Pathways of action followed by Flemish beef farmers – an integrative view on agroecology as a practice

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Abstract

In the face of longstanding social and technological trends, the application of agroecological insights at beef farms in Flanders may at first seem a curious proposition. We found, however, that beef farmers pursue agroecological principles through an impressive diversity of practices in this context. In 37 semi-structured interviews we asked farmers how they put into practice a set of principles which covers many themes addressed in agroecological literature. Inspired by a grounded theory approach, but also based on literature and consultation of fellow researchers, we conceptualized for each principle distinctive pathways of action to categorize relevant practices. By documenting farmers' practices, we show that an agronomic interpretation of agroecology as a practice obfuscates the many ways farmers can contribute to the social dimensions of agroecology too, which also problematizes those food systems approaches that undervalue the farmers' agency in changing their social context themselves. This grounded conceptual framework may be used to further assess how each beef farmer addresses these different principles together in practice. Given these results and perspectives, we contend that empirical inquiries such as these are instrumental in maintaining the connection between agroecological theory and practice, allowing both to move dialectically forward.

Keywords

Agroecology, Livestock Farming Systems, Flanders, Beef Production

1. Introduction

The current global food system's sustainability challenges (FAO 2017) have prompted an expanding academic field and social movement to foster agroecology as a possible solution (Holt-Giménez and Altieri 2013; HLPE 2019; IPES-Food 2019). In Belgium too, this moment of urgency and of opportunities has been grasped by a variety of actors and organizations to promote agroecology at different political levels and sectors of society (Stassart et al., 2018). In our research, we focus on the beef sector in Flanders, as it faces growing economic uncertainty and societal criticism. Low and over the years declining market prices in combination with increasing production costs have rendered beef production one of the least profitable agricultural activities on average in Flanders for over a decade. The beef farming population is declining and aging with few prospective successors (Platteau et al. 2018). With the malpractices with hormones in the 1990s still in the public memory, recent food safety and quality scandals in slaughter houses have further deteriorated the reputation of the sector. This compounds the economic and psychological stresses on beef farmers. Many beef farmers are now at a cross-road: continue scale enlargement and intensification or search for alternative pathways. Several authors have proposed agroecology as a more sustainable, alternative development path for livestock systems in temperate regions (B. Dumont et al. 2013; Bonaudo et al. 2014; Wezel and Peeters 2014), yet what agroecology practically entails for beef farmers, remains largely unexplored.

In the face of longstanding social and technological trends, the application of agroecological insights in this context may strike one as curious proposition at first. Agriculture in Flanders has clearly retreated from agroecology over the last centuries. Whereas many productivity improvements made in the 16th and 17th century by farmers in these regions were arguably in line with agroecology (Mazoyer and Roudart 2006), productive forces continued to be revolutionized in order to increase marketable surpluses, giving rise to more industrialized forms of agriculture (Worster 1990). The region witnessed a progressive disappearance of mixed subsistence-oriented farming, in favor of market integration, specialization, intensification of land use, mechanization and land concentration, before and after the implementation of the Common Agricultural Policy (Zanden 1991; Peeters 2010). However, an enormous diversity of cattle production systems in Flanders still persists, indicating that the industrialization of beef farming is incomplete, and perhaps withstood and even reversed. Indeed, by exploring the structural characteristics of Belgian cattle farms based on farm survey data from 2011 (Statistics Belgium 2013), we found that few farmers are specialized in one cattle-related activity (dairying, rearing cows, veal production, fattening of cows and bulls, and breeding). This study will mainly focus on beef farms of the more specialized type, namely those only rearing suckler cows and fattening bulls and cows. Yet among these systems too, an impressive diversity was observed along multiple dimensions such as scale (herd size, area in use, labor force), stocking rates, marketing strategies and degrees of specialization, through part-time activities, raising other livestock species or growing non-forage crops. Underlying this diversity, we surmise, is the ability of farmers to produce agricultural commodities in very different ways and circumstances, and perhaps the persistence and emergence of practices in line with agroecology. If so, we may discover agroecology already in the daily practice of Flemish beef farmers.

As such, the aim of this paper is to explore through what Pathways of Action (POA) Flemish beef farmers may put agroecology into practice. We elaborate upon this concept of POA in the next section. In Section 3 we lay out our method and in Section 4 , we present the conceptual framework obtained with this method. In the Discussion section we examine the contribution of our results to agroecology, the methodological merits and limits of our approach, and the perspectives this study provides for future research.

2. Concepts: from principles over POAs to practices

Agroecology cannot be reduced to a set of specific practices, rather it promotes *"a dialogue of wisdoms"* and integrates *"elements of modern science and ethno-science"* which allows it to provide a series of principles*, "which when applied in a particular region take different technological forms depending on the socio-economic, cultural and environmental context"* (Rosset et al. 2017). There remains, however, a methodological gap to be bridged between the ideal models of agroecological farming systems and the specific practices encountered on actual farms (Toffolini et al. 2018). This disconnect has as a consequence that practitioners are left figuring out themselves how agroecology is to be translated in practices fit to their situation, whereas agroecological theory may have insufficiently absorbed the lessons from local experiences. Grounded theory (Glaser et al. 1968) has popularized the idea that theory should emerge from data, rather than the other way around, which led us to believe that simply by asking farmers how they put agroecology into practice, a concept of agroecological practices in this context could be articulated. While promising, this proposition was flawed, because in our intuition very few farmers in Flanders were familiar with agroecology as a concept. For this reason, a framework needs to be provided to the farmers. Given that multiple authors have proposed that principles may a fertile middle ground for empirical inquiry into agroecological practices (A. M. Dumont et al. 2016; Bell and Bellon 2018), a list of principles assembled from a literature review, may constitute an acceptable frame for our discussions with farmers on putting agroecology into practice.

