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SOIL HEALTH IN PRINCIPLE AND PRACTICE

a study of changing farmer perceptions and practices in the context of organic certification in Sweden

Courtney Adamson

Visiting address: Albanovägen 28
Postal address: Stockholm Resilience Centre, Stockholm University, SE 106 91

info@stockholmresilience.su.se
www.stockholmresilience.su.se

A PARTNER WITH
Beijer Institute OF ECOLOGICAL ECONOMICS
KUNGL. VETENSKAPS-AKADEMIEN THE ROYAL SWEDISH ACADEMY OF SCIENCES

Supervisor: Jamila Haider

Co-supervisors: My Sellberg, Rebecka Milestad, Simon West

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These days

Whatever you have to say, leave
the roots on, let them
dangle
And the dirt
    Just to make clear
    where they come from

Charles Olson

For my fellow farmers and researchers.

Abstract

Researchers, policymakers and practitioners alike look to alternative and innovative farming systems as mechanisms for changing, and potentially transforming, unsustainable agricultural practices. Organic agriculture has steadily emerged as a policy option for bringing about this change. However, organic farming systems are diverse in practice, and organic agriculture as a concept has evolved significantly, from marginal farming movement to codified and certified production system, over time. This thesis explores the development of organic agriculture and certification in the context of food system transformation. It does so with an exploratory empirical study concerning how organic farmers change and develop their practices, in particular practices concerning soil health, in the context of organic certification in Sweden. In employing an interpretive approach to explore the shifting perceptions and practices of organic farmers, the study highlights how meaning shapes action (i.e., practice), and can in turn have tangible impacts for the way agroecosystems function. Further, it uses a practice perspective, grounded in a relational ontology, to capture social-ecological change as a patchwork of dynamic, non-linear and holistic processes. Concretely, the study develops a conceptual framework to analyse farmers' experiences regarding 1) converting to organic; 2) developing organic practices and practices to improve soil health; and 3) adapting to certification rules, including new rules to enhance soil health practices. The results illustrate the different mechanisms at work in farmers' experiences as they change their on-farm practices, as well as how the social-ecological systems farmers are embedded in influence these change processes. This thesis provides an enabling perspective on change and transformation, focusing on the capacity of individuals to change how they see and act, as a complement to systemic and structural perspectives. (276 words)

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And thank you Alexander and family, for being the ones I get to share (and sometimes struggle through) these experiences with.

Glossary

Agroecosystems	Ecosystems that support the food production systems on farms and in gardens, and which involve the human activity of agriculture.
Crop rotation	A farming practice involving rotating the growing of different species of crops on fields over a number of seasons.
Ecological Outcome Verification (EOV)	A protocol for monitoring trends in land health through measuring key indicators of ecosystem functioning, which is holistic and outcomes focussed. Associated with regenerative forms of agriculture.
Green manure	A crop that is grown for its function in the growing system rather than for harvest. Legume crops, for example, are an important crop in organic growing systems that assist with the biological fixation of nitrogen in soils.
Ley crops ('vall' in Swedish)	A collection of perennials species (grasses, legumes etc.) that are grown in circulation with grain or other crops. Featured in organic crop rotation.
Tilling / ploughing	Preparation of soil for agricultural production involving mechanically breaking apart and turning soil. Used for mechanical weed management in organic farming systems.
No-till or no-dig agriculture	Farming techniques that involve minimal ploughing, digging or disturbance of soil.
Nordiska Råvara (Nordic Produce)	A company started in 2016 specialising in sourcing diverse crop varieties, including old-breed varieties of legumes and grains from Sweden. The company works with farmers long-term to develop growing techniques to improve and regenerate soil health.
Organic agriculture	An integrated farming system that focusses on securing agricultural productivity through incorporation of practices to preserve natural resources, soil fertility and quality, biodiversity, and welfare of animals. It requires elimination of the use of agrochemicals, synthetic fertilisers and genetically modified organisms. The International Federation of Organic Agriculture Movements (IFOAM), a worldwide umbrella organisation for organic farming movements, states that the four core principles of organic farming are health, care, ecology and fairness.
Regenerative agriculture	An approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting ecosystem services, with the objective that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production (Schreefel et al. 2020).
Svensk Kolinlagring (Swedish Carbon Storage)	A Swedish project working on the development of regenerative and carbon farming methods, and a carbon farming market, for businesses and farmers in Sweden.

Contents

Prologue: *practices in soil and sustainability science*

A couple of days after I started the research for this thesis project, in the autumn of 2022, I received an email from our organic certification auditor that it was time for the annual audit of our farm. Just like that, the parallel journeys of both researching and practising organic farming began. However, 'parallel' is perhaps a misleading term to use here, for in reality, the journeys have interpenetrated each other deeply, to the point that I have often needed to sit down and reflect: *am I researching or farming in this moment*? The answer was often, both. In the past, when I have completed research, I have often considered myself an observer peering in. However, the experience with this study has provided new insights borne out of both the opportunities and challenges of combining research and practice, as well as a sense of the responsibility I have as a researcher to be reflexive about where I fit into the research puzzle that I'm seeking to explore.[1]

For the duration of the thesis year, I have had one foot in the soil and the other in sustainability science. I've been researching practice and practising research, with the aim of becoming both a better farmer and better researcher as a result.

[1] I include further reflections on the study and my approach at Appendix 8.1.

1 Introduction

The urgent need for deep and broad food system transformation, as "the nexus that links food security, nutrition, and human health, the viability of ecosystems, climate change, and social justice" (Caron et al., 2018:1), is widely accepted (Rockström et al., 2020; Webb et al., 2020). Within this discourse, the fact that current dominant industrial agriculture practices used to produce food around the world today are unsustainable and must change is well documented (Webb et al., 2020; Arbenz et al., 2017; Reganold and Wachter, 2016). The deteriorating effect of these practices on the condition of soils is of particular concern (Panagos et al., 2022). It is hard to overstate the importance of soils, which house at least 25% of all species biodiversity and produce the majority of food for the world's population (FAO, 2022; Poch et al., 2020; Decaëns et al., 2006). In 2020, a report from the European Commission entitled 'Caring for Soil is Caring for Life' reported that 60-70% of European soils are in an unhealthy condition due to unsustainable management (European Commission, 2020).

Transformation of the food system entails an intentional shift to a substantively new system, including "fundamental changes in structural, functional, relational, and cognitive aspects … that lead to new patterns of interactions and outcomes" (Patterson et al., 2017:2). Despite a broad range of literature urgently calling for comprehensive system transformation, researchers such as Scoones et al. (2020:65) highlight that this transformation agenda suffers from a lack of clarity concerning what is in fact meant by the term 'transformation', including in relation to "what should be transformed, by and for whom, and through what processes". Scoones et al. (2020:66) point to the need for research on multiple distinct, yet potentially complementary, perspectives on transformation, including not only structural and systemic perspectives, but also enabling and emancipatory perspectives that focus on "human agency, values and capacities necessary to manage uncertainty, act collectively, identify and enact pathways to desired futures".

Scoones et al. (2020) highlight how enabling approaches to transformation, through a focus on practice and agency, uncover the attributes and capacities that empower action. This thesis draws on this reflection and provides a novel perspective on organic agriculture and certification as means to achieve food system transformation, by focussing at the farm level and using farmers' practices as the primary unit of analysis.

1.1 Studying organic agriculture in the context of transformation

Researchers, policymakers and practitioners alike look to alternative and innovative agricultural production systems as mechanisms for bringing about change to unsustainable agricultural practices (Eyhorn et al., 2019; Reganold and Wachter, 2016). Organic agriculture has steadily emerged as a policy option for bringing about this change (Milestad et al., 2020; Muller et al., 2017). Since the 1990's, expansion of organic agriculture has been a key policy goal in the European Union (EU), with

the EU Farm to Fork Strategy and Green Deal proposing a goal of 25% agricultural land under organic certification by the year 2030. It also aligns with policy objectives under the EU Soil Strategy and Biodiversity Strategy for 2030, and the EU Common Agriculture Policy (CAP). The potential for organic agriculture to act as a prototype for sustainable agriculture derives from its guiding principles of health, ecology, care and fairness, which are grounded in environmental, political and social aims (Darnhofer, 2014). In terms of both farming and broader food production and consumption, it is considered capable of addressing a number of the United Nations Sustainable Development Goals (Stefanovic, 2022), including in relation to human health and diets (Reganold and Wachter, 2016; Strassner et al., 2015).

Organic agriculture initially emerged as a marginal farming movement between the 1920's and 1940's, and has steadily become institutionalised over time, developing into a codified certification system at the EU level in the 1990's (Fouilleux and Loconto, 2017; Lamine and Bellon, 2009). The global organic community defines the evolution of organic agriculture according to three specific periods, namely, 'Organic 1.0' (the early pioneering era), 'Organic 2.0' (the period of institutionalisation, growth and marketing of organic) and 'Organic 3.0' (an evolving era looking to future challenges for organic) (Rahmann et al., 2017). The evolution of organic agriculture and certification is unique, and a lot can be learned through studying its change over time, both for the future of Organic 3.0, as well as for existing and proposed environmental labelling schemes and certifications as mechanisms to enhance food system sustainability (Elrick et al., 2022).

While organic agriculture has been put forward as an option for enhancing the sustainability of agriculture, researchers also highlight and problematise how organic farming has changed from an alternative and pioneering farmer movement into a heavily codified production system over time (Reganold and Wachter, 2016; Darnhofer et al., 2010). A large body of research addresses two hypotheses of 'conventionalisation' and 'bifurcation' in relation to organic agriculture in the EU and globally. These hypotheses problematise the ongoing influence of industrialised agriculture on organic agriculture and draw into question its ability to deliver what it claims in principle, in practice (Darnhofer et al., 2010). If organic agriculture and certification are to be regarded as policy tools in moving towards more sustainable agriculture systems in the EU, then it is important to understand how these concepts and frameworks continuously change and evolve in practice, as well as the implications this change might have for the role of organic agriculture in broader food system transformation (Milestad et al., 2020; Darnhofer et al., 2010).

Studies exploring organic agriculture in the context of transformation tend to draw on transitions thinking using a socio-technical systems perspective (Stöhr and Herzig, 2022; El Bilali, 2019; von Oelreich and Milestad, 2017; Darnhofer, 2015). Studies considering the impact of conventional farming systems on organic agriculture also primarily assess change from structural or

systemic perspectives (Darnhofer et al., 2010). As a result, the majority of studies tend to overlook the heterogeneity and complexity of ongoing change processes *within* organic agriculture. Further, surprisingly few studies directly examine the role of organic certification and related processes (e.g., certification audits) in shaping and changing farmers' practices (Seppänen and Helenius, 2004), and the implications this may have for broader transformative change. These research gaps highlight the need for more nuanced studies of change in organic farming practices that pay attention to *where* and *how* this change is experienced, and its potential role in generating pathways for transformative change.

