions of an ecosystem with the aim to use them in the most optimal way (Journal Officiel, 2015). A review of ecological farming approaches by Rega et al. (2018) shows that no general agreement exists regarding how to define agroecological farming practices and systems. Farming practices considered to be agroecological, such as using organic manure and crop rotations, also are used in organic, low-input, and integrated farming systems. The different systems represent a

Fig. 1 Livestock farmers at work in different situations and performing a diversity of tasks (photos by Jean-Yves Pailleux)



continuum rather than strictly delimited types (Rega et al. 2018). Moreover, agroecological principles can be applied in various ways, giving rise to a diversity of farm systems. The following search criteria were used to search journal articles: livestock AND (work OR work conditions OR labo\$r conditions OR labo\$r) AND (agroecology OR organic farming OR crop-livestock OR low-input). The classification of farming systems used as search criteria were derived from the review from Rega et al. (2018), and “crop-livestock” was used to specify integrated farming systems. We chose to use a generic search (such as “working conditions”) rather than specific dimensions (e.g., “health”) as one of the objectives of this paper was to understand how papers flagged as concerning livestock farmers’ working conditions use dimensions and indicators to study these.

The timespan chosen was 1990 to the present since scientific interest in the topic of farmers’ work and working conditions started to emerge in the early 1990s in the livestock farming systems research community (Dedieu and Servièrè 2012). In addition, we interrogated the database of the journal, *Agroecology and Sustainable Food Systems*, as we expected that it could contain relevant papers based on the topics it addresses. Moreover, we consulted the “Scientific event and literature monitoring newsletters” of the International Association on Work in Agriculture (IAWA, <https://www.workinagriculture.com/>). In addition, papers of interest were obtained by scrutinizing reference lists of the papers retained from the search. We considered journal articles written in English or French, from across the world. The language criterion led to the exclusion of two papers.

2.2 Selection procedure of relevant papers

To identify relevant papers for this review, the titles and abstracts of papers were screened. Our main criteria for inclusion of papers in the review was that the study’s main focus was on livestock farmers’ work and working conditions in an agroecological farming system. For this purpose, a database was created in order to compare papers by listing the type of production system studied, the methodology, the dimensions and indicators used by the authors to assess farmers’ work and working conditions, the geographic region, and the scientific discipline.

Criteria to reject papers were related to the origin of the obtained data and the amount of detail provided. We only retained papers that based their results on empirical data obtained from commercial livestock farms. The search result contained several conference papers, but when these proved to contain insufficient details to be analyzed, they were also set aside. In addition, when the type of production (crop or livestock) was unspecified, making it impossible to relate the results to animal production systems papers, these papers were rejected for further analysis.

Papers from production systems other than livestock (horticulture and arable farming systems) were used: (i) when no references were available on livestock farming systems, to study certain dimensions of farmers’ working conditions; (ii) for comparative purpose: and/or (iii) for an illustrative purpose.

2.3 Analysis of the selected papers

The working dimensions studied in the individual papers with a focus on livestock farmers’ working conditions were listed and are presented in the results section. A comparative analysis was conducted to show whether or not dimensions were studied across papers and in which farming context. To identify dimensions not studied in agroecological livestock farming systems, results from other production systems applying agroecological practices (Hall and Mogyorodý 2007; Navarrete et al. 2015; Finley et al. 2017; Baer-Nawrocka and Błocisz 2018) and literature on working conditions in farms in general were used (Martel and Dupuis 2006; Servièrè et al. 2019a).

As a complement, a separate list was made of papers obtained through the query that did not focus on farmers’ working conditions, but which analyzed agroecological livestock farming systems’ performance in general and studied social performance related to farm work by using indicators such as labor productivity or labor requirements. They were listed separately because, in line with Jansen (2000), it was considered that the sole use of these types of indicators provides an incomplete picture of farmers’ working conditions. The aim was to obtain an overview on the indicators used in these cases

and discuss the value of these approaches compared to those in the papers identified as focusing on working conditions.

3 A scarcity of studies specifically addressing farmers' work and working conditions in agroecological livestock farming systems

Few papers focused specifically on the working conditions of livestock farmers and farm workers in agroecological farming systems. Using our search strategy, we identified nine papers matching our criteria (Table 1). Across these papers, different animal production systems and agroecological farming systems (organic $n = 4$, crop-livestock $n = 3$, and low-input $n = 2$) were studied. In some articles, comparisons with non-agroecological systems were included ($n = 6$). Different livestock production systems have their own constraints affecting farmers' working conditions; for example, seasonal lambing periods result in workload peaks at certain periods during the year, and dairy systems have the constraint of daily milking activities. Therefore, comparisons with conventional farming systems of the same production system are probably more informative to understand the impact of the adoption of agroecological farming practices than comparisons across production systems. Moreover, some activities, such as direct-sales activities, have a strong impact on farmers' work and working conditions (Darduin et al. 2015) and can be found across production systems.