While taking this initial, comprehensive stance towards agroecology as a practice, we also wish, to be sensitive to a longstanding tradition in agroecological thought that elevates particular ways of pursuing principles (e. g. Rosset and Altieri 1997). To investigate the applicability of various normative stances to categorize practices mentioned by farmers, we propose and mobilize the concept of POA to identify groupings of practices related to each principle. We define a POA here similarly as what Chantre et al. (2014) call an "agronomic-coherence class", *i. e.* "*a range of practices whose coherence is defined by adherence to some action principles*". Yet, whereas this concept was originally only applied to the sphere of nitrogen input use, we extend it to other themes addressed by agroecology.

Recently, Toffolini et al. (2018) proposed the concept of "way of acting", which refer to "*specific combinations of practices by which farmers target farming systems properties in line with agroecological principles*". We don't believe that this concept can be mobilized in an exploratory study such as ours. According to Toffolini et al. (2018), the "ways of acting" are discovered through the study of farming systems said to be run in line with agroecological principles. Whereas we appreciate the contribution of this approach to discover commonalities between such cases, we found this approach contradictory to a comprehensive view on agroecology as a practice. By snubbing, for instance, the vast majority of conventional whole-selling farmers, we are potentially closing off ways of implementing agroecological principles from the beginning. Moreover, it is perfectly conceivable that farms identified *a priori* as agroecological, may turn out to fall short for some agroecological principles in the end. So rather than defining the agroecological way to pursue a principle based on the particular way they are tackled in *a priori* defined systems, we delay this judgment and first explore the various ways these principles are tackled by beef farmers generally. The concept of POA also has two major

practical advantages for analysis. As each POA is tied to only one principle explicitly, the range of practices to consider for each POA is confined, and there is no need to consider whether practices categorized under a POA are actually compatible with the pursuit of other principles. The other remarkable analytical advantage of the concept POA to "ways of acting", but also strategy, is that it is dissociated from the particular actors' intent or understanding of their actions. Being on a POA requires no commitment, articulated or otherwise to agroecology from the farmer. It merely marks a position occupied by farmers happening to have similar activities. By stripping away the need to analyze actors' reasoning behind an action, the categorization of practices can be simplified.

Whereas we seek to be initially at least agnostic on the agroecological nature of particular ways pursuing certain principles, we stipulate that in our research we support a integrative rather than an agronomic perspective on agroecology as a practice generally. *"At its origins, agroecology as a practice shows a mental model that clearly sees the linkages and interactions among all three approaches (science, movement, practice) and dimensions (ecological and techno-productive, socioeconomic and cultural, and sociopolitical) of agroecology"* (Rivera-Ferre 2018). Our main contention in this paper is that both social and technical dimensions of agroecology are operative at the farm level, and that therefore the farm level remains an excellent place to explore both the social and technical dimensions of agroecology as a practice in their interconnectedness.

3. Materials and methods

To explore how agroecology can be put into practice by beef farmers, we developed a four-step method as depicted in Figure 1.

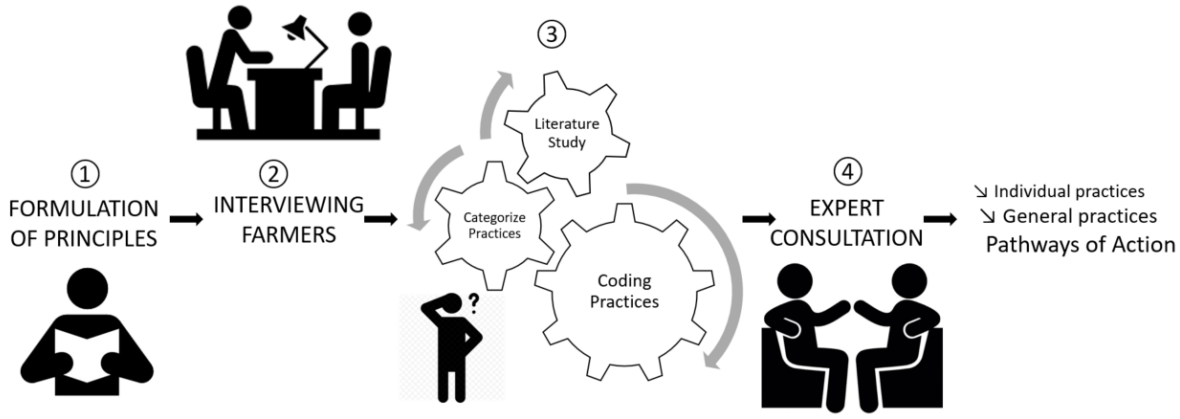

Figure 1 Diagram of the method, which involves four steps: (1) creating a list of principles based on literature review, (2) gathering accounts on practices in relation to agroecological principles from farmers selected through theoretical sampling, (3) identification and categorization of practices through qualitative analysis of interview transcripts informed by literature review, and (4) triangulating preliminary results by consulting experts for validation.

We reviewed a number of lists of principles proposed in the literature (Altieri and Nicholls 2005; Malézieux 2012; Stassart et al. 2012; Méndez et al. 2013; Bonaudo et al. 2014; B. Dumont and Bernués 2014; Levidow et al. 2014; Duru et al. 2015; Debruyne et al. 2017), and created a list of our own fitted for the requirements of our study. We selected principles to be implemented by (livestock) farmers, and also reformulated these into more direct and comprehensible language. We required that the list covered all recurring themes in the agroecological literature, as identified by A. M. Dumont et al. (2016), namely environmental equity, financial independence, market access and autonomy, sustainability and adaptability, diversity and exchange of knowledge, social equity, partnership between producers and consumers, geographic proximity, rural development and preservation of the rural fabric.