1.2 Research question and aims

The current study seeks to fill the above identified research gaps in relation to change in organic agriculture and certification, and provide a novel perspective in relation to broader food system transformation. In line with these aims, it pays attention to the heterogenous, complex, and unpredictable processes and dynamics of change in relation to farming practices in the context of organic certification. Further, by focussing on farmers' changing perceptions it seeks to illustrate how meaning and interpretation play a role in shaping farming practices, which can in turn have tangible impacts on how agroecosystems function. Concretely, I draw on an exploratory empirical study of organic farmers in Sweden, with a specific focus on farmers experimenting with practices to improve soil health, and ask:

> *How do organic farmers change and develop their practices in the context of organic certification in Sweden?*

Additionally, the research objectives for the study are as follows:

- To **employ** a practice perspective, grounded in a relational ontology, to study the dynamic and emergent interactions between the system of organic certification and farmers' practices.
- To **develop** an interpretive approach for the study, as a way to study how meaning shapes action (i.e. practices), and also critically reflect on my role as both researcher and farming practitioner, as part of the social phenomenon under study.
- To **operationalise** the interpretive approach and study farmers' practices through a combination of ethnographic methods, including interviews, farm 'walkabouts' and observations, and accidental ethnography.
- To **reflect** on the findings of the study in relation to change in agricultural practices, and broader food system transformation.

2 Study context

With just over 20% of agricultural land under organic management in 2020, Sweden currently has one of the largest shares of certified agricultural production in the EU (Eurostat, 2022). However, despite broad policy support and a period of steady expansion (Milestad et al., 2020), positive trends for organic production have stagnated in recent years (Swedish Board of Agriculture (SBA), 2020). In relation to production, challenges to meeting policy goals include, among other things, concerns about efficiency and yields in organic farming, and whether or not organic agriculture should be a forerunner with ambitious standards to foster innovation (Milestad et al., 2020). Further, academic and broader discourse in Sweden present the need to move 'beyond organic' to cater for broader agricultural system dynamics and build food system resilience (Röös et al., 2021). Sweden therefore presents an interesting study context in light of the EU policy goals to significantly expand the certified area. Further, my decision for the case study was also shaped by my own professional involvement in the organic sector in Sweden.

2.1 Organic agriculture in Sweden

In Sweden, the first signs of a formal organic sector emerged in the early 1980's. Prior to this, pioneering groups of farmers worked with alternative organic farming methods in isolation (Källander, 2000). The farmer representative body, the National Association of Alternative Farmers (now known as the organic farmer association 'Ekologiska Lantbrukarna'), was formed and established a private body for organic standard setting and certification named KRAV (Kontrollföreningen för Alternativ Odling),[2] in 1985. The impetus for an organic label at the time came from producer desire to coordinate the presence of organic farming on the Swedish market (Kenne et al., 2013; personal communication, Lars (farmer and advisor), 2022.11.29).

Since the 1990's, a series of direct policy goals have been set by both private and public actors to increase the percentage of organic certified agricultural land in Sweden (see Figure 1). Retail actors were involved in developing the organic certification and market for organic certified products in Sweden during this period (personal communication, Henrik (representative of organic certification body), 2022.12.05). The expansion of organic certified land in Sweden accelerated after Sweden's accession to the EU in 1995 and the establishment of specific payments for organic farmers (Källander, 2000). As a result of Sweden's EU membership, the national KRAV Standards must remain consistent with EU Organic regulations (currently EC/848/2018). Farmers can decide to be certified 'EU Organic', and additionally, KRAV. KRAV rules cover additional areas of production and are described as more demanding in relation to, among other things, animal welfare, social

[2] 'Control organisation for alternative growing'.

responsibility, including fair working conditions, and climate (personal communication, Henrik, 2022.12.05). Further details regarding relevant developments in organic agriculture and certification in in Europe and Sweden are provided in Appendix 8.3.

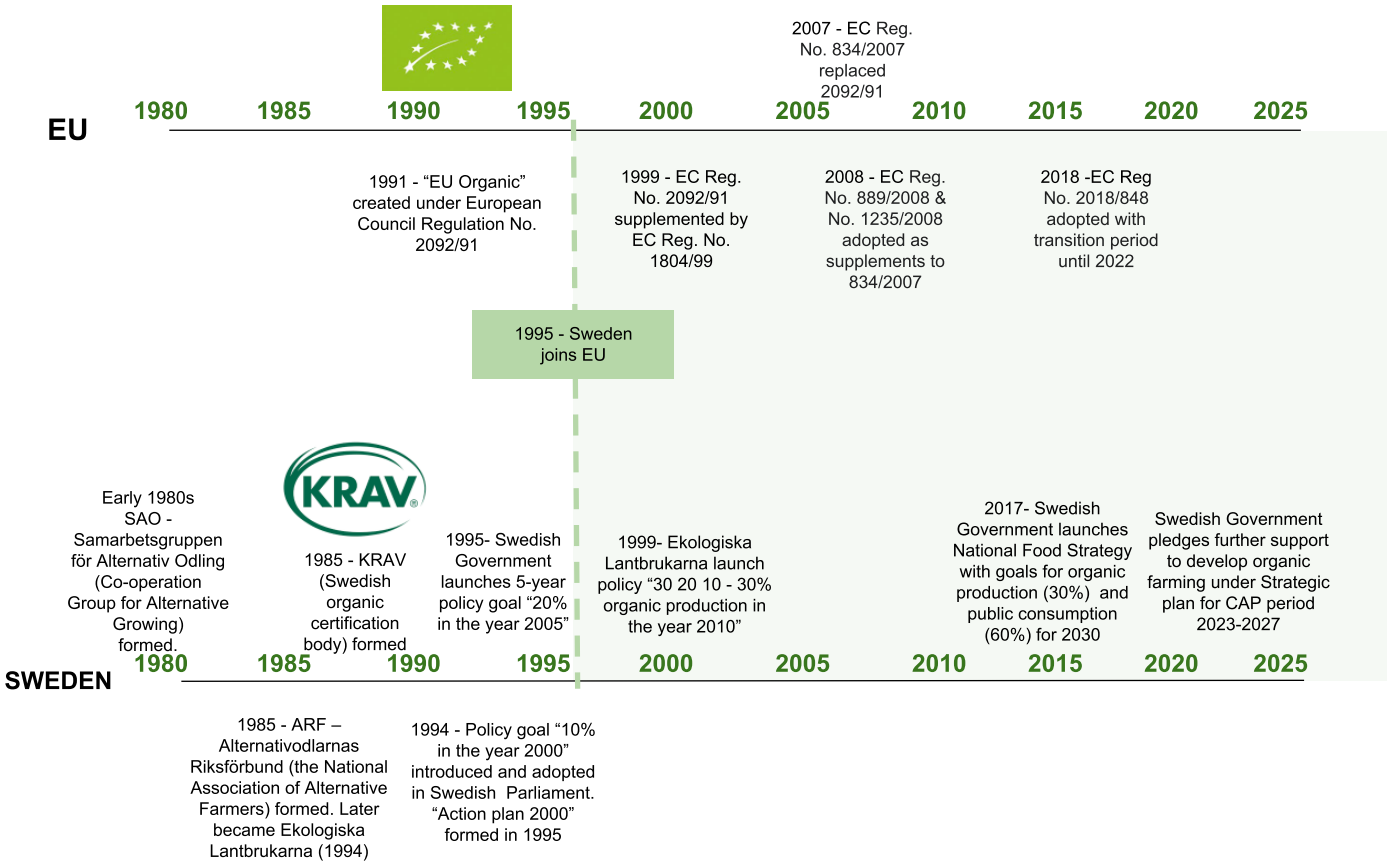

Figure 1. Timeline of policy developments for organic agriculture and certification in Sweden. European Council Regulation No. 2092/91 came into force in 1991 and was subsequently replaced by European Council Regulation No. 834/2007. More recently, European Council Regulation No. 2018/48 came into force, with a formal transition period until 2022. The most recent EU Organic regulations introduce a series of amendments seeking to draw organic agriculture back to its principled roots following concerns arising from its rapid expansion in the early 2000's (see Appendix 8.3 for further details).

2.1.1 The system for organic certification in Sweden

Organic certification is a voluntary market mechanism, which farmers can use in order to communicate with consumers that their agricultural production methods meet certain prescribed standards (Fouilleux and Loconto, 2017). Organic certification is said to address information asymmetry in the market, which exists because consumers are not able to decipher methods of production for the products they purchase (Leitner and Vogl, 2020; Seppänen and Helenius, 2004). In becoming certified in the EU, farmers submit themselves to a system of certification that involves

transparently reporting their production methods and undergoing on-farm audits from a third-party accredited auditing body (Seppänen and Helenius, 2004).[3] EU Organic rules stipulate the methods of production that a certified farmer are required to follow. Therefore, while the certification system directly concerns farmers and producers, public agencies concerned with agriculture and food production, certification and accreditation bodies, standard owners (e.g., KRAV), and a range of consumers, its performance is also embedded in a broader system involving a range of activities, actors and sectors across the agricultural industry in Sweden. The certification system in Sweden can therefore be conceptualised as a number of different fields of activity, which overlap and interact in practice. Figure 2 maps these different fields, illustrating how farmers gain access and participate in these different fields as a result of acquiring certification. Actors associated with the different fields of activity in Sweden are also illustrated around the fields in Figure 2.

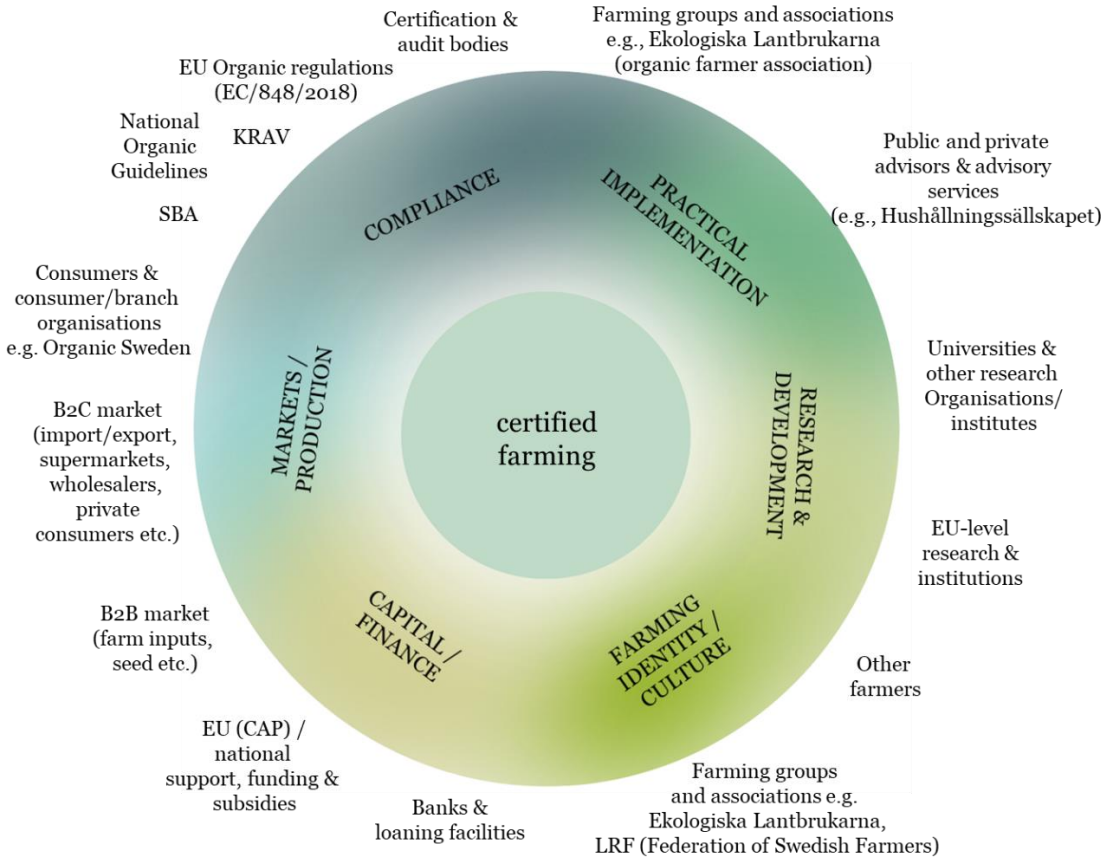

Figure 2: diagram of the different fields of activity in the certification system in Sweden, including relevant actors. The different actors are associated with specific fields as indicated by their position, however, also move between different fields in practice. Organic certified farming takes place within this system (as illustrated in Figure 3). The figure is not intended to be representative of all actors in the system across Sweden and instead reflects the information gained through interviews with farmers and other actors, as well as from personal experience. Clarification: B2B: business-to-business, B2C: business-to-consumer.