Given the limited number of relevant papers, it is unsurprising that we could not observe geographical differences. The high number of papers from France might be explained by the relative importance of the scientific community within French national research institutes for agriculture, food, and environment working in the field of farm work, as identified by Malanski et al. (2019). The only topic that this scientific community is not studying is that of "occupational health" (Malanski et al. 2019).

From the nine papers, we identified 11 categories of dimensions that were used to study farmers' working conditions in agroecological farming systems. These are dimensions that are not specific to agroecological farming systems but can be found in agricultural contexts in general. Not all dimensions contributing to farmers' working conditions were addressed across the different papers (Table 2). The dimensions most frequently studied in the papers were "workload" and "knowledge, skills, experience, resources and/or tools used," followed by "work organization." Sometimes, specific dimensions of work were studied in specific farming systems; for example, farmers' use of resources considered a reflection of operational and cognitive changes made by farmers to transition to self-sufficient crop-dairy farming systems (Coquil et al. 2013, 2014) or the impact of agroecological farming practices on labor productivity in suckler ewe farms with different types of feed systems (Aubron et al. 2016). In addition, some papers addressed a specific activity, like Darduin et al. (2015) describing the impact of direct-sales of farm products on the work of organic broiler farmers in France. Others studied overall farm work (Cournut et al. 2018b).

4 Dimensions which are not addressed in the literature

Different dimensions known to contribute to working conditions were not addressed in the papers obtained through our query. Workforce composition and distribution of work among farm workers can be impacted by the adoption of agroecological practices. For example, it is recognized that organic farming systems require more labor (Finley et al. 2017; Baer-Nawrocka and Błocisz 2018). Task distribution and/or specialization of farm work among farm workers might also be impacted in more agroecological diversified systems (Navarrete et al. 2015). These dimensions were not addressed except in the papers by Cournut et al. (2018b) and Hostiou

Table 1 Papers focussing specifically on the working conditions of livestock farmers and farm workers in agroecological farming systems

Reference	Country	Agroecological farming system studied	Comparison with non-agroecological farming system?
Bendahan et al. 2018	Brazil	Integrated crop-livestock-forestry system	Yes
Cournut et al. 2018b	France	Organic livestock systems	No
Aubron et al. 2016	France	Suckler ewe farming with different feeding systems	Yes
Lusson and Coquil 2016	France	Low-input cattle systems	Yes
Darduin et al. 2015	France	Organic broiler farms with direct-sales activities	No
Huijbers et al. 2015	The Netherlands	Organic broiler farms	Yes
Coquil et al. 2014	France	Autonomous crop-livestock systems (dairy cattle)	Before/after transition comparison
Coquil et al. 2013	France	Self-sufficient mixed crop-dairy farming systems	Before/after transition comparison
Hostiou 2013	France	Organic suckler sheep farms	No

Table 2 An overview of the work dimensions studied in scientific papers focusing on the working conditions of farmers and farm workers in agroecological livestock farming systems

Reference	Work dimensions studied										
	Workload	Work organization	Work flexibility	Workforce composition	Labor productivity	Availability of equipment	Knowledge, skills, experience, resources, and/or tools used	Professional norms and/or identity	Health	Free time	Farmers' appreciation of farm work
Bendahah et al. 2018	x	x				x					
Courmut et al. 2018b	x	x		x						x	
Aubron et al. 2016					x						
Lusson and Coquil 2016		x				x		x			
Darduin et al. 2015		x				x		x			
Huijbers et al. 2015											x
Coquil et al. 2014						x					
Coquil et al. 2013						x					
Hostiou 2013	x	x	x ¹	x							

¹ Main dimension studied in the paper; the other dimensions are used to determine this main dimension