To make the full scope of agroecology as a practice in the Flemish beef sector apparent, a theoretical rather than a representative sampling strategy was followed (Corbin and Strauss 2014). Hypothesizing that diverse circumstances may lead to equally diverse solutions, we sampled farms to obtain a large and diverse set of beef farmers. In the public debate on agroecology, 'alternative' agricultural systems such as organic and short-chain-food networks in urban and peri-urban areas are regularly touted as emblematic instances of agroecology in this region (Stassart et al. 2018). As farmers involved in such initiatives may be well placed to contribute to the question at hand, we sought to include these farmers in the sample. Yet we were also interested to hear from 'conventional' whole-selling farmers, the overwhelming majority of beef farmers in Flanders, as they may very well have taken significant steps to put agroecological principles in practice too. As an initial sampling design, we therefore sought to include farmers along the ranges of three axes: organic/non-organic, short-chain-marketing/wholesale marketing of meat, and different degrees of specialization (other agricultural activities). Halfway the data gathering, it was deemed unnecessary in the light of the objective, to obtain an evenly distributed sample along these axes. Instead, it was decided to adopt a variational sampling approach, by contacting farmers of potential interest based on previous interview experiences, To get into contact with farmers we relied on existing farmer networks, webpages of farms, online press articles, online phone books, and asking interviewed farmers for referrals. During semi-structured interviews we presented one or more members of the farm household with the established list of principles and asked them how they put each principle into practice. Given the at the times contentious history between farmers and environmental movements in these regions (Hermans et al. 2010), we realized that agroecology could turn out a divisive issue for farmers. At the beginning of the interview, we therefore stated our aim was to discover the potential relevance or irrelevance of agroecology to beef farming in Flanders, and thought that farmers may have valuable perspectives on this topic.

The interviews were transcribed and analyzed in Nvivo 11®. In the first stage of the analysis, we coded in an open-ended manner any action farmers said to take that furthered or was at odds in their estimation with a principle, thus creating an inventory of codes referring to practices related to at least one principle. Using the matrix coding function of Nvivo®, the practices coded and mentioned by farmers during the discussion of each principle could be identified, thus creating initial subsamples of practices to consider for each principle. In a second stage, we created principle by principle new codes in an attempt to find a common denominator for various practices contributing a principle by conceptualizing more general practices of often lower level of detail, by merging and revisiting initial codes, a process referred to as axial-coding (Corbin and Strauss 2014). In the third stage, we compared these various practices to pursue a principle, and sought concepts to create coherent groupings of practices, leading up to the description of at least two POAs for each principle, under which these general practices are categorized. We aimed to create a conceptual framework that fits the accounts of farmers, rather than rigidly impose an already existing one. Nonetheless, we also sought to deliberately and explicitly integrate insights from scientific literature on these various agroecological themes. To remain sufficiently grounded, we followed a couple of data-sensitizing principles when using literature in grounded theory as outlined by Thornberg (2012), namely theoretical agnosticism, theoretical pluralism, theoretical sampling of literature, staying grounded, theoretical playfulness, memo-ing extant knowledge associations, and constant reflexivity. Initial conceptualizations regularly led to an uneasy fit with the data, resulting in the exploration of new concepts. The concepts we thus ended up proposed to refer to practices mentioned by farmers and the POAs to categorize them, emerged through an iterative process of engagement with relevant scientific literature and the transcripts themselves.

As a validation step, we triangulated our preliminary results by consulting researchers at ILVO (N=8) familiar with Flemish agricultural context, of different disciplinary background and expertise. In one-

to-one encounters, we presented each researcher with the coding and categorization related to three principles lying closest to his/her expertise to weigh in on the codes and categorizations made and our qualitative assessment of these practices contributing to a certain principle. We used these insights to finalize the analysis.

4. Results

Table 1**Fout! Verwijzingsbron niet gevonden.** shows the list of principles investigated in this study. The first principles (1-5) correspond with the goals of agroecology for livestock systems proposed by the report of the International Symposium on Agroecology for Food Security and Nutrition *(FAO 2014)*, adapted from principles for livestock systems proposed by B. Dumont et al. (2013). Added to these ecological principles we reformulated a couple of principles (6-10) proposed by Debruyne et al. (2017) which was an effort to make the principles proposed by Stassart et al. (2012) more comprehensible to Flemish stakeholders. We also added three principles (11-13) to cover additional socio-economic themes associated with agroecology, but not yet covered by the list.

Table 1 List of agroecological principles used in the semi-structured interviews.

1. Strengthen animal health in an integrated manner	FAO 2014
2. Close nutrient cycles	FAO 2014
3. Maintain a high diversity of species and genetic varieties in time and space	FAO 2014
4. Preserve and use biodiversity	FAO 2014
5. Reduce the use of external chemical inputs	FAO 2014
6. Increase the resilience and adaptability of the farm-ecosystem against environmental shocks	Debruyne et al. (2017)
7. Strive for autonomy from powerful input suppliers and purchasers	Debruyne et al. (2017)
8. Pursue financial independence and control over economic and technical decisions	Debruyne et al. (2017)
9. Exchange knowledge from a diversity of sources to solve problems	Debruyne et al. (2017)
10. Maintain the social network on the countryside	Debruyne et al. (2017)
11. Strengthen the bonds between producers and consumers	Authors addition
12. Create locally embedded food systems of production and consumption	Authors addition
13. Divide the burdens and the benefits of food production and consumption equitably	Authors addition

In total 37 cases were included for this study. In 25 cases we spoke with only male identified members of the farm household, in 5 with only female identified, and in 8 cases with both male and female identified members of the household. These were spread unevenly along the three axes used during sampling (table 2). The under-sampling of conventional whole-selling farmers was based on the assumption that additional accounts of such farmers would result in the elicitation of relatively few new practices related to agroecological principles. We were unable to identify organic, specialized farmers not engaging in direct sale of meat.