[3] Additional details about the development of certification in Sweden are available in Appendix 8.3.

2.2 Organic agriculture as an alternative farm management system

While EU and national rules for organic production nowadays stipulate a set of codified practices, approaches to organic farming across different farms, regions and countries remain diverse in practice (Tully and McAskill, 2019). Generally speaking, farming organically involves combining a range of different precautionary, proactive and conservation-minded farm practices (Reganold and Wachter, 2016). It also entails the management of a series of complex interactions between different structural factors in the aim of achieving certain outcomes for the overall farming system (see Figure 3). Important practices include the rotation of different crops, including the use of green manures and ley crops, the use of biological sources of fertility, such as animal manures, composts and crop residues, as well as natural management of pests and disease, including beneficial insects, plants and other organisms.

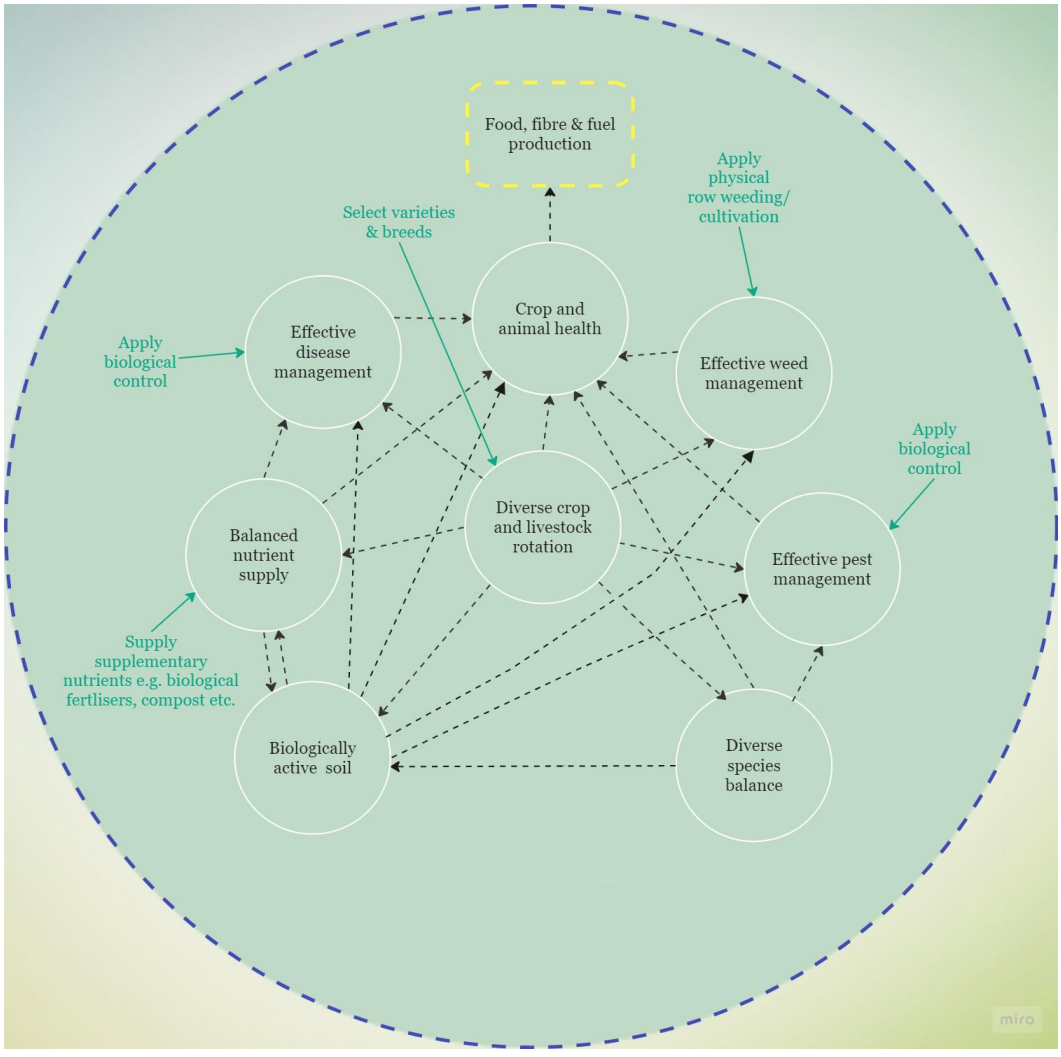

Figure 3: visual representation of on-farm organic management practices for the production of organic food, fibre and fuel. The figure is developed from Reganold and Wachter (2016) and illustrates interactions between the different structural factors/properties to achieve desired aims/outcomes for the organic farming system (white circles), as well as some supplementary management strategies available to the farmer (green text). The figure broadly represents a diversified crop and livestock operation.

Importantly, organic farming systems can vary, relying more on external and supplementary inputs, such as biological fertilisers, or operating more as a closed-circuit system (Rahmann et al., 2017; Reganold and Wachter, 2016). Some researchers describe these varied approaches as different branches of organic practice. The first branch of practice, 'input substitution', is seen as an approach to organic farming that focuses on the replacement of chemical inputs with biological ones (Darnhofer, 2010; Seppänen and Helenius, 2004). The second branch of practice, referred to as 'system redesign' focusses on building "…diversified production systems according to the ecological model of nature, in which interactions among their components maintain important properties of the production system, such as soil fertility, productivity, and resilience and resistance against crop failures" (Seppänen and Helenius, 2004:3). Farmers following this approach are said to go beyond the requirements for EU Organic certification (Reganold and Wachter, 2016).

2.3 Organic agriculture and soil health

Maintaining agricultural productivity through long-term management of soil fertility and condition is a cornerstone of organic (Tully and McAskill, 2019). Article 6(a) of the current EU Organic regulations states that central aims of organic production include "the maintenance and enhancement of soil life and natural soil fertility, soil stability, soil water retention and soil biodiversity, preventing and combating loss of soil organic matter, soil compaction and soil erosion, and the nourishing of plants primarily through the soil ecosystem".[4] Despite these commitments in principle, organic agriculture has also received criticism for its heavy reliance on methods such as tillage for mechanical weed management, and an increase in farmers intensifying organic production and favouring an 'input substitution' approach to maintaining fertility/productivity, and as a result, depleting soil nutrient content and impacting soil quality over time (Rahmann et al., 2017; Bàrberi, 2015).

A number of closely related terms, such as soil fertility, soil quality, and soil health, are often used to describe the condition, quality and life of soils (Lehmann et al., 2020; Tully and McAskill, 2019). The terms 'soil health' and 'soil quality' are often used synonymously, to describe the "capacity of soil to function as a living ecosystem that sustains plants, animals, and humans and support ecosystem services including agricultural production" (Williams et al., 2020:1; Karlen et al., 2017). However, soil health is also said to go beyond soil quality and incorporate broader sustainability goals that include planetary health (Lehmann et al., 2020). It is this broader concept of 'soil health' that is of particular interest for the current study.

Interest in the concept of 'soil health' has grown in different disciplines and for a number of different actors, including farmers, conservationist, scientists, advisors and policymakers, over the last 10 years (Karlen et al., 2017). Soil health has received greater attention due to several evolving and

interlinked crises driven by a changing climate and the erosion and degradation of soils due to the impact of human activities (Karlen and Rice, 2015). Further, the war in Ukraine and ongoing concerns about the use of finite resources and energy shortages has led both researchers and practitioners to consider improving soil health in agricultural systems as a way to reduce reliance on external inputs, such as synthetic fertilisers and pesticides (Rumpel et al., 2022; Poch et al., 2020). The prospect of using mechanisms such as soil carbon sequestration to combat climate change has also led to increased interest in the functioning of soil ecosystems (Panagos et al., 2022; Rosinger et al., 2022; Rumpel et al., 2022; Tully and McAskill, 2019; Lori et al., 2017).

2.3.1 Case study: Swedish organic farmers digging into soil health

In light of above contextual factors and trends, I identified the empirical case of organic farmers working with soil health in Sweden as of interest and value to the study of changes in organic farming practices in the context of certification in Sweden. In line with Yin (2014), I selected an embedded case study design with farmers and their practices as distinct embedded units of (see Figure 4).

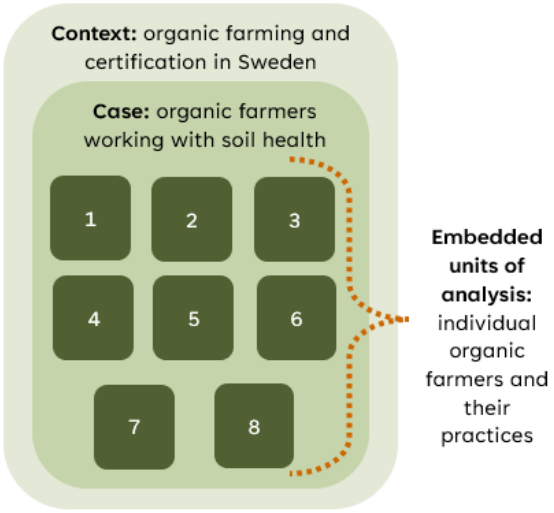

Figure 4: visualisation of case study design following Yin (2014). I selected this embedded case study design due to its revelatory value, both in terms of what an exploratory empirical study of organic farmers working with soil health can uncover for the broader research context (i.e., organic farming and certification in Sweden), as well as the value of this material in reflecting on the theory drawn on in this study. Further details regarding methods for selection of study participants are outlined in section 4 below.