(2013), but these papers do not allow a comparison of results with non-agroecological livestock systems, nor do they provide detailed information on farmers' activities. Hall and Mogyorody (2007) studied whether the distribution of tasks between men and woman was different in organic farming systems compared to conventional systems. They concluded that organic farming provided a window for women to be more involved in farming activities and decision-making, but the issue was complex and involved gender, farmers' ideologies, farm structure, labor intensity, and the level of experience and knowledge of individuals (Hall and Mogyorody 2007). In the nine papers identified, no clear identification of, or specific analyses distinguishing between, the working conditions of self-employed farmers and employees were made. Hostiou (2013) was the one exception, as the paper considered all farm workers (including voluntary workers) to analyze work organization and flexibility in organic suckler sheep farms and showed that in some cases, specific tasks can be assigned to employees. As agroecology stimulates employment, attention needs to be paid to the working conditions of all types of farm workers. For example, wage levels, participation in decision-making processes, and the distribution of work (of physical and tedious tasks) of employees should be analyzed (Timmermann and Félix 2015). Income, social security, access to health insurance in cases of health problems, and the level of work insecurity are also relevant for farm owners (Dumont and Baret 2017). Dumont and Baret (2017) also identified the "leeway and control level" dimension, under which we find, for example, the feeling of being able to innovate and to be autonomous in decision-making processes.

In contrast with the abundant literature available on workers' health in agriculture (Malanski et al. 2019), only one paper related to the health dimension in agroecological livestock systems was obtained from the query. It studied the prevalence of antibiotic resistant bacteria among broilers and humans living around and/or working on organic broiler farms. No differences in prevalence were detected between organic and non-organic broiler farms (Huijbers et al. 2015). This paper referred to a very specific health risk; no studies were identified on unpleasant tasks, physical or physiological issues related to work (Dumont and Baret 2017). The scant amount of available literature including health when studying working conditions is regrettable, as improving human health is known to be an important motivation of farmers to convert to organic farming (Rigby et al. 2001). More generally, farming can be a profession that is physically and psychologically difficult. The result obtained might be explained by the query used since more specific keywords such as "injury," "occupational health," and "occupational exposure" are most often used by authors studying health at work in agriculture (Malanski et al. 2019). We chose to use more generic terms as one of the objectives of this paper was to understand how working conditions are considered in the available scientific

literature by describing and comparing the dimensions and indicators used across studies.

5 A need to get closer to the reality of farmers' working situations and activities

The search string used identified numerous papers studying the sustainability of farming systems from different continents. The search string selected these papers since they addressed indicators related to work to study either a social or economic dimension of sustainability. Most often, the use of one indicator, such as labor costs, labor productivity, or labor efficiency, was involved (e.g., Kumar et al. 2012; Toro-Mujica et al. 2012; Veysset et al. 2014; Stark et al. 2016). This thus provides a very narrow view of the working conditions of farm workers despite the fact that in 2000, Jansen already argued for a wider definition of labor, including qualitative changes in labor. Few exceptions were found. Monzote et al. (2012) identified different social indicators, including working conditions, stability of labor, equity of income distribution, and women's involvement in farming activities, to compare the sustainability of three mixed crop-livestock systems. The small-scale mixed farming system scored better than the specialized medium-size dairy farm system. Another example is the review by Bokkers and de Boer (2009) on the economic, ecological, and social performances of conventional and organic broiler production in the Netherlands. They considered working conditions as a factor contributing to social dimensions alongside animal welfare, food safety, and product quality. The indicators of working conditions used were working hours, number of physical and psychological complaints related to work, and the effect of barn conditions on health, but no comparative studies between organic and conventional farms were found. In addition, labor productivity indicators allow the conclusion that working conditions of farmers are different, but do not allow an assessment of whether or not the conditions are improved.

Farming activities and by consequence working conditions on an extensive grazing-based cattle farm are different than on an integrated crop-livestock-forestry farm, but both might be considered agroecological. The question which then arises concerns how agroecological farming systems may be compared when studying farmers' working conditions. A similar question arises concerning the comparison with the so-called conventional systems which also represent a diversity of systems, with some systems that can be close to forms of agroecological systems. Not all authors describe on what ground they claim that they are studying agroecological farming systems. Aubron et al. (2016) provided the indicators used to assess the level of agroecology of the farm systems, namely, the farms' feed systems (contribution of grazing activities and level of feed autonomy) and the use of local feed resources.

Coquil et al. (2014) used the indicator of imported nitrogen units per hectare per year to quantify a certain type of autonomy of crop-livestock dairy systems. It is clear that for comparison purposes, it is necessary to describe the level of agroecology of the systems under study.