Table 2 Distribution of cases along the three axes of the initial sampling design: (transitioning to) organic or not; Direct Sale of meat or not; Diversified Agricultural Activities or not in terms rearing other livestock species than bovines for sale and/or growing cash crops (excluding wheat).

Organic?	Direct Sale of Meat?	Diversified Agricultural Activities?	N
Yes	Yes	Yes	10
		No	1
	No	Yes	1
		No	0
No	Yes	Yes	4
		No	3
	No	Yes	15
		No	3

The open-ended coding round yielded 690 different codes for individual practices. These were clustered into 336 general practices each linked to a single principle. Some of these individual practice nodes are clustered in multiple general practices, and some general practices are identical but for being linked to a different principle. In the next part of this section, we present the different POAs arrived at after grounded analysis and external validation. In Table 3 we give a non-exhaustive list of codes for practices associated with each POA.

Principle 1: Strengthen animal health in an integrated manner

When asked how low drug use is accomplished, farmers mention a whole range of actions to prevent clinical disease. Struck by the incommensurability of some practices mentioned by different farmers, we used the Control management and Adaptive management models conceptualized by Napel, Bianchi, & Bestman (2006) to categorize practices mentioned by farmers. We also identified a number of practices contributing to animal health, which were – after deliberation with two experts – compatible with both approaches. Therefore we identified three POAs for these principles: the CONTROL POA, revealed in practices which reduce exposure to pathogens by controlling environmental conditions; the ADAPTIVE POA, revealed in practices to adapt animals to a relatively uncontrolled environment; and the BASIC HEALTH POA, revealed in practices which are necessary to maintain in general the metabolic functioning of the animal in either approach.

Principle 2: Close nutrient cycles

Initially, we found two POA's: the INTERNAL CYCLING POA which reveals itself in practices related to the partial or complete re-use of nutrient streams produced at the farm, and to the partial or complete satisfaction of nutrient needs by on-farm production; and the LOSS MITIGATION POA which reveals itself in practices related to reducing losses to the environment at different sites. However, from a landscape ecology perspective (Martin et al. 2016), nutrient cycles can also be closed beyond the farm gate, which was also noted by some farmers. A third POA then is the EXTERNAL CYCLING POA, which reveals itself in practices related to the partial or complete return of on-farm produced biomass through third parties.

Principle 3: Maintain a high diversity of species and genetic varieties in time and space

This principle covers one facet of agrobiodiversity, namely those species and genetic variants that are harvested (Duru et al. 2015). This planned biodiversity encompasses several aspects, including species diversity, varietal diversity within species, and genetic diversity within species and varieties at different spatial-temporal levels. In agroecology, diversification goes beyond species richness, it is about functional interaction (Khumairoh et al. 2012; Rosset et al. 2017). That is the way many species are integrated into the landscape and are allowed to interact, thus supporting ecological processes of nutrient cycling and pest control. Equally species rich systems can thus be very integrated or not, and we therefore distinguishes two POAs: the WITHOUT SEPARATION POA, revealed in practices which increase species and genetic diversity at farm level, without separating these in space and time; and the WITH SEPERATION POA, revealed in practices which increase species and genetic diversity at farm level, with separating these in space and time,

Principle 4: Preserve and use biodiversity

The fourth principle discussed with farmers, covers farmers' practices in relation to non-harvested species, or associated biodiversity. Farmers mentioned an enormous variety of practices contributing (but also weakening) biodiversity. As many farmers replied that they did little (or didn't care) for non-useful organisms, but did look after biodiversity in the soil, we operationalized the concept of

conservation agriculture, in which soil life is enhanced as long as it is functional to crop production, and juxtaposed this to nature conservation, which looks to preserve and increase associated biodiversity in its own right. Two POAs emerge from this distinction then: the CONSERVATION AGRICULTURE POA, revealed by practices indicating the farmer is looking to enhance biological processes to improve and maintain yields; and the NATURE CONSERVATION POA, revealed by practices that contribute to the conservation and even augmentation of associated agrobiodiversity species, which may have little or even negative effects on yields.

Principle 5: Reduce the use of external chemical and fossil inputs

During the interviews we discussed the reduction of the following four "chemical" inputs (chemical fertilizers, chemical pesticides, fuel, electricity. We found the Efficiency-Substitution-Redesign framework (Hill and MacRae 1996) initially useful to categorize practices, but also identified two other groups of practices related to input use, and therefore identified five separate POAs: the EFFICIENCY POA, revealed in practices indicating the farmer has moved to a more rational use of inputs, but without replacing these with an alternative input and requiring no radical changes in the farm's functioning; the SUBSTITUTION POA, revealed in practices indicating the farmer has replaced synthetic inputs with alternative inputs, including solar and renewable energy inputs; the REDESIGN POA, revealed in practices indicating the farmer has moved towards the use of local inputs, through integrated ecosystem design and management; the LOW-OUTPUT POA, revealed in practices indicating the farmer reduces chemical inputs drastically, while accepting lower overall physical yields; and the TRANSFER POA, revealed in practices indicating the farmer has transferred the question of pest management, nutrient availability and energy use partly to other actors.