The study focus was also influenced by the following considerations:

1. As a practitioner, I intuitively understood that studying organic farmers who are prioritising soil health would have the potential to uncover interesting information regarding developments within organic agriculture and certification. I was particularly interested in

[4] See Appendix 8.4 for an overview of relevant articles in the current EU Organic regulations.

accessing all forms of experimentation and deliberation from farmers in relation to soil health, which I felt could provide a valuable entry point to exploring how organic certification can interact with and shape farmers' practices.

2. All organic farmers concerned with the production of organic crops must think about soil. This includes farmers managing livestock since organic farmers must grow a percentage of feed for their animals. As a practical consideration, focussing on soil practices allowed me to focus on a shared concern across a diverse and broad range of farming systems and practices.
3. Studying farmers who are actively working to improve the health of their soils is intrinsically interesting to study given its importance to the long-term health of agroecosystems (Williams et al., 2020). Further, there is still limited understanding in agricultural sciences regarding how soil management practices affect soil health at the farm level in Sweden (Williams et al., 2020). Capturing the practical and tacit knowledge of innovative farmers in this area is therefore also of significant value (Šūmane et al., 2018).

3 Theory

The central aim of this study is to explore how organic farmers change and develop practices, in particular practices concerning soil health, in the context of organic certification. The study is therefore informed by literature covering change in organic agriculture and practices over time, including through the application of a practice perspective and practice theory. Below, I provide a brief overview of this literature, then highlight how this literature informed intended contributions, and shaped the theoretical perspective for the study.

3.1 Studying change in organic agriculture and practices

There is ample literature exploring change in organic agriculture in Europe and potential implications of this change for sustainability (Darnhofer et al., 2010). One dominant line of research explores the change and evolution of organic farming practices in the EU in relation to the hypotheses of 'conventionalisation' or 'bifurcation' (Darnhofer et al., 2010; De Wit and Verhoog, 2007).[5] This research looks at, among other things, mechanisms such as the changing structure and size of farms (e.g., Pépin et al., 2021; Best, 2008), increasing farmer reliance on off-farm inputs and input substitution (e.g., De Wit and Verhoog, 2007), and differences in the overall farming approaches of later entrant organic farmers to the those that converted in earlier years (e.g., Best, 2008), as ways to diagnose trends and potential causal mechanisms for the different hypotheses.

[5] These hypotheses concern the potential problematic influence of conventional farming and market forces on organic agriculture. It is beyond the scope of this thesis to go further into the extensive and highly debated body of research concerning these hypotheses.

Darnhofer et al. (2010:70) point out that the above studies, for a range of reasons, fail to "sufficiently capture the heterogeneity and complexity of the ongoing processes within organic farming". They also have a tendency to place organic farms and farmers into one homogenous group, or define them in terms of strict binaries or dichotomies. Further, researchers primarily examine change using structural or systemic perspectives, and by looking for 'cause-effect linkages' in order to identify universally applicable mechanisms (Darnhofer et al., 2010). In response to this, some researchers propose that a more discerning approach to studying change in organic agriculture involves studying the diversity and types of change taking place (Freyer et al., 2012; Darnhofer et al., 2010; Lamine and Bellon, 2009). This involves studying ongoing processes and dynamics of change in context rather than seeking to uncover universal cause-effect mechanisms for general application (Darnhofer, 2021; 2020).

3.1.1 Taking a practice perspective

In contrast to the above approaches, using a practice lens can capture the heterogeneity and complexity of ongoing processes within organic farming as it prioritises the situated agency of farmers and "foregrounds the everyday actions of people as a way to understand social phenomena" (West et al., 2016:400; Gad and Jensen, 2014). With practice as the primary unit of analysis, "analytical focus is neither placed on the social system nor on individual agency, but rather on the entwinement of agency and structure in practice" (Behagel et al., 2019:482). Practice, however, is an "amorphous concept with roots in different philosophical traditions and scholarly disciplines" (Wagenaar and Wilkinson, 2015:1267). For the purposes of informing myself for the current study, I therefore focused on understanding the ways in which practice theory, or a practice lens/perspective, has been applied to the study of change in organic practice in the EU, or sustainable farming practices more generally.

One body of research analyses how socio-cultural dynamics either enable or restrict change in farmer values and practices, and in turn influence processes of change and transformation in relation to organic and sustainable agriculture (Freyer and Binge, 2012; Sutherland and Darnhofer, 2012; Carolan, 2006). Sutherland and Darnhofer (2012), for example, employ Bourdieu's concepts of habitus, fields and capital in practice theory to examine how conversion to organic farming plays a role in change processes related to ideas, norms and values of farming identity and what it means to be a 'good farmer'.[6] This research is valuable in uncovering how meaning and interpretation in relation to socio-cultural norms and values play a central role in shaping practice. It also responds to calls from researchers such as Lamine and Bellon (2009) for studies on the dynamics of conversion in organic agriculture. However, it is limited in studying how ecological dynamics in farming also influence

[6] There is an extensive body of literature regarding the 'good farmer' concept, see Burton et al. (2020). I primarily touch upon this concept in relation to organic farming conversion for this thesis.

meaning and interpretation (e.g., influence a farmer's understanding of what it means to farm organically), and how this in turn can also shape and change farming practice.

Alternatively, Brédart and Stassart (2017) employ a practice perspective grounded in pragmatist sociology and the philosopher John Dewey's notion of experience to analyse farm trajectories. Their aim is to present a way to study these trajectories while maintaining a transformative standpoint. They seek to access the "non-linearity, gradualness, and robustness of transition paths" from the farmer's point of view (Brédart and Stassart, 2017:2). Pragmatism acknowledges that "knowledge, knowledge application and knowledge creation cannot be separated from action; that acting is the high road to knowing" (Hajer and Wagenaar 2003:26). Dewey was interested in understanding how individuals use existing means to change situations through courses of action, and saw that experience was "achieved" when the course of action implemented made it possible to change a harmful situation (Brédart and Stassart., 2017:3; Duram, 1998). The breakdown and change of daily farming practice (referred to as habit by Dewey) can therefore feature as the point of study, and this is in fact considered a contribution of pragmatism in contrast to later iterations of practice theory (Miettinen et al., 2012).

3.2 Study contributions

In light of the above literature, I sought to develop an approach to the empirical study that 1) was situated in context, 2) avoided generalisable cause-effect mechanisms and linear, orderly or mechanic accounts of change, and 3) paid attention to farmer knowledge, interpretation, practices and experiences. In addition, I saw a need for new ways to study how organic farmers' practices are both enabled and constrained by not only social dynamics (e.g., certifications rules and policies), but also ecological dynamics (e.g. changes in farm ecosystem, soil health etc.) and how these intertwined dynamics shape pathways of change. The above literature and findings shaped my decision to use an interpretive approach to the study, as well as a theoretical framing using a practice perspective, as outlined below.

3.2.1 A conceptual framework based on Brédart and Stassart's proposed theory of action

In the following section, I outline a conceptual framework I developed to study the dialogue between farmers and their practices, which is informed by the work of Brédart and Stassart (2017).

Brédart and Stassart (2017), in their study of changing farming practices, propose a theory of action to study how interlinked events and courses of action lead to learning, including farmers learning to pay attention to new events and take new actions in the course of experience. They propose that "learning is the result of surprises, of what destabilizes the farmer and raises doubt in her/his mind about her/his practices" (Brédart and Stassart 2017:1). Change is also understood as "…a constant process of adjusting goals and means that is punctuated by events that become events only when

attention is given to them" (ibid). In studying change in this way, it is possible to see which events farmers learn to pay attention to due to dominant farming norms and values, such as those associated with industrial agriculture.

As illustrated by Figure 5 and explained further in Table 1, the dynamic interaction between events, actions, and the attention that individuals learn to pay to these events and actions, is what shapes and determines the outcome(s) of experience. The strength or value of experience also depends on farmers being able to see (i.e., pay attention to) the consequences of a course of action. This is what gives experience meaning. I use the conceptual framework in Figure 5 in this study as a tool for exploring the underlying mechanisms in farmers' experiences as they change and develop their practices in the context of certification.

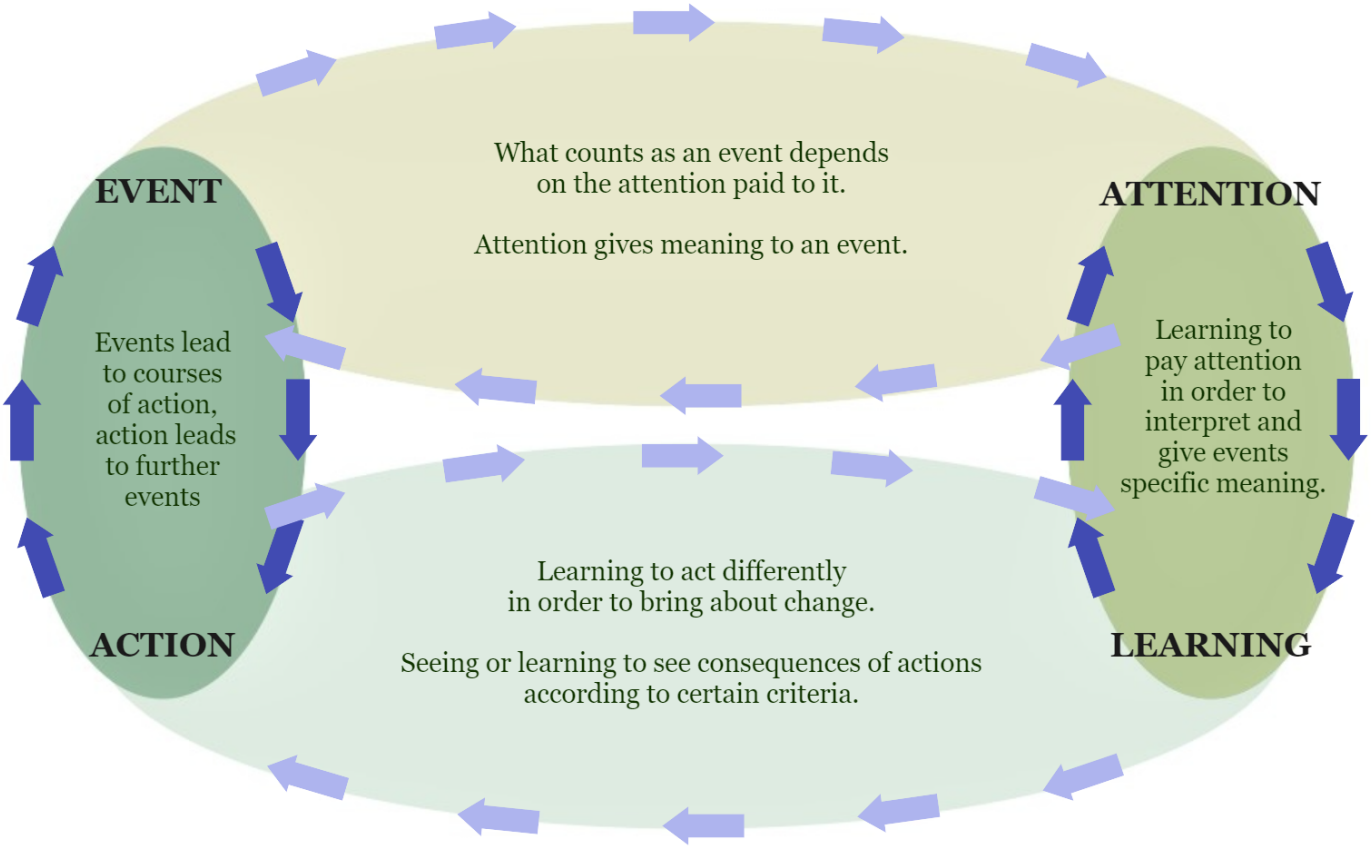

Figure 5: conceptual framework developed from Brédart and Stassart (2017) to assist with analysis of the dialogue between farmers and their practices, by looking specifically at the way in which events, actions, attention and learning interact in experience.