Moreover, a comparison of the different situations is difficult as the papers identified did not provide detailed insight into the exact content of farmers' work, the conditions under which they work, or the difficulties they face. In addition, agroecological farming practices need to be described to be able to explain their impact on farmers' working conditions. For example, labor requirements can depend on the degree of specialization of a farm, farm size, type of production system, crop choices, on-farm processing and direct-sales activities, and the level of experimentation on the farm (Jansen 2000; Bendahan et al. 2018). Bendahan et al. (2018) quantified the expected additional labor needed for the adoption of crop-livestock-forestry practices in three different types of livestock systems. They showed increased labor requirements in all systems, ranging from an additional 21 to 80% depending on the system. In another example, the evolution of different crop-livestock farming systems in Guadeloupe showed that labor productivity (added value/work day) depended on the type of crops produced and the level of mechanization (Stark et al. 2016). Such detailed data are not always available and make it difficult to compare farms and systems.

6 Contrasting impacts on workload, work organization, and complexity of agroecological systems

Concerning the different dimensions determining working conditions, we observed positive as well as negative impacts of agroecological practices and/or farming systems across and sometimes within different dimensions (Table 3). For example, the amount of work in agroecological livestock farming systems increased in some examples, but also was found to decrease in certain cases. Cournut et al. (2018b) showed that the time spent at work can be highly variable across organic livestock farms. Sometimes, this can be explained by specific choices made, such as direct-sales of farm products, or farmers' objectives of having free time and holidays. Whether the amount of work was acceptable to the farmers and/or farm workers was not always evaluated. This information is relevant to assess whether the working conditions can be regarded as sustainable (Navarrete et al. 2015). Moreover, how the workload is experienced is not necessarily only related to the amount of work but also to the distribution of work over time and how it is balanced with free time (Cournut et al. 2018b) and family life, for example (Servière et al. 2019a; Hostiou et al. 2020).

Table 3 The effect of the adoption of agroecological practices on different dimensions contributing to livestock farmers' working conditions

Work dimension	Effect of the adoption of agroecological practices or system on the work dimension studied
Workload and labor productivity	Increased workload (estimated additional man days per year required) (Bendahane et al. 2018) Decreased workload (Lusson and Coquil 2016) The time spent at work is highly variable between organic livestock farms (Courmut et al. 2018b) Decreased labor productivity (feed units produced through rangeland grazing or hay per working hour) (Aubron et al. 2016)
Work organization	Reduced flexibility and the overall farm organization changes (Bendahane et al. 2018), simplification for some ,and expected complexification for others (Lusson and Coquil 2016) On average a decreased amount of flexibility (number of hours per year for free time or unplanned activities) compared to reference values in conventional systems, but with a strong variation across organic farms (Hostiou 2013)
Knowledge, skills, and experience	A need for acquisition of formal knowledge and experience (Bendahane et al. 2018) The use of new tools (e.g., participating in training sessions, farm equipment, different accounting system) can be used as a resource to change farmers' existing practices or stimulate the adoption of new practices (Coquil et al. 2013; Lusson and Coquil 2016)
Appreciation of work	Farm work is more in line with personal convictions (Lusson and Coquil 2016) and motivations (Courmut et al. 2018b)
Equipment	Need of specific equipment and in the right quantity (Bendahane et al. 2018)
Professional identity	Changed professional norms, in terms of production objectives, views of what "good" farming practices are changes (Coquil et al. 2014)
Health	The prevalence of antibiotic resistant bacteria in people working on organic broiler farms is not higher than on conventional farms (Huijbers et al. 2015)

The choices farmers make related to their work organization (e.g., through the delegation of certain tasks, simplification of herd management practices or choices in work distribution over the year) can have an important impact on the daily workload and consequently the time they have available for unexpected tasks or free time (Hostiou 2013). Work organization might be an important determinant of working conditions. Work organization in agroecological farming systems was considered to be more complex than in non-agroecological systems in some cases (Bendahane et al. 2018) and less complex in others (Lusson and Coquil 2016). The level of experienced complexity might be dependent on the initial level of complexity of the farm system before the transition. For example, in extensive cattle systems that were appreciated by farmers for their flexibility, the transition to crop-livestock-forestry systems that require certain activities to be implemented during a specific time window was difficult. Moreover, the overall organization of farm work changes when adopting such systems. It involves more than introducing new components and their related activities; it requires rethinking all of the interactions within the farm system (Bendahane et al. 2018) and possible competition between farming activities as shown in different crop systems (Dupré et al. 2017; Delecourt et al. 2019). Therefore, although certain activities such as marketing farm products might not be specific to agroecological farming systems, they still have important implications for farmers' work (Darduin et al. 2015). Moreover, as shown by Dupré et al. (2017) in the context of market gardening, the chosen marketing route affects crop

choices and the corresponding workload, skills, and knowledge necessary on the farm and the perceived complexity in the planning of farming activities. It also raises the question whether the complexity perceived is temporary or related to the transition and whether this will diminish by obtaining certain skills, knowledge, and experience. Furthermore, farmers do not necessarily perceive complexity as a source of discomfort as shown in diversified vegetable farming systems. On the contrary, it can be a source of pleasure (Navarrete et al. 2015). However, in certain cases, perceived complexity was a barrier to the adoption of agroecological practices (Lusson and Coquil 2016). In general, to better understand how livestock farmers manage their transition, it would be interesting to understand how different dimensions contributing to working conditions interact, the trade-offs farmers make, and whether these are evolving over time and why.