Principle 6: Increase the resilience and adaptability of the farm-ecosystem against environmental shocks

The sixth principle concerns actions taken by the farmer that strengthen ecosystem resilience against environmental shocks, such as pathogens and temporary adverse weather conditions. In our discussion of this principle with farmers we emphasized that we were particularly interested in practices that could make the ecosystem in biophysical terms more resilient to environmental shocks, rather than discussing what technical and social means allowed them to bridge these. Yet, we found that many farmers could think of very little practices that allowed them to avoid or mitigate the effects of an environmental shock on biophysical yields, and thus also considered the many ways farmers can cope with the effects of adverse environmental shocks. Three POAs were distinguished then: the AVOID POA, revealed in practices that indicate the ecosystem is designed in such a way that the chance of an environmental shock reaching the production system is reduced; the MITIGATE POA, revealed in practices indicating that the physical damages when an environmental shock does hit the farm, are or can be contained; and the COPE POA, revealed in practices that allow the farmer to sustain temporary reductions in physical yields.

Principle 7: Strive for autonomy from powerful input suppliers and purchasers

In our analysis of practices related to the pursuit of this and the next principle, concerning commercial and financial autonomy, we take up the work of rural sociologist Jan Douwer Van der Ploeg (1990, 2010). From an analytical point of view, farming consists of three interrelated and mutually adapted processes: the mobilization of resources, the conversion of resources into end-products; and the marketing and re-use of the end-products. These three processes can to a different degree be commodified. Farmers' responses echoed Van der Ploeg's contention, that commercial autonomy not only appear in farmers gaining independence from markets, but also in the ability to establish advantageous market relations. Two distinct groups of mentioned practices were consistent with the

latter interpretation, and we therefore defined three POAs: the DO-IT-YOURSELF POA, revealed in practices that allow the farmers to distance him-/herself from markets generally; the CONTROL POA, revealed in practices that indicate the farmer is able to flexibly redefine the commercial relations they have with powerful commercial players; and the ALTERNATIVE PARTNERS POA, revealed in practices that indicate the farmer looks to circumvent powerful commercial players.

Principle 8: Pursue financial independence and control over economic and technical decisions

Likewise, the notion of autonomy as it relates to financial decisions, is translated by farmers, on the one hand, in actions related to becoming independent from financial institutions, and on the other hand, being able to define these creditor-debtor relations. We also identified a set of practices regularly mentioned by farmers that we deemed conducive to either approach, and we therefore suggest three POAs: the INDEPENDENCE POA reveals itself in practices that allow to minimize lending from financial institutions; the LEND ON OWN TERMS POA reveals itself in practices indicating a willingness to lend from banks while having the ability to define the terms of this relationship; and the MANAGE FINANCES POA reveals itself in practices to maintain the farm's own financial fund.

Principle 9: Exchange knowledge from a diversity of sources to solve problems

Knowledge exchange involves getting access to it and sharing it. Farmers mentioned practices often mentioned practices that fitted both sides, as knowledge exchange has often a co-creative aspect to it. Even so, we found that for individual practices one side outweighed the other. We therefore identified the following two pathways: the KNOWLEDGE BUILDING POA revealed in instances where farmers gather information from a variety of sources; and the KNOWLEDGE SHARING POA revealed instances where farmers share information with other farmers and/or researchers.

Principle 10: Maintain the social network on the countryside

Farming takes place in a social context, and plays from an agroecological point of view a key role in the maintenance of the rural fabric (A. M. Dumont et al. 2016). A range of instances were mentioned by which farmers were integrated in local rural networks, yet in deliberation with the experts we categorized these to construct two POAs: the RURAL ECONOMY POA reveals itself by practices which connect the farmer with business partners and customers in the local community, and the RURAL SOCIAL LIFE POA reveals itself by practices which connect the farmer with regular citizens in the local community.

Principle 11: Co-operation between producers and consumers

We found that farmers engage with other producers and consumers for a variety of goods and services. In many instances these arrangements are market-based, yet we did observe other forms of social relations. To distinguish those forms we take up the work of anthropologist Karl Polanyi (Polanyi 1944), to categorize practices by the principles of exchange, reciprocity and redistribution which regulate economic relations between humans. At first glance, most relations with consumers are market-based, yet we found that many of these exchanges appear to be heavily structured by personal relations, giving them a more reciprocal nature (Jackson 2007). We therefore defined three POAs: the EXCHANGE POA, which is revealed in practices by which the exchange of goods and services (through money) is based on the socially determined value these goods and services possess, and actors act and treat each other as mere possessors of commodities; the RECIPROCITY POA, which is revealed in practices by which goods and services are exchanged between actors who have an enduring give-and-take personal relationship; and the CO-OPERATIVE POA, which is revealed in practices whereby goods and services

are pooled and shared in a larger organization, and the benefits of this enterprise are distributed within the collective.

Principle 12: Create locally embedded food systems of production and consumption

Analysis of practices mentioned by farmers shows that both on the input and output side of the equation, farmers can create local food systems through two POAs: the SELF-RELIANCE POA, revealed in practices indicating a self-supplying of inputs which would usually be sourced from far away, and in practices indicating that distribution to local consumers is done by farmers themselves; and the LOCAL PARTNERSHIP POA in contrast reveals itself in practices where farmers look to local partners to supply them with inputs and commercialize their products to local consumers.

Principle 13: Divide the burdens and the benefits of food production and consumption equitably

Almost every farmer is convinced that s/he does not or would not get a 'fair price' within the conventional value chain. There is a common conviction that such work is not remunerated in a fair way, feeding into a feeling of not being appreciated by society. While some of these chain industries are in the hands of farmer organizations, the general perception is that these industries do not or aren't able to put producer interests at the right place. Agro-industrial and retail capital are said to have a tight hold on the production process and the terms of trade. Breaking the power of this corporate food regime, individually and/or collectively, is a key theme in much of the political agroecological literature (Guzmán et al. 2013; Holt-Giménez and Altieri 2013; Rosset et al. 2017). While many farmers do feel powerless, we were able to identify three POAs: the WITHIN THE REGIME POA, which is revealed through practices that improve the social position of the farmer while working within the mainstream institutional environment; the AROUND THE REGIME POA, revealed through practices indicating that farmer is looking to create alternative networks which may prove to be more just; and the OUT OF AGRICULTURE POA which is found within practices that indicate the farmer looks for opportunities outside of agricultural production to improve his/her social position.