Description of key terms for the conceptual framework based on Brédart and Stassart (2017)	
Term	Description and related terms
Experience	Experience *"occurs when tension breaks the continuity that exists between the individual and the environment (understood as the entire set of existential conditions). Experience is thus a special way of adapting"* (p.3) *"Experience can also be understood as 'an unforeseeable series of changes of which chance, accident, but also groping, effort, desire, and will-power are often decisive factors'"* (p.3) (Brédart and Stassart translating Zask, 2015, p.51)
Event	Events *"create a break in a scenario and destabilizes it. It has an unexpected character. It shatters routines. It thus becomes a matter of coping with uncertainties"* (p.9)
Action	Action concerns *"how the experience is conducted to change the process at work in the situation little by little, how the farmers learn to act differently and reorient their trajectories"* (p.8)
Attention	Attention is *"… a kind of state of active watchfulness that scrutinises the unfolding course of things for what could be an event, just as one scans the sky for signs of a coming storm, and in which the farmer learns to draw inferences from non-apparent relations that are hidden behind what is apparent, inferences that enable him [sic] to foresee the consequences of his actions"* (p.10)
Learning	*"… learning results from a relationship between events and the attention that the farmer develops to spot these events, give them meaning, and link them to a course of action"* (p.10)
Additional terms relevant to analysis under conceptual framework	
Withdrawal	*"The withdrawal depends on rendering visible or invisible the various elements and processes to which mechanism of attachment and detachment are connected"* (p.10) 'Innovation through withdrawal' is innovation structured around dissociation and detachment mechanisms in relation to certain practices and technological artefacts (Goulet and Vinck, 2012)
Stabilisation	Stabilisation describes the way in which practices persist or not over time. Practices are, for example, stabilised by socio-cultural norms and values, as well as through the ability of a farmer to access resources that facilitate practice. Brédart and Stassart (2017) provide the following example: *"Growing corn on the farm and buying protein, typically soybean cattle cake, is a practice that has been stabilized in norms and values. It is taught in the agricultural schools, universities, or at a young age when farm children calculate feed rations with their fathers"* (p.11)

Table 1 – overview of key terms for the conceptual framework (Figure 5) to study the underlying mechanisms in the dialogue between farmers and their practices. Quotes are taken from Brédart and Stassart (2017) unless otherwise indicated.

4 Research approach

Agroecosystems are complex adaptive social-ecological systems (SES) and I therefore position this research within the field of SES research (Perrin et al., 2020). However, following the approach of West (2016:11), I apply the SES concept as a "productive boundary object" that recognises dynamic linkages, rather than a "technically applied concept" (Stojanovic et al., 2016). Epistemological, ontological and methodological configurations in SES research are extremely broad and varied, however, all approaches can be characterised by shared concerns regarding the dynamics of social-ecological systems and processes, including emergence and complexity (Folke et al., 2016; West, 2016). I therefore employ a relational ontology to embrace this complexity and avoid reductionism, as well as observe indeterminate, emergent and non-linear social-ecological processes and relations (Darnhofer, 2021; 2020; 2019; West et al., 2020).[7] A relational philosophical approach aligns well with a practice perspective and an interpretive approach because of a shared focus on situated experience and the dynamics of continually unfolding processes (West et al., 2020; West et al., 2019).

4.1 Interpretive approach - linking meaning and practice

West (2016:3) helpfully describes how taking a broadly interpretive approach to study social-ecological complexity can be instrumental in acknowledging 1) the provisional and emergent nature of knowledge and meaning in SES; and that, 2) meaning is not something that simply attaches to social-ecological systems and relations, but rather, "plays a constitutive role in creating and shaping them, and therefore informs how sustainability is pursued and realized". In line with this, the concepts farmers use to inform and reflect on their practices, such as organic agriculture, can be understood as indeterminate concepts "emerging from our experience of and engagement with the world around us rather than simply existing 'out there' for us to find" (West, 2016:12). Organic principles and rules can therefore be considered as "new ways of thinking and kinds of interpretive frameworks [that] influence the questions that are asked and the answers that are developed" by farmers in relation to their practices (Šūmane et al., 2018:234; Hassanein and Kloppenburg, 1995).

In pursuing an interpretive approach, I drew on Wagenaar's (2011) conceptualisation of the different 'faces of meaning' in interpretive policy research. In particular, I studied both hermeneutic and dialogical meaning. While both forms of meaning have different philosophical underpinnings, I followed the approach taken by West (2016) by studying these forms in a way that acknowledges their ability to overlap, while remaining cognisant of their philosophical and methodological differences. Hermeneutic meaning sees meaning as formed in the subjective mind of an individual, and that an

[7] Relational thinking is nowadays drawn on in varied forms across a number of different disciplines and academic fields. In general, this philosophical approach conceptualises reality as a perpetual state of becoming, emerging from ongoing dynamic processes and relations (West et al., 2020).

individual's understanding is regulated through ongoing interpretation of their own acts and the acts of others in a broader intersubjective context (Wagenaar, 2011). Dialogical meaning, on the other hand, is the study of meaning as it emerges through practical action. Wagenaar (2011:57) describes it as meaning that "…emerges from the patterned activities we engage in when we grapple with concrete situations that present themselves to us as in need of being resolved."

4.1.1 Operationalising an interpretive approach

For the study, I followed Schwartz-shea and Yanow's (2011) advice on interpretive research design, employing abductive reasoning and engaging with multiple pieces of the research 'puzzle' at once. I started the research by systematically reflecting on my own experiences as a certified organic farmer, as well as exploring academic literature and broader policy concerning organic agriculture and certification in the EU and Sweden. I then expanded the research iteratively by moving back and forth between data collection, theory, and data analysis in an abductive process of sense-making (Schwartz-Shea and Yanow, 2011).

4.2 Methods - data collection

Fieldwork for the study, which involved travelling to organic farms and interviewing farmers, as well as other relevant actors and stakeholders, was conducted between November 2022 and January 2023 (see Table 2).

November 2022					December 2022						January 2023	
			3-day fieldtrip				*3-day fieldtrip*					
F1	F2	F3	F4	A1	Organic research conference	A2	F5	F6	F7	F8	A3	A4-7

Table 2: outline of fieldwork design for the study, which allowed time for data analysis and reflection between visits to farmers (F1-F8) and interviews with other actors and stakeholders (A1-A7). Attendance at industry events, such as a conference on the future of organic research at the Swedish University of Agricultural Sciences, as well as my professional involvement in the sector, were also systematically reflected using the method of accidental ethnography (see section 4.2.3).

The overarching aim of data collection was to explore and gain a deeper understanding of the subject under study, as well as promote theoretical reflection and identify areas for further research (Baxter & Jack, 2008). I was therefore not seeking to be representative in my selection of organic farmers and focussed on obtaining a diversity of experiences and perspectives (Sutherland and Darnhofer, 2012). I selected farmers based both on my knowledge of the industry as an organic farmer and exploration and research of publicly available information, such as websites, magazines and newspapers, to find out which farmers were actively working with methods to improve soil health (see Table 3). Farmers consider soil to varying degrees and it was my intention to visit and interview farmers who identified as actively working with soil health.

All farmers were certified EU Organic, the majority were also KRAV-certified, and two farmers were certified Demeter.[8] To select participants, I employed 'maximum variation purposive sampling' to ensure variation in the types of farms I visited and capture a wide range of perspectives (Tracy, 2013). Variation concerned types of production, scale, length of certification, location (within practical limitations) and soil health practices (see Table 3). This provided for a degree of comparative analysis and assisted with sense-making during data collection. By ensuring variation, I also aimed to avoid being restricted by my own preconceived notions and ideas concerning types of organic farms and farmers in Sweden. I wanted to create space for being surprised by the data; a key element in taking an interpretive and abductive approach to research (Schwartz-Shea and Yanow, 2011).

Farm visits with Organic farmers					
Farmer	Production	Certified production	Certification	Identification of soil health practices	Data collection
Kerstin (F1)	Animal husbandry (meat production), vegetable production, greenhouse production	Less than 50 hectares	KRAV since 1999	Experimenting with regenerative methods, including rotational grazing and no-dig vegetable growing methods.	On-farm interview in greenhouse, walkabout. Informal discussions. Review of company website.
Anders (F2)	Crop production, produces hay for feed for horses. Small-scale vegetable production (new)	100-200 hectares	KRAV since 2000	Identified in newspaper for innovation in relation to old-breed varieties in organic farming and experimenting with regenerative methods.	On-farm interview and walkabout. Short informal discussion following interview. Review of company website. Shared meal with family following interview.
Johan (F5)	Small-scale vegetable production, tunnel/ greenhouse production, animal husbandry (meat production)	Less than 50 hectares	EU Organic 5-6 seasons and Demeter 2-3 seasons	Provides education in small-scale market farming, discusses soil health in industry publications. Experimenting with methods to improve soil health.	On-farm interview and walkabout. Review of company website.
Patrik (F6)	Crop production, commercial seed production, bees, animal husbandry (egg and meat production)	More than 500 hectares	KRAV since 1999 (took over family farm 2006)	Discusses soil health and experimenting with regenerative methods in industry publications and interviews.	On-farm interview. Review of company website.
Bosse (F7)	Crop production, animal husbandry (egg and meat production), own mill for production of flour	100-200 hectares	KRAV since 1994 and Demeter since 2016	Identified in online and print resources describing practices with old- breed varieties and compost to improve soil health.	On-farm interview and walkabout.

[8] The Demeter certification also uses the EU Organic regulations as a set of base requirements.

Malin (F8)	Animal husbandry (milk and meat production), crop production	100-200 hectares	KRAV since 1995	Won award for practices 2022, experimentation with biochar, biogas production and other innovations. Experimenting with regenerative methods.	On-farm interview (partner present for part of interview) and walkabout.
Farmer & advisor					
Torsten (F3)	Crop production	100-200 hectares	KRAV since 1995 (took over family farm progressively 2011-18)	Organic farming advisor & regenerative farming advisor. Experimenting with regenerative methods. Identified through participation in soil health seminars.	On-farm interview and walkabout.
Lars (F4)	Animal husbandry (meat production), annual and perennial vegetable and fruit production, greenhouse production	Less than 50 hectares	KRAV since 1985 (has farmed on different farms during this time)	Involvement with organic farming sector and certification since establishment, involvement with IFOAM. Experimenting with methods to improve soil health.	On-farm interview (partner present for beginning of interview).
Interviews with other actors & stakeholders					
Actor	**Role**	**Organisation type**			**Data collection**
Anna (A1)	Organic advisor	Swedish Board of Agriculture			Interview
Henrik (A2)	Representative	Organic certification body			Interview
Lina (A3)	Auditor	Certification audit company			Interview
(A4-7)	Representatives – personnel responsible for organic rule development in Sweden	Swedish Board of Agriculture			Interview

Table 3 – overview of study participants, which included farmers, farmer advisors, and other actors and stakeholders involved in the certification system in Sweden.