7 Skills, knowledge, norms, and values at the center of agroecological transitions

There is a general consensus concerning the fact that the acquisition of new skills, experience, and informal and/or formal knowledge is necessary to adopt agroecological practices and/or stimulates the adoption of agroecological practices (Table 3). Change can be a source of uncertainty for some (Lusson and Coquil 2016) or a contribution to the challenging nature of work, which can be a source of pleasure for others (Navarrete et al. 2015). We did not identify papers specifically

focusing on how information about aspects of the farming systems related to work and work organization is used by livestock farmers when transitioning or experimenting with agroecological farming. Delecourt et al. (2019) have shown that farmers' work-related information needs evolve when transitioning toward more sustainable cropping practices. This is probably no different for livestock farmers. Coquil et al. (2013) showed that dairy cattle farmers use new resources (e.g., as animal and plant observation methods) when piloting the evolution of their farming system toward self-sufficient crop-livestock systems. Authors also agreed that the adoption of agroecological farming practices allowed farmers to work in a system that is more in line with their personal beliefs and motivations (Table 3). Although this sometimes necessitated changing professional norms, a process that is not always easy for farmers (Coquil et al. 2014), it can contribute to the positive appreciation farmers have of their work.

8 A broader and multidimensional framework to study livestock farmers' working conditions

In agriculture in general, few studies exist which focus on working conditions using a multidimensional approach (Malanski et al. 2019). Dumont and Baret (2017) proposed a multidimensional framework to compare vegetable farmers' working conditions in conventional, organic, and agroecological systems. They showed that farmers' working and employment conditions were not per se better in agroecological systems and that farmers make concessions between the economic, social and ecological aspects of their enterprise. To our knowledge, such a multidimensional approach has not yet been used to study livestock farmers' working conditions. Bouttes et al. (2020) analyzed the evolution, during the conversion to organic farming, of dairy farmers' satisfaction levels concerning their work conditions, economic, agronomic, livestock-related, and social issues. To study dairy farmers' satisfaction regarding their working conditions after conversion to organic farming, they used multiple dimensions: workload, the perceived difficulty of seasonal and year-round tasks, and the free time available to cope with unexpected events or non-professional activities. However, the results were aggregated, making it impossible to understand which dimensions contributed to the overall score and how. Even though the majority of the farmers interviewed were satisfied with their working conditions after the conversion to organic farming, the results showed that not all farmers' working conditions had evolved positively, and not all farmers were satisfied with their current working conditions (Bouttes et al. 2020).

It would be interesting to develop such a framework for livestock farming systems as it would make it possible to add

specific dimensions, such as human-animal relationships, and address additional implications on working conditions of working with animals that contribute to the difficulty of attracting a new generation of livestock farmers. For example, farm workers' working conditions can impact their views of, and measures taken to favor, animal welfare (Anneberg and Sandøe 2019). Porcher (2011) showed that in industrialized farming systems, farm workers can be forced into working conditions that are incompatible with their wish to "raise animals" due to the strong rationalization of farm work in terms of economic and technical performances. Consequently, this leads to situations of "suffering" in both animals and farm workers. Specific constraints, such as the need of a daily presence related to raising animals or tasks that cannot be postponed (e.g., milking), also need to be taken into account as they can interfere with certain agroecological practices that need to occur at a specific moment in time or that require more time (e.g., observation of animals needed to be able to use alternative medicine).

In this paper, the choice was made to focus on only one aspect of social sustainability, namely, the work and working conditions of farmers and farm workers. However, when considering agroecology as a way to contribute to social equity, we can argue that dimensions related to job security, social benefits, income, and political experience at work should also be included to evaluate farmers' and farm workers' working conditions. Although agroecology offers the promise of better working conditions, there are examples in agroecological farming systems showing that when farm owners have to find a balance between economic and social performances, the latter are not always a priority (Shreck et al. 2006; Dumont and Baret 2017). Moreover, it also would be interesting to combine this with studies of the social sustainability of agroecological farming systems at a territorial level. Examples include studying the impact of changes in working conditions on the quality of rural life, employment, and landscapes and in maintaining local culture and know-how. These factors are known to contribute to how farmers themselves appreciate their profession (Servière et al. 2019a). They also should include social interactions with neighbors, colleagues, and persons outside the farming community who can provide support to farmers in their daily work (e.g., by sharing work or risks or providing emotional support) (Bouttes et al. 2020).