Table 3 General practices corresponding with the POAs identified for each principle.

Principle	Pathways of Action	General Practices
ANIMAL HEALTH	CONTROL	Early weaning, separating and binding of animals, using preventive medication, using artificial insemination techniques, maintaining high hygienic standards for housing and feed, immediate treatment of diseases, shearing and washing, nematicides in grazing areas.
	ADAPTIVE	Robust breeds and crossbreeds, long grazing season, extensive and diverse grazing, no preventive medication, herbal medicine and repellents, strategic rotation of mowing and grazing lands, rotating grazing species, social learning within herd to adapt to challenging environments, tolerate some disease, avoid C-sections.
	BASIC HEALTH	Investing in good housing conditions, vaccination, avoiding nutritional deficiencies, access to colostrum, awareness for disease, strawing stables, selective breeding.
NUTRIENT CYCLING	INTERNAL CYCLING	Self-sufficiency in own concentrates, straw and roughages, on-farm re-use of manure, composting, feeding on-farm produced harvest residues, recycling roadside clippings, trees for firewood and composting.
	LOSS MITIGITATION	Efficient fertilizer application, preference for solid manure, soil cover during winter, agroforestry systems, extensive grassland management, reduced, timely and no-tilling practices, permanent grasslands, sufficient strawing in stable, manure stocking facilities.
	EXTERNAL CYCLING	Mutual exchange of manure, straw, roughage with other farmer, re-use of effluents slurry processing, re-use beet pulp from sugar factory.
PLANNED DIVERSITY	WITH SEPARATION	Long rotations of monocultures, multiple but separated branches of livestock species and breeds, single-species catch crops, multiple commercial varieties in rotation.
	WITHOUT SEPARATION	Mixed grazing of cattle breeds and other grazing species, cross-breeding, and importing new genetic material (stud or artificially insemination), strip agriculture, agroforestry, seed cultivation and saving, cultivation of genetically heterogeneous land races, multi-species catch crops, polycultures such as grain-legume mixtures and grass-clover, various practices which induce or install higher sward diversity in grasslands.

ASSOCIATED DIVERSITY	SOIL CONSERVATION	Reduce soil disturbance, incorporate organic matter in soil, maintain soil cover, avoid acidifying fertilizers, maintain and install grasslands, agroforestry.
	NATURE CONSERVATION	No or little pesticide use, low or no fertilizer use on grasslands, extensive grazing, maintain non-crop habitats such as bushes, trees and flower strips, respect and broaden field margins, install biodiversity friendly crops such as grass-clover, ecological focus areas, agroforestry systems, accept yield losses, attract birds and insects near stable and farm yard.
EXTERNAL INPUTS	EFFICIENCY	Targeted and efficient use of pesticides and artificial fertilizers on crops and grasslands, efficient engines and economic driving, turn off unnecessary lighting and engines, power-saving light bulbs.
	SUBSTITUTION	Buy pesticides and fertilizers (including manure) of organic origins, install heat pumps, solar panels and wind mills, use various mechanical methods for weed control.
	REDESIGN	Legumes, high crop diversity, grass-based feeding systems, long grazing season, no-till cultivation, on-farm re-use of biomass, incorporating organic matter in soil, rotating grazing species, agroforestry.
	LOW-OUTPUT	Extensive grassland management, accept weeds and pests, reduce fertilization rate, choose more robust but slower growing varieties.
	TRANSFER	Buy feed and straw.
ECOLOGICAL RESILIENCE	AVOID	Closed herds, indoor livestock systems.
	MITIGATE	Drainage, irrigation, dredge ditches, robust breeds and varieties, building up organic material in soil, reduce stocking densities in stable and grazing areas, monitor and compensate soil mineral deficiencies, maintain soil cover, less and timely tilling, wide crop rotations or strip cropping.
	COPE	Diversify income sources (off-farm employment, multiple agricultural branches, pluri-activity), maintain a financial buffer or build physical feed and forage stocks, risk transfer (insurance, contract farming, seasonal subscriptions by customers).
COMMERCIAL AUTONOMY	DO-IT-YOURSELF	No or little pesticide and fertilizer use, own self-provisioning of roughage, concentrates and straw, own seed and planting material, own spraying and harvesting equipment, own processing, own transporting, processing, and/or distribution of products.
	CONTROL	Put commercial partners in competition, avoid commercial debts, built in financial buffer, differentiate product, purchase in group, gather and exchange market information, avoid contracts in favor for free markets.
	ALTERNATIVE PARTNERS	Alternative suppliers and sale channels, involvement within farmers' co-operatives for processing and/or distribution.
FINANCIAL AUTONOMY	INDEPENDENCE	Reduce investments costs and needs, share investments, find alternative financing sources.
	LEND ON OWN TERMS	Negotiate interest rates with banks, lend cautiously and strategically.
	MANAGE FINANCES	Know your numbers, build in a financial buffer, spread risk by income diversification, share or transfer production risks with consumers and acquaintances through seasonal subscriptions or an alternative legal structure, as well contract farming.
KNOWLEDGE EXCHANGE	BUILD KNOWLEDGE	Visit other farms, look outside, gather documentation on internet and books, monitor own activities, do experiments, consult other farmers, commercial partners, research institutes and professional consultants, go to info meetings.
	SHARE KNOWLEDGE	Give farm demonstrations, professional consulting, employ trainees, be involved in formal learning networks, exchange insights with colleagues informally, or at info meetings, be involved in participatory research activities.
RURAL FABRIC	RURUL ECONOMY	Contact with local consumer through direct sale of products, work together with other farmers and locals for a variety of goods services (land, products, planning, processing, political organizing, intermediary products, machinery, labor, knowledge, distribution, …), make local publicity and organize open-farm days and festivities for costumers and potential partners.
	RURAL SOCIAL LIFE	Be involved in local social organizations, municipal government, activate and assist people with disabilities, talk regularly to neighbors, organize school visits and open-farm days.
PRODUCER-CONSUMER TIES	EXCHANGE	One-way sale and buying of goods and services on the market from producers or consumers (land, agricultural products and intermediaries such as livestock, straw, manure and feeds, selling knowledge accountancy, agricultural wage labor and transport services).
	RECIPROCITY	Double exchanges with other farmers of land, machinery, agricultural products and intermediaries, regular exchanges of knowledge, help each other out, direct sale of agricultural products to consumers, gifts of labor and land from costumers.
	CO-OPERATION	Small farmer co-operatives for production planning, processing, and distribution, co-ownership of land and machinery, collective political organization, group buying, formal knowledge networks, farm shares (land and or capital) owned by costumers, seasonal subscriptions of costumers.
LOCAL FOOD	SELF-RELIANCE	Sale of products on the farm or at farmers' markets, harvesting by customers, production of own concentrates and seeds, reduce need for concentrates and off-farm inputs.
	LOCAL PARTNERS	Sale of products by local butcheries, convenience stores and supermarkets, alternative food networks, and/or neighboring farmers, local sourcing of agricultural inputs rather than relying on concentrates with components from overseas.