4.2.1 Semi-structured interviews and farm 'walkabouts'

I prepared an open-ended and semi-structured interview guide to assist with conducting on-farm interviews with farmers (Boonstra et al., 2011), which I tested and improved at the start of fieldwork (see Appendix 8.5). The interview format provided space for farmers to describe their experiences with organic farming and certification (Kohler Riessman, 2008). I asked farmers about changes in their farming practices, and in particular, experimentation with methods to improve soil health. The guide also focused on farmers' interpretations and sense-making in relation to concepts of organic agriculture and certification (Wagenaar, 2011). Additionally, I employed the use of a simple timeline on a piece of paper during the interview to emphasise my focus on experiences over time (Wagenaar, 2011).

On six out of the eight farms, I went on a 'walkabout' tour with the farmer either prior to or after the interview (Strang, 2010; Cooke and Lane, 2015). During these tours, I limited planned questions and let the discussion be guided by topics farmers wanted to discuss. I either recorded conversations with farmers during these walkabouts or noted down my recollections of the conversations during or after the tour on a 'reporting summary template' (Guest et al., 2013), depending on what was practically possible in each situation. The walkabout method was helpful to my approach as it "explicitly acknowledges that the physical environments that are of importance to people's lives will serve as repositories of memory of experience in those spaces" (Cooke & Lane, 2015).

4.2.2 Interviews with other stakeholders and actors

In addition to the farm visits and interviews, I also prepared semi-structured interviews guides and conducted interviews with other actors and stakeholders involved in the certification system in Sweden to develop my understanding of the broader intersubjective context (Eden, 2008) (see Table 3). Visits to farms were interweaved with these interviews, which allowed for a helpful form of dialogue to unfold between the data collected. Interviews with other actors and stakeholders often confirmed and extended, or provided a different perspective, in relation to the experiences of farmers. I used these interviews both to inform context and in the results.

4.2.3 Accidental ethnography

The role of the researcher is critically reflected upon in interpretive research and the use of memo-writing and a reflexive journal during both data collection and analysis were central to my research process (Wagenaar, 2011; Schwartz-Shea and Yanow, 2011). These tools also enabled me to systematically reflect on my day-to-day experiences in farming. Here, I relied on Levitan et al.'s (2017) guidance on 'accidental ethnography' to incorporate my own practitioner data and experiences in organic farming outside of the formal data collection process (also see Fujii, 2015).

4.3 Methods - data analysis

I manually transcribed all material from visits with farmers as part of the first round of data analysis (approximately 120 pages). I completed this transcription between other visits to farms and interviews with other actors and this enabled me to reflect on and develop my approach to fieldwork as it progressed. I was also able to begin interpreting and loosely analysing the data as I transcribed, including making note of reoccurring or interesting themes (Kohler Riessman, 2008). For the interviews with other actors, I either transcribed the interview myself or with the help of a secure transcription service (approximately 60 pages). I also had my own systematic reflections during and around fieldwork. Once all interviews were transcribed, I commenced a first round of inductive coding, focussing on action terms and "experience-near concepts" so as to stay close to farmers'

reflections regarding their practices (Schwartz-shea and Yanow, 2011:50). I also coded under the simple codes of 'meaning' and 'intention' to maintain an interpretive focus.

During the first round of analysis, I primarily coded long segments of text containing farmer narratives and reflections. Due to this, I began to pay attention to the narrative arch in most of the interviews with farmers (Kohler Riessman, 2008). I then decided to write out two interviews with farmers in the form of a narrative account using the farmers' descriptions of how their practices had changed over time. I selected two farmers specifically due to their early conversion from conventional to organic and the length and diversity of their experiences with organic farming and certification. The continuous narrative form allowed me to access the dynamics and processes of change, as well as how farmers' perceptions and interpretations shaped their practices. Following this, I coded the interviews and narratives according to a coding system (Appendix 8.6) that aligned with the conceptual framework I developed (Figure 5). See Appendix 8.7 for an overview of this iterative process of analysis. Critical reflections on methods are also included at Appendix 8.2.

5 Results & discussion

I present results in sections 5.1 and 5.2 in narrative format, focusing primarily on two experiences of the organic farmers I visited and interviewed, namely 1) converting to certified organic farming; and 2) developing organic practices and practices to improve soil health. Following this, I examine some of the farmers' interactions with organic rules and certification in more detail in section 5.3. Additionally, I discuss what we can learn more broadly from the dialogue between farmers and their organic practices in each section. The narratives in sections 5.1 and 5.2 begin with two farmers' conversions in the 1990's and early 2000's, continuing chronologically with the development of organic certification in Sweden.[9] Section 5.3 takes place in the period from approximately 2015 to present (see Appendix 8.3 for a reminder of the developments in organic agriculture and certification in Sweden).

5.1 Opportunity for experience: converting to organic

Converting to organic farming can be conceptualised as an opportunity for experience for farmers to change relationships with material aspects of the farm and implement new courses of action. It also has the potential to stabilise a new set of practices. Through withdrawing certain practices to meet the organic certification rules, such as the use of synthetic inputs to manage nutrient demands, as well as weeds and disease/pests in crops, farmers pay attention to new aspects of their farming systems, and experiment and learn to make new connections and develop new practices. A farmer's conversion to

[9] These two narratives were identified during data analysis, as mentioned in section 4.3.

organic agriculture can therefore also be framed as innovation structured around the withdrawal of certain practices and artefacts associated with conventional and industrialised forms of agriculture.[10]

The narrative below explores some of the underlying dynamics of the farmers' experiences as they convert to organic farming. While I primarily emphasise the experiences of Anders and other farmers in relation to organic seed and variety selection following conversion, I also illustrate how this is just one experience in a myriad of layered experiences, ongoing both prior to and following conversion, which all influence the gradual shifting of perceptions and practice.

Narrative 1 – converting to organic

Anders converted to organic in the year 2000, at a time when it was possible for farmers to access financial support if they were prepared to try growing organically for five years. He saw the chance to convert as a challenge and opportunity. He expresses to me that he had never really been keen on buying in synthetic fertilisers in any case. Conversion also aligned with earlier changes he had sought to make in relation to his practices. For example, when working as a conventional farmer he had developed a weed sprayer that enabled the farmer he was working for at the time to minimise chemical use to 10% of previous levels. He is also familiar with experimenting with his farming system. He describes experiences with his wife's uncle, who had started working with no-till farming methods as early as the late 1970's. Due to this experience, Anders had also started to experiment with no-till on the farm he was working on at the time:

> *"So we divided the field down the middle, and I ploughed as usual on one half and then used my new system on the other half and I had learnt somewhere that … if one does this and then can see that there is a difference, then the harvest difference will be more than 10%, and 10% is quite a lot … The soil that was at that farm was a type of soil that responded best to no-till because so much organic matter built up at the surface and that prevented crust formation, which was a very difficult problem for these soils … [Everything from this experience] has followed with me and I've always been interested in growing systems, perhaps not so interested in machines and the like, but growing systems."*

Anders sees his farming system as a holistic system. At one point during my visit, we are standing in a section of one of his barns where he had kept pigs in the past and I ask him where he might have developed this perspective from. He answers that he doesn't really know, there were the experiences with his wife's uncle, but he has always been interested in farming systems and had wanted to be a farmer since he was very young. He had also taken up an opportunity to convert a percentage of his previous pig farming operation to organic, and observing the pigs' natural behaviour when they could be outside had also made a strong impression on him.

Converting the farm to organic meant Anders was required to use new crops that were specifically approved for organic growing. There was no organically produced seed at the time and so the grain variety he used was untreated conventional seed called 'Dacke'. Anders recounts that conversion was a significant adjustment for the farm. Shortly after converting to organic, he

[10] Reflections from Lars regarding organic agriculture as 'innovation through withdrawal' are available at Appendix 8.8, Reflections 1-3.

experienced two problematic changes. Firstly, the proliferation of weeds in the system, which forced him to look at ploughing again, a practice that he had managed to minimise in his conventional system through earlier experimentation and experience. Secondly, he noticed the poor performance of the Dacke crop. He expresses that the growth of the Dacke variety was heavily dependent on being fed with fertiliser, so it could take up nutrients easily from the soil with its shallow roots, and that it competed poorly against the weeds:

> *"I felt that if I was going to grow those [chemically] untreated varieties [Dacke] that were short and that are developed to take up nutrients from fertiliser that is very shallow, that isn't the way that one grows organically … I wanted to have varieties that also had deep roots and long stalks, that is what I have realised more and more along the way, and so I felt that if I don't find anything else then I was going to go back [to conventional] after five years [of trialling organic] …*
>
> *… I don't believe in growing organically and having these common varieties that are developed. Then one can't let it be without fertilising. Rather, it's the whole growing system that I describe, that is when the opportunity opens itself"*

Another farmer, Bosse, who converted to organic in the 1990's, shares a similar reflection on the early grain varieties he grew:

> *"They were those conventional varieties except they were organic and particularly for the autumn wheat I was forced to have nitrogen, it was a really bad harvest, not really bad, it was a low harvest, low protein and heaps of weeds."*

According to Anders, the practices he sees as on offer in the organic system in his context are crop rotation and using ley crops, legumes (such as field beans) to fixate nitrogen, and grain crops with strong growth and deep roots to take up nutrients.[11] In order to achieve his intentions for farming organically, he has embarked on a long road of experimentation with his grain crops since conversion. In 2003, Anders went to a farmer gathering where there was a presentation from an expert on old-breed grain varieties. The farmers at the gathering were offered small, 1kg bags of these grains. He knew he wasn't going to be able to handle such small bags, that he needed much more, but took the bags in good faith anyway. After this, he made contact with Länsstyrelsen (The County Board) and Hushållningssällskapet (a private advisory service) and they agreed to help with the sowing of these grains if he agreed to open up his farm to visitors so people could come and see how the grains grew. Anders set up a small on-farm trial of the grains and kept growing the other Dacke variety on the larger fields around these trial plots. The difference he saw in the growth habit of the old-breed varieties was significant, they grew to double the height of Dacke and didn't respond well to fertilisation, for they didn't need it. He felt this was something he wanted to work with, even though he knew the challenge remained in accessing enough seed. He harvested the grains and gradually built up his own seed over the years.

Other farmers that I visit reflect on the ongoing absence of variety development for organic farming. Torsten reflects on the fact that organic grain varieties are often advertised in relation to industry standards, such as their ability to bake well despite low protein levels. While acknowledging protein levels are a concern, Torsten sees the need for crops to be developed with more attention

[11] Anders also uses horse manure from horses on the farm to manage soil fertility.

paid to their agronomic performance in the organic farming system. Similar to Anders and Torsten, other farmers reiterate their need for organic crops that have a strong ability to compete against weeds, low demand for nutrients and the ability to take up nutrients through a deep root system, resilience to dry conditions and also suitability for intercropping to enable increased diversity in production.