The study of working conditions in agroecological farming systems therefore requires, as previously mentioned, not only a multidimensional but also an interdisciplinary approach combining scientific disciplines that are able to describe, understand, and evaluate livestock farmers' working conditions, farming activities, and agroecological farming systems. Combining systemic approaches of work and activities (Coquil et al. 2018) with livestock farming systems approaches.

9 Conclusions

It is difficult to compare the literature available as there are few studies on livestock farmers' working conditions in agro-ecological farming systems, and those that do exist focus on different geographic regions, animal production systems, and agroecological systems. To allow comparisons between production contexts, sufficient data should be provided on farm structure, farming activities, and the agroecological practices adopted. Different agroecological practices have specific and sometimes contrasting impacts on the different dimensions that affect farmers' working conditions. As the adoption of agroecological farming practices can have diverse effects (positive as well as negative) on the different dimensions of working conditions, we recommend that future research should take into account the multiple dimensions contributing to working conditions, using a multidimensional approach that also should allow interactions between dimensions to be understood. To our knowledge, such an approach has not yet been used to study livestock farmers' working conditions in agroecological farming systems. Moreover, the dimensions studied could be broadened to assess whether agroecology fulfills the promise of providing farm workers with honorable and fulfilling employment, as well as other aspects of social sustainability.

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Data availability The data will be made available on from the corresponding author upon reasonable request.

Declarations

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

Conflict of interest The authors declare no competing interests.

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References

- Anneberg I, Sandøe P (2019) When the working environment is bad, you take it out on the animals – how employees on Danish farms perceive animal welfare. *Food Ethics* 4:1–14. <https://doi.org/10.1007/s41055-019-00044-6>
- Aubron C, Noël L, Lasseur J (2016) Labor as a driver of changes in herd feeding patterns: evidence from a diachronic approach in Mediterranean France and lessons for agroecology. *Ecol Econ* 127:68–79. <https://doi.org/10.1016/j.ecolecon.2016.02.013>
- Baer-Nawrocka A, Błocisz J (2018) Efficiency of Polish organic and conventional farms. *Stud Agric Econ* 120:55–60. <https://doi.org/10.7896/j.1724>
- Béguin P, Pueyo V (2011) Quelle place au travail des agriculteurs dans la fabrication d'une agriculture durable? *Perspect Interdiscip sur le Trav la santé* 13:1–21. <https://doi.org/10.4000/pistes.1708>
- Bendahan AB, Pocard-Chapuis R, De Medeiros RD et al (2018) Management and labour in an integrated crop-livestock-forestry system in Roraima, Brazilian Amazonia. *Cah Agric* 27. <https://doi.org/10.1051/cagri/2018014>
- Bokkers EAM, de Boer IJM (2009) Economic, ecological, and social performance of conventional and organic broiler production in the Netherlands. *Br Poult Sci* 50:546–557. <https://doi.org/10.1080/00071660903140999>
- Bouttes M, Bancarel A, Doumayzel S, Viguié S, Cristobal MS, Martin G (2020) Conversion to organic farming increases dairy farmers' satisfaction independently of the strategies implemented. *Agron Sustain Dev* 40:12. <https://doi.org/10.1007/s13593-020-00616-5>
- Coquil X, Béguin P, Dedieu B (2013) Transition to self-sufficient mixed crop-dairy farming systems. *Renew Agric Food Syst* 29:195–205. <https://doi.org/10.1017/S1742170513000458>
- Coquil X, Béguin P, Lussou J-M, Dedieu B (2014) Ressources pour une transition vers des système de polyculture-élevage plus autonomes. *Fourrages* 219:203–212
- Coquil X, Cerf M, Auricoste C, Joannon A, Barcellini F, Cayre P, Chizallet M, Dedieu B, Hostiou N, Hellec F, Lussou JM, Olry P, Omon B, Prost L (2018) Questioning the work of farmers, advisors, teachers and researchers in agro-ecological transition. A review. *Agron Sustain Dev* 38:47. <https://doi.org/10.1007/s13593-018-0524-4>
- Council of the European union A and FC meeting (2014) Presidency conclusions on strengthening of EU policies for young farmers
- Coumou S, Chauvat S, Correa P, Santos Filho JCD, Diéguez F, Hostiou N, Pham DK, Servièrre G, Sraïri MT, Turlet A, Dedieu B (2018a) Analyzing work organization on livestock farm by the work assessment method. *Agron Sustain Dev* 38:58. <https://doi.org/10.1007/s13593-018-0534-2>
- Coumou S, Teyssier E, Chauvat S (2018b) Taking into account the work in the production of references for organic livestock. In: *Rencontres Recherches Ruminants*
- Darduïn U, Delanoë M, Nicourt C, Cabaret J (2015) Le travail d'élevage au risque de la vente en circuits courts. *INRA Prod Anim* 28:271–280