SOCIAL EQUITY	WITHIN THE REGIME	Produce High-Value niche market products for wholesale, apply for government subsidies, put mainstream players in competition, negotiate higher price by bargaining and following markets, cut out handlers, contract farming, invest to stay competitive, engage in collective political action like demonstrating or being involved in pressure groups, purchase in group, be involved in supply chain initiatives.
	AROUND THE REGIME	Organize upstream and downstream processes yourself or with other non-regime actors and create demand for your own product.
	OUT OF AGRICULTURE	Off-farm employment, non-agricultural activities at the farm (e. g. agro-tourism, nature conservation, education), retire.

5. Discussion

The main result of this study is a conceptual framework on how the various dimensions of agroecology are put into practice by Flemish beef farmers. The combination of a qualitative semi-structured data gathering method and an initially open-ended analysis let to the discovery of many practices through which farmers can pursue an array of agroecological principles. The open-ended nature of questions yielded diverse answers on which basis the scope of each principle was explored. In so doing, we were able to uncover the many ways beef farmers still and already today put agroecology into practice. This bears scientific, practical, and political relevance, as these practices constitute in the words of David Goodman (Goodman 1999), "*a material base from which to interrogate hegemonic industrialized metabolic relations and to construct alternative political and institutional futures*." Frequently we were surprised to learn about practices, we did not anticipate, such as "fodder trees", "hanging up holly branches in the stable", "sharing current market prices offered by handlers to other farmers", "building a stable yourself", "weigh-beam at the farm", "promote personally local meat in the supermarket", or "using on-farm produced wood for heating". Such references enticed us to reconsider the scope of a principle and categorizations, we may have had before this study. A grounded analytical approach thus gave us the ability create a comprehensive account of agroecology as a practice, which a deductive approach such as using a checklist of practices derived from literature couldn't possibly have.

The results of this study vindicate our main contention in this paper, namely that farmers can and do take actions to operationalize not only technical but also social dimensions of agroecology. There is a tendency to reduce agroecology at the farm level to the agronomic sphere, and reserve the social dimensions of agroecology to particular actors such as policy makers and movement representatives. In so doing farmers are artificially severed farmers from social movements (Rivera-Ferre 2018). By skipping the farm level as legitimate level of social analysis, one disregards, the many ways farmers may create the social conditions favorable to putting agroecology into practice themselves. Attention therefore must be paid to the everyday politics farmers may be engaged in (Kerkvliet 2009). Our results invite agroecologists to consider how farmers are addressing the socioeconomic, the sociocultural, and the sociopolitical dimensions of agroecology, and how this may indirectly contribute to addressing the techno-productive and ecological dimensions.

In our analysis, we moved backed and forth from a comprehensive understanding of these principles to various normative understandings. The formulation of POAs revealed many questions and contradictions concerning the boundaries of agroecology as a practice in this context. Namely about the compatibility of control measures in an agroecological animal health management model (P1), about the open nature of most beef farming systems (P2), about the appropriate scales for installing diversity (P3), about the place of nature conservation for its own sake within agroecology (P4), about the compatibility of efficiency, substitution and low-output measures within an agroecological approach to reduce inputs (P5), about the substitutability of natural for social capital (P6), about farmers' ambiguous role in the commoditization of agriculture and the reproduction of agro-industrial and financial capital (P7, P8), about the origins of farmers' knowledge (P9), about the necessity of local economic activities to maintain the social fabric (P10), about the role of often informal, reciprocal and

redistributive arrangements in sustaining agroecological food systems (P11), about the role of large retailers in supplying local food (P12), and about the political strategy to reform rather than resist and work around regime institutions (P13). We concede, that the translation of principles into POAs by farmers, may be very different in situations which markedly differ in terms of social organization of agriculture (for example tribal or communal systems), physiological nature of the particular product concerned, pedoclimatic conditions, or cultural traditions. Yet given the prevalence of (family labor based) commodity production, modern technologies and hegemonic discourses across the globe, we wouldn't be surprise that these POAs are applicable in other sectors and regions, and that the questions raised by such conceptualization, may be pertinent in other contexts.