Anna, an organic advisor with more than 25 years of experience, explains to me that she has seen little variety development for organic farming and that organic seed varieties are commonly taken from conventional seed trials on the basis that they might have the potential to grow well in the organic farming system. However, crops grown in conventional farming systems are subjected to different growing conditions, including in relation to how they are provided with nutrients or protected from pests and disease.

After 20 years, Anders now has his own 'evolution' variety of grain that is adapted to the specific growing conditions of his soils. He has developed varieties of other crops as well. Choosing this method of growing and this kind of product has meant that he has needed to develop infrastructure for handling and storage. He shows me the space and infrastructure needed for the processing of grain in his barn. He also explains how being certified organic was key to him being able to obtain a loan and that this was important for building the infrastructure he needed. He also needed to pursue independent sales and distribution channels with customers given the nature of his products, but he explains that he enjoys this kind of challenge.

Similar to Anders, Bosse started growing old-breed grain varieties following conversion, and as a result of his experience with other modern organic-approved varieties. He tells me that the old-breed varieties function very well in the organic system and that the difference with other organic-approved crops is like "night and day". As we walk around on his farm, he shows me the small mill he built in his barn to be able to independently process the grain he grows into flour. He is also part of a cooperative of organic growers for the region who sell different flours from organically grown old-breed varieties. Further details of Bosse's experience with old-breed varieties are provided at Appendix 8.8 (Reflections 4-5).

Anders explains to me how he makes decisions in relation to his growing system and the crops that he grows, and that he has tried to do things that he feels are right. After time has passed, his feelings are often confirmed by other farmers, or sometimes in research. He recounts a number of experiences where other farmers have questioned his approach or told him it definitely won't work, including in relation to farming organically and the old-breed varieties. He stresses to me that his approach is what works for him, in his context. He tells me he's not aiming for maximum harvests, but to keep them stable or perhaps increase slightly. His central focus nowadays is building up the soil with the help of the growing system he has developed involving the old-breed varieties and then harvesting what nature can produce on this basis. This focus over time has led him to continue looking for new ways and methods for improving soil health on the farm, as well as new experimentation with regenerative methods and participation in projects such as Svensk Kolinlagring.[12]

[12] See Glossary.

Other farmers also reflect on how they have learned to pay attention to new aspects and relations in their farming system since converting to organic, leading them to make new connections and change or develop their practices. Bosse describes how his view of 'waste' on the farm has changed as he has developed composting practices.[13] Further, Patrik expresses how he learnt to observe the growth of his crops differently:

> *"I believe that the biggest challenge [with converting to organic] concerns how you see what is 'good'. An example, if you intercrop a ley crop in together with a spring grain, it can look disappointing if the spring grain is not so thick and lush. However, in the bigger picture one will receive a good, intercropped ley crop. And if one receives a good spring grain crop, then you'll get a worse intercropped ley crop. So, it requires that one sees what they do as part of a bigger picture, that which one loses on one side, is what one wins on the other side. It concerns what one thinks looks good when they look at a field, I have learnt myself that this is something one can change depending on how much knowledge one has."*

***

What can we learn from Anders and the other farmers' experiences in the context of conversion?

In line with Goulet and Vinck (2012), and as introduced above, conversion to organic can be conceptualised as an innovation structured around the withdrawal of certain practices and artefacts associated with industrial forms of farming. However, rather than simply involving the removal of certain practices, such as the use of synthetic inputs, the tangible restrictions associated with farming organically can lead farmers to experiment with system redesign through observing and learning to pay attention to new aspects and relations in their farming systems (Lamine and Bellon, 2009). Goulet and Vinck's (2012) research on 'innovation through withdrawal', which Brédart and Stassart (2017) draw on in relation to their theory of action, highlights that this innovation process is constituted by different mechanisms, including 1) rendering entities and associations (i.e. relations) visible or invisible, and 2) bringing together or associating new entities.[14] Anders' ability and willingness to pay attention to the condition and health of the soil both in the lead up and since conversion has continually shaped the practices he has developed on the farm, leading him to present-day exploration of soil health through further experimentation and involvement in projects linked to regenerative agriculture. Anders' relationship with soil is continuously unfolding in a patchwork of experiences, which he attributes, amongst other things, to the fact that he farms organically (see Figure 6).

[13] See Appendix 8.8, Reflection 6.
[14] I included coding for these aspects in relation to the conceptual framework. See Appendix 8.6 for details on the coding system.

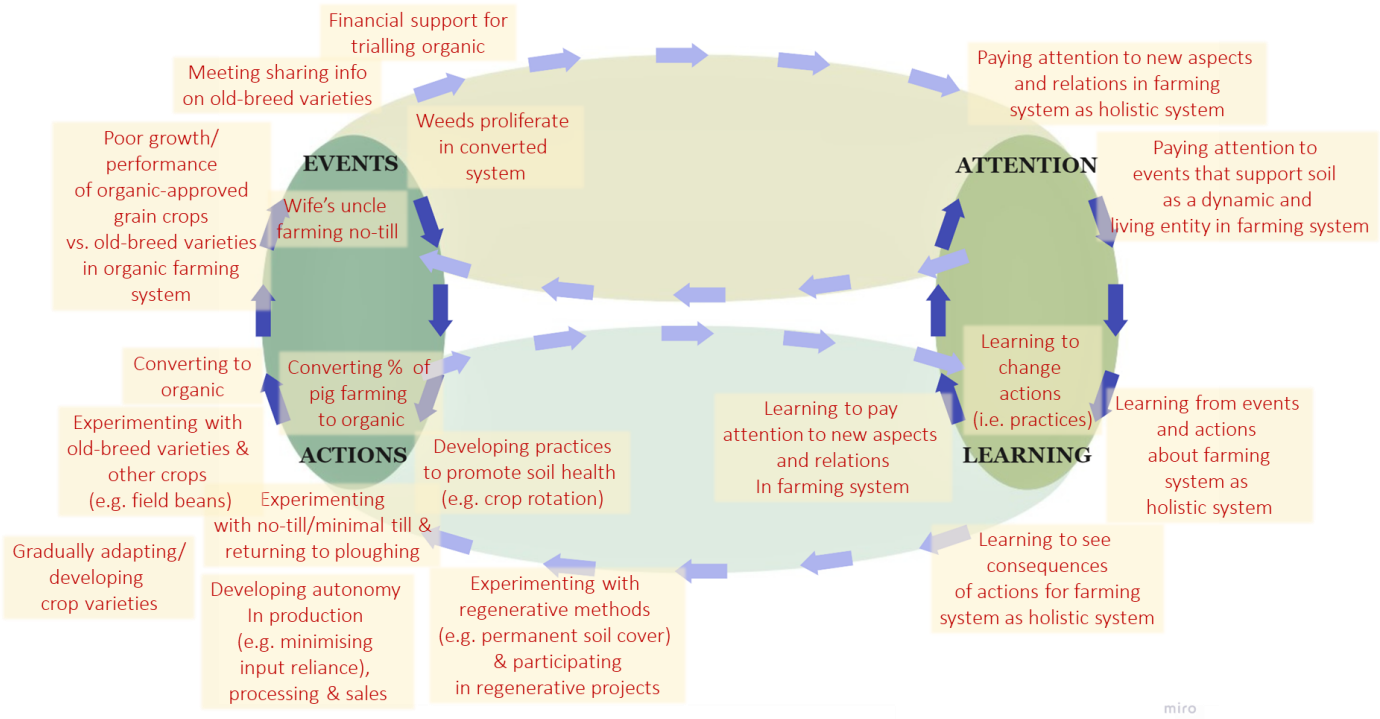

Figure 6: visual representation of interactions between a patchwork of different events and actions, leading to shifts in attention and learning, in the ongoing experience of Anders' conversion to organic farming. Interactions between different events, actions, attention and learning overlap with each other over time, with events having a trigger-like character where they destabilise a course of action/practice. This representation is not exhaustive and highlights a selection of important actions and events relevant to Anders' conversion experience captured during fieldwork.

Despite the opportunity for experience that organic conversion can provide to change courses of action (i.e. practices), the absence of appropriate resources, such as crop varieties with good agronomic performance in the organic system, can effect the capacity of farmers to stabilise practices that can optimise the organic farming system (Röös et al., 2018; Lammerts van Bueren et al., 2011). Brédart and Stassart (2017:6) describe this in terms of a "deprivation of current experience" with implications for later experience. From my interviews with the organic farmers, it was clear that their ability to develop and persist with certain organic practices is dependent on their ability to access and work with important resources, such as seed, capital to build infrastructure, or machinery. Access to appropriate resources within the system of certification (recalling Figure 2) can therefore impact if and how certain organic farming practices are stabilised over time or not.

5.2 Experiences with organic practices and soil health

The farmers' understandings of what it means to farm organically are dynamic and evolve through an ongoing dialogue between their own subjective interpretations, their practices and the practices of others, as well as the farm ecosystem and broader socio-cultural context. Over time, certain problematic experiences with organic farming and certification lead the farmers interviewed to question the meaning and direction of their practices. The farmers seek ways to reconnect with

experience (i.e. find new courses of action) by, for example, exploring new methods for improving soil health. The narrative below explores shifting farmer perceptions and interpretations as they develop organic practices and practices to improve soil health over time.

Narrative 2 – farmers in dialogue with their practices

Bosse started working part-time as a farmer in 1988 and soon after became a full-time farmer in 1989. He farmed as a conventional farmer for five years before converting to organic in 1994. More recently, in 2016, he certified as a biodynamic grower. In the late 1980's, when he first started farming, he didn't see organic as an alternative; there wasn't any monetary value to be gained by becoming organic and it seemed like it was only for "idealists". However, in line with Sweden joining the EU, financial support became available for farmers converting to organic growing and Bosse decided to convert just prior to Sweden becoming an EU member. Similar to Anders, he tells me he never really liked using agrochemicals, but it was primarily the money that convinced him to convert. He describes how his view of farming has changed the longer he has grown organically. Even nowadays, when he thinks that the gains to be made for being certified organic are minimal in terms of added value, he wouldn't stop being certified. He says he isn't a fanatic or idealist, but that his idealism has increased, and his idea of the farm functioning as a holistic and self-sustaining system, in his words as a "self-playing piano", has only grown over time. However, he also doesn't see that organic certification or growing organically mean the same thing these days, and that it's now something owned and created by industry rather than farmers.

Similar to Bosse, other farmers' understandings of what it means to farm organically are dynamic and evolve over time. In Appendix 8.8 (Reflections 7-12), I include reflections from farmers on their understanding of organic farming. A dominant theme from the farmers' reflections is their interpretation of organic farming as a holistic farming system. However, despite the farmers' intentions to manage their farming systems as such, many recall experiences where the organic practices they develop do not always enable them take action to remedy problematic situations, including in relation to soil health. For example, Patrik expresses that in 20 years of farming organically, he hasn't seen that things have improved in relation to soil health. Things haven't become worse, but they also haven't improved. He has also experienced problems with his organic crops, such as low gluten quality in wheat crops and insect problems in field beans. He sought advice from a Danish advisor who explained to him that the issues with his crops were connected to the health of the soil. Patrik thought the advisor's theories sounded interesting, and a potential solution to the problems he was experiencing.