- Dedieu B, Servière G (2012) Vingt ans de recherche-développement sur le travail en élevage : acquis et perspectives To cite this versi. *Inra Prod Anim* 20:85–100
- Delecourt E, Joannon A, Meynard JM (2019) Work-related information needed by farmers for changing to sustainable cropping practices. *Agron Sustain Dev* 39. <https://doi.org/10.1007/s13593-019-0571-5>
- Dumont B, Fortun-Lamothe L, Jouven M, et al (2013) Prospects from agroecology and industrial ecology for animal production in the 21st century. *Animal* 7:1028–1043. <https://doi.org/10.1017/S1751731112002418>
- Dumont AM, Baret PV (2017) Why working conditions are a key issue of sustainability in agriculture? A comparison between agroecological, organic and conventional vegetable systems. *J Rural Stud* 56:53–64. <https://doi.org/10.1016/j.jrurstud.2017.07.007>
- Dupré L, Lamine C, Navarrete M (2017) Short food supply chains, long working days: active work and the construction of professional satisfaction in French diversified organic market gardening. *Sociol Ruralis* 57:396–414. <https://doi.org/10.1111/soru.12178>
- Finley L, Chappell MJ, Thiers P et al (2017) Does organic farming present greater opportunities for employment and community development than conventional farming? A survey-based investigation in California and Washington. *Agroecol Sustain Food Syst*:1–21. <https://doi.org/10.1080/21683565.2017.1394416>
- Gliessman S (2007) *Agroecology: the ecology of sustainable food systems*, second. Taylor and Francis Group
- Hall A, Mogyoródy V (2007) Organic farming, gender, and the labor process. *Rural Sociol* 72:289–316. <https://doi.org/10.1526/003601107781170035>
- Hostiou N (2013) Work flexibility of organic suckler sheep farms in France. *Org Agric* 3:111–121. <https://doi.org/10.1007/s13165-013-0050-2>
- Hostiou N, Vollet D, Benoit M, Delfosse C (2020) Employment and farmers' work in European ruminant livestock farms: a review. *J Rural Stud* 74:223–234. <https://doi.org/10.1016/j.jrurstud.2020.01.008>
- Huijbers PMC, van Hoek AHAM, Graat EAM, Haenen APJ, Florijn A, Hengeveld PD, van Duijkeren E (2015) Methicillin-resistant *Staphylococcus aureus* and extended-spectrum and AmpC β -lactamase-producing *Escherichia coli* in broilers and in people living and/or working on organic broiler farms. *Vet Microbiol* 176:120–125. <https://doi.org/10.1016/j.vetmic.2014.12.010>
- Jansen K (2000) Labour, livelihoods and the quality of life in organic agriculture in Europe. *Biol Agric Hortic* 17:247–278
- Journal Officiel de la République Française, 2015. Vocabulaire de l'agriculture et de la pêche, 75:91
- Kling-Eveillard F, Cerf M, Chauvat S, Sabatte N (2012) Le travail, sujet intime et multifacette: premières recommandations pour l'aborder dans le conseil en élevage. *Inra Prod Anim* 25:211–220
- Kumar S, Subash N, Shivani S et al (2012) Evaluation of different components under integrated farming system (IFS) for small and marginal farmers under semi-humid climatic environment. *Exp Agric* 48:399–413. <https://doi.org/10.1017/S0014479712000087>
- Lusson J-M, Coquil X (2016) Transitions vers des systèmes autonomes et économes en intrants avec élevages de bovins : freins, motivations, apprentissages. *Innov Agron* 49:353–364. <https://doi.org/10.15454/1.4622868226062979E12>
- Malanski PD, Schiavi S, Dedieu B (2019) Characteristics of “work in agriculture” scientific communities. A bibliometric review. *Agron Sustain Dev* 39. <https://doi.org/10.1007/s13593-019-0582-2>
- Martel JP, Dupuis G (2006) Quality of work life: theoretical and methodological problems, and presentation of a new model and measuring instrument. *Soc Indic Res* 77:333–368. <https://doi.org/10.1007/s11205-004-5368-4>