While it was our initial intention to adopt a grounded theory approach, in practice we deviated from this approach in important ways, most significantly when gathering the data (see further), but also to some extent in the analysis phase and in selecting cases. Ideally for theoretical sampling, decisions for additional data gathering are taken based on through analysis of previous interviews, yet for practical reasons these were made based on general observations made during data gathering and transcription. Additionally, the active and intentional integration of literature in data analysis may appear contradictory to the core proposition of grounded theory, namely that theory emerges from the data without theoretical preconceptions. Thornberg (2012) provides convincing practical and epistemological arguments to abandon the dictum of delaying literature review in classical grounded theory. The selection of relevant practices for each principle was based on a theoretical triangulation of three sources: the judgment of the farmers interviewed, the judgments of the scientific literature we were aware of before and during the analysis, and the judgment of the experts consulted at a later stage. Given our findings, we believe this "informed, grounded analytical approach" allows to construct theory sensitive to currently standing academic debates, while still grounded in the accounts of farmers. To this end, the analytical advantages of mobilizing the POA concept in an exploratory setting became clear, namely the smaller scope of practices to consider for each POA, and the ability to disjoin practices from farmers' motivations. This allowed us to flexibly consider, enrich and detail different existing frameworks.

In this study, we take as empirical entry point the accounts of farmers when confronted by list of principles on their practices. The data gathering method is therefore deeply hermeneutical and context-dependent, as it depends on these particular farmers' understanding of these principles, their understanding of their own actions, and their understanding of the interviewers' motives. Hostile or sympathetic predispositions of farmers towards agroecology can easily lead to distorted accounts on their actual practices. We sought to undercut these by communicating that we ourselves had not yet made a determination on the relevance of agroecology in this context, and that we valued their perspective of farmers on this matter. We concede, however, that the accounts from which these results derive are incomplete. Yet, the identification and categorization of practices is done at the sample level, rather than based on a case-by-case characterization of individual farmers. This attenuates the influence of particular farmers embellishing or downplaying their actual practices. Rather, the results depend on the total diversity of perspectives on agroecology and its principles, which was precisely the objective of our sampling strategy. While a diversity of perspectives is represented in this study, one can levy the legitimate criticism that only one group of actors' has been consulted to define the scope of each principle, namely individual farmers. This exposed us to underplaying the interests of other vulnerable social groups and also other farmers. For instance, while the last principle on social equity also concerns relations within the farm-enterprise or the household, farmers mentioned mostly practices focused on dealings with actors outside the farm. Farmers' answers were therefore insufficient to conceptualize POAs that addressed internal power dynamics of a class nature or generational, race and gender issues. Whereas the involvement of other perspectives,

through literature review, critical self-reflection, and consultation of experts, did reveal such blind spots, this could be more appropriately addressed by involving other stakeholder groups.

Semi-structured interviews imply that these accounts of farmers in relation to agroecology are framed significantly by the selection and wording of these principles. While our intuition that very few farmers would be familiar with the term agroecology, proved correct, our particular framing of agroecology needs examining. We don't presume to have created a complete or accurate list of agroecological principles, but this is to our mind no reason for concern. Anybody who seeks to pin down agroecology in a definitive list of principles, should be aware that such an exercise is futile. We concur with Bell & Bellon (2018) that agroecology as a theory of and for sustainable agriculture is bound to remain incomplete and social-historically contingent, and that agroecological challenges and preferences may and will change over time. Principles are continuously re-assessed and re-negotiated by the different actors involved in the agroecological community, and they should be, if agroecology is to qualify as a critical theory. Between the moment when we established our own list of principles, September 2017, and the moment of submission, we found a number of existing and new lists and reviews of principles which we did not take into consideration (Migliorini and Wezel 2017; CIDSE 2018; HLPE 2019). These lists of principles are often formulated to address a much broader audience then farmers. Our list is designed for a particular group of actors, namely Flemish beef farmers, and this has its consequences. When categorizing practices, we became aware that a farm-/farmer-oriented list of principles can easily lose sight of how farms are physically embedded in wider landscapes and how contemporary farmers are part of a wider social division of labor. Input use, nutrient cycling, agrobiodiversity have dimensions that go beyond the field margin and farm gate, and improving the social position, autonomy and resilience of individual farmers may come at the cost of other farmers and vulnerable social groups. This vindicates recent efforts to produce principles to be operationalized at the landscape and/or food system level as well. This entices us to reconsider the principles proposed, and explore principles more in tune with this unescapable reality of social and ecological interconnectedness. As to the scope, we found our list lacking a principle that directly spoke to the role of farmers in establishing food systems acceptable to local social values and diets. Yet, considering that our study revealed both significant advantages and limits of our list with respect to other lists of principles, we contend that exploratory, empirical inquiries of principles can be instrumental in maintaining the connection between agroecological theory and practice.

Lastly, we note, that it does not escape us that the qualitative data gathered for this study can serve to further explore other worthy topics, such as the analysis of perspectives and attitudes of the interviewed farmers towards these principles, or the theorization of the social structures and conditions that explain farmers engaging in activities in line or at odds with agroecology. Moreover, the accounts of farmers on their practices may prove a sufficient basis to make case comparisons between individual farmers' sets of practices in relation to agroecology. The conceptualization of POAs raised many questions on how to delineate agroecology as a practice. By assessing whether the sets of practices of these farmers as a whole address all principles sufficiently, and if so whether there are different combinations of POAs that accomplish this, we may be able to substantiate or call into question the salience of particular normative views on agroecology as a practice in this context. Such interlinkages in practice between POAs are the subject of on-going research. Considering these findings and perspectives, we suggest that the formulation of principles, and empirically exploring these in semi-structured interviews with farmers, may be a valuable method to come to grips with actual farmers' practices, and therefore to improve scientific recommendations for agroecosystem design and management.

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