- Monzote FRF, Bello R, Alvarez A, Hernández A, Lantinga EA, van Keulen H (2012) Identifying agroecological mixed farming strategies for local conditions in San Antonio de Los Baños, Cuba. *Int J Agric Sustain* 10:208–229. <https://doi.org/10.1080/14735903.2012.692955>
- Navarrete M, Dupré L, Lamine C (2015) Crop management, labour organization, and marketing: three key issues for improving sustainability in organic vegetable farming. *Int J Agric Sustain* 13:257–274. <https://doi.org/10.1080/14735903.2014.959341>
- Porcher J (2011) The relationship between workers and animals in the pork industry: a shared suffering. *J Agric Environ Ethics* 24:3–17. <https://doi.org/10.1007/s10806-010-9232-z>
- Rega C, Paracchini ML, McCracken D, et al (2018) Review of the definitions of the existing ecological approaches
- Rigby D, Young T, Burton M (2001) The development of and prospects for organic farming in the UK. *Food Policy* 26:599–613. <https://doi.org/10.5367/000000008787167718>
- Ryschawy J, Tichit M, Bertrand S et al (2015) Comment évaluer les services rendus par l'élevage ? Une première approche méthodologique sur le cas de la France. *Inra Prod Anim* 28:23–38. <https://doi.org/10.20870/productions-animales.2015.28.1.3008>
- Searchinger T, Waite R, Hanson C, Ranganathan J (2018) Creating a sustainable food future: a menu of solutions to feed nearly 10 billion people by 2050
- Servière G, Balay C, Coumut S (2019a) Sociel-La durabilité sociale des exploitations d'élevage dans leurs territoires. *Innov Agron* 71:109–121
- Servière G, Chauvat S, Hostiou N, Cournut S (2019b) Le travail en élevage et ses mutations. *INRA Prod Anim* 32:13–24. <https://doi.org/10.20870/productions-animales.2019.32.1.2418>
- Shreck A, Getz C, Feenstra G (2006) Social sustainability, farm labor, and organic agriculture: findings from an exploratory analysis. *Agric Human Values* 23:439–449. <https://doi.org/10.1007/s10460-006-9016-2>
- Stark F, Fanchone A, Semjen I, Moulin CH, Archimède H (2016) Crop-livestock integration, from single practice to global functioning in the tropics: case studies in Guadeloupe. *Eur J Agron* 80:9–20. <https://doi.org/10.1016/j.eja.2016.06.004>
- Steinfeld H, Gerber P, TD W, et al (2006) *Livestock's long shadow: environmental issues and options*. Rome, Italy
- Stoate C, Báldi A, Beja P, Boatman ND, Herzon I, van Doorn A, de Snoo GR, Rakosy L, Ramwell C (2009) Ecological impacts of early 21st century agricultural change in Europe – A review. *J Environ Manage* 91:22–46. <https://doi.org/10.1016/J.JENVMAN.2009.07.005>
- Timmermann C, Félix GF (2015) Agroecology as a vehicle for contributive justice. *Agric Human Values* 32:523–538. <https://doi.org/10.1007/s10460-014-9581-8>
- Toro-Mujica P, García A, Gómez-Castro A, Perea J, Rodríguez-Estévez V, Angón E, Barba C (2012) Organic dairy sheep farms in south-central Spain: typologies according to livestock management and economic variables. *Small Rumin Res* 104:28–36. <https://doi.org/10.1016/j.smallrumres.2011.11.005>
- van der Linden A, de Olde EM, Mostert PF, de Boer IJM (2020) A review of European models to assess the sustainability performance of livestock production systems. *Agric Syst* 182:102842. <https://doi.org/10.1016/j.agsy.2020.102842>
- Van Der Ploeg JD, Barjolle D, Bruil J et al (2019) The economic potential of agroecology: empirical evidence from Europe. *J Rural Stud* 71: 46–61. <https://doi.org/10.1016/j.jrurstud.2019.09.003>
- Veysset P, Lherm M, Bébin D, Roulenc M (2014) Mixed crop–livestock farming systems: a sustainable way to produce beef? Commercial farms results, questions and perspectives. *Animal* 8:1218–1228. <https://doi.org/10.1017/S1751731114000378>

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