Bosse feels that there has been a pre-occupation with organic farmers "*hunting the highest organic harvest*" via an overreliance on buying in organic inputs and fertilisers. He reflects that for a period of ten or so years, he also bought in a lot of organic-approved inputs. However, when he looks back now, he recalls how the weeds (thistle and couch grass) continued to increase as symptoms of an unbalanced system. He suspects that it was because there was too much nitrogen in his system, and as a result problematic symptoms revealed themselves over and over again. He also thinks that he had too much nitrogen with the clover-rich ley crops in his crop rotation in his context, something that organic farmers rely on in their system to biologically fixate nitrogen in the soil. Even this caused thistles to increase, making it hard to handle the weeds. Nowadays he focusses on growing the old-

breed grain varieties, and on growing a diversity of species in the ley crops, including chicory, ribwort plantain and others.

During my interview with Anna, she reflects on her experiences with organic farmers who attempt to intensify organic production by, for example, decreasing the portion of ley crops in their system:

> *"As I have worked in an area with many animal farms, it has rarely been a problem to source plant nutrients or have ley crop production. There has always been an excess of manure production and comprehensive ley crops. However, if one comes to areas with fewer animal farms, there I have seen cases where farmers have grown vegetables on the same field year after year. The farm's ley crop production is on another field, however for the purpose of auditing the farmer reports that they have still had 20% ley crops in their crop rotation. The certifying bodies have become more observant of this and have started to implement more requirements in relation to proper crop rotation. Farmers quite quickly notice [the need for proper crop rotation] themselves in any case. The better the soil health and crop rotation is, the less problems you will have. When problems with weeds or plant disease become too big, one is forced to have ley crops. Nature quite simple strikes back if managed badly."*

Anna reiterates that driving the organic system too intensively doesn't work in the long run, that it can work for 10 or so years but then there will problems with weeds and poor soil structure, and the worms will disappear. She also highlights that removing practices that are important to the overall functioning of the organic system and instead buying in organic fertilisers is too expensive to be sustainable long-term. Other farmers I interview are also critical of the large range of organic-approved inputs available nowadays, including more questionable inputs.[15] Patrik thinks this enables farmers to work reactively, rather than actively building up the health of the farming system through proactive practices, such as proper crop rotation and crop diversity. He and others, including Torsten and Johan, reiterate Bosse's reflection on the importance of species diversity for soil health, and describe how they are continually experimenting to incorporate a range of species into their cropping systems.

Bosse and the other farmers I interview are all experimenting with new soil management practices, including no or minimal till, avoiding open fallow, permanent soil cover, increasing crop diversity, green manures and intercropping, as well as using composts and biological ferments. Bosse explains in detail how he learnt about the connection between soil organic matter and the growth of his crops through challenging experiences, referring to an "*aha moment*" when he saw the importance of organic matter for crop growth during the drought of the 2018 season in Sweden. Other farmers also recount different experiences and their shifting relations with soil (see Appendix 8.9).[16]

Every farmer describes their involvement in collective action in exploring soil health, whether through projects such as Svensk Kolinlagring, companies such as Nordiska Råvara, courses for regenerative agriculture, interaction with advisors focusing on soil health and new soil health measurement methods such as Environmental Outcome Verification, or connection with regenerative

[15] An example of an input in organic agriculture that has been highlighted as problematic is vinasse (a liquid fertiliser made from crop residues in conventional production e.g. sugar beet), Milestad et al. (2020).
[16] See also Johan's experience at Appendix 8.8, Reflection 13.

farming networks online and through social media.[17] Concepts such as regenerative agriculture are currently providing farmers with diffuse and loosely defined principles to act upon in contrast with the now formalised and codified practice of organic agriculture.[18] These evolving concepts and their associated principles and practices are important for farmers due to their ability to inspire new reflections, actions, and learning. For example, as I am out walking along the fields with Malin, she reflects on how rotational grazing with the cows[19] challenges her idea that her fields should always look lush and neat, as experimentation with the new practice has led to new patterns and diversity of growth in the field. Patrik also reflects on the way different farming practices challenge his idea of how things should be in the farming system. He reflects on how he has maintained a conventional outlook despite extensive experience growing as an organic farmer:

> *"…the majority of those that are organic, including myself, we are conventional in our outlook, we want to have monocultures … the difference between being conventional and organic, that's a big step, but the difference between being organic and regenerative, that is probably as big a step if not bigger because one must stop thinking about growing monocultures."*

Lars, a farmer who was involved with the development of organic certification in Sweden and internationally, reflects on the similarities of the organic movement in Sweden in the 1980's before it went through a process of institutionalisation, and the regenerative movement today. He expresses his wish that organic agriculture could be more of a "process" than something requiring assessment against strict standards. I ask him what would be required for organic to be more of a process and he explains:

> *"What I mean with a 'process' is that one emphasises more relations and learning than assessment and quantification, which is not that interesting. Or a few fun things such as in relation to soil health, those tea bags or underwear that one digs down [into the soil].*[20] *It is processes in any case that invite reflection and learning…and digging [in the soil], seems to have been forgotten. Shovel diagnosis."*

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What can we learn from Bosse's and the other farmers' experiences with their practices?

Organic farming as a farm management system grounded in both principles and codified practices concerning long-term soil fertility, quality and condition, has the potential to render soil visible as a dynamic and living organism in the farming system. Despite the potential value of converting to organic and farming organically to shift farmer attention and render new or different aspects of the farming system visible (and therefore relations with these aspects possible), the experiences of Bosse and other farmers in narrative 2 also illustrate that inherent tensions exist within these processes.

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[17] See Glossary.

[18] See examples of how farmers reflect on regenerative agriculture in relation to organic agriculture at Appendix 8.8, Reflections 14-16. Reflections 17-18 from Torsten also illustrate his experience with collective action, learning and experimentation in relation to regenerative agriculture.

[19] See Glossary.

[20] Digging tea bags or underwear into the soil to see how long it takes for them to break down has been developed as a method for assessing biological activity and life in the soil.

Patrik, for example, reflects on the fact that he has maintained a conventional outlook on his farm, and has continued to prioritise growing monocultures. He is now looking to regenerative agriculture as a way to improve soil health, including by withdrawing monocultures as a practice. He reflects that regenerative farming shifts his attention to methods for increasing diversity in his production. Similarly, Bosse's reflections on his early practices in the organic system and heavy reliance on inputs to manage nutrient demand illustrate the continuation of practices stabilised by the norms of conventional modes of farming. Brédart and Stassart (2017:10) refer to this as farmers essentially "cut[ting] themselves off from experience" by continuing to rely on conventional frames of reference. In relation to the conceptual framework at Figure 5, we can see this as a weakening or even breakdown of the feedback mechanisms between events, action, attention and learning.

Puig de la Bellacasa's (2014) essay on the process of soil, as a relational entity, becoming visible as a 'living world' in an era dominated by the technical management of the environment, treats the passing of 'soil-as-living' into visibility as an event in its own right. This is reminiscent of Brédart and Stassart (2017) focus on 'events' in their theory of action. According to them, events only become events when people learn to pay attention to them. From my interviews with farmers (and as recounted at Appendix 8.8), the visibility of soil and farmers relations with it are continually shifting due to a range of different events and experiences. It is clear that paying attention to soil management and health is a way for the farmers I visited to act in relation to new and emerging situations, such as challenging experiences related to farming and producing food in a changing climate. The farmers, including Anders and Bosse, reflect on the inspiration they gain from their focus on soil health and through their involvement in movements such as regenerative agriculture. Collective action, inspired by such movements, is important for farmers in shifting their attention and inspiring them to learn to take new courses of action to address problematic situations (Hassanein and Kloppenburg, 1995). Collective action is therefore an important factor in changing practices stabilised by dominant norms and values in the industry.

5.3 Organic certification and experience

By submitting to the certification system, farmers elect to pay attention, give meaning, and respond to events that being certified gives rise to. Events, such as on-farm certification audits, can be conceptualised as events interrupting the course of action, by creating a break in a scenario, giving rise to deliberation and potentially destabilising or changing practice. The narrative below explores in more detail the farmers' experiences in the certification system in Sweden in more recent years.

Narrative 3 – adapting practice to meet organic certification rules

I ask farmers about the role of certification and audits in upholding principles regarding soil health in practice. While many see that the principles are served through codified practices that support soil health, such as crop rotation and the use of green manures, they also express that it seems difficult, if

not counterproductive, for a farmer's commitment to organic principles in relation to soil to be assessed against certification rules and through mechanisms such as auditing processes. When I ask Patrik how the organic certification rules influence his methods for improving soil health, he answers that he doesn't think they do and expresses that while KRAV or EU Organic have an intention that soil health will improve through codified practices such as crop rotation, or using organic fertilisers, in reality it is still possible to damage soil health through a range of practices, including ploughing, letting fields lie open fallow, or not having sufficient crop diversity.

Patrik's comments highlight the fact that, while principles and practices to support soil health are contained in organic certification rules, they don't necessarily carry through to the farm. This can be linked in part to the fact that certification is focussed on farmers using specific practices in production, and not necessarily the outcome of these practices. Anders also highlights this fact when he reflects on the difference between farmers developing organic practices to serve an important function in their farming system, or simply to fulfill the requirements of the certification rules.[21] Anders provides the example of using ley crops in crop rotation, which he sees as an important practice for the long-term functioning of his farm because they assist with weed management, as well as resting and replenishing the soil. He notes:

> *"People see this here with ley crops as a requirement on them, that they must have a certain percentage of ley crops while I see that regardless of the rules I would have ley crops in any case, because they mean so much more in the whole growing system…"*[22]

Several farmers also express that auditing nowadays predominantly feels like a process involving auditing their ability to produce documents, rather than farm. Farmers are wary of additional organic rules being created in relation to soil health given that they already have difficulty covering the plethora of codified requirements, with one farmer expressing that they no longer read the certification rule book due to its complexity. Farmers such as Torsten also expect that introducing additional rules in relation to soil health could cause farmers to end their certification, however he also sees how raising standards in this way may be necessary for the future of organic.[23] Lina, who works for a certification body in Sweden, mirrors the reflections of farmers when she describes her experiences conducting certification audits. In the early days of certification, she was out much more in the fields assessing crops. She also had more of an advisory and education role in the past and feels that this was of more value to the farmers. Nowadays she feels that she checks farmers' documentation much more than the farm.

Despite the above concerns with certification, farmers also express that being certified organic doesn't necessarily limit their experimentation with new soil management methods, and that limitations in the regulations can also inspire experimentation and innovation. Johan, for example, expresses that despite his extensive concerns with the way KRAV and EU Organic have developed over time, he does feel that being certified makes him a better farmer, stating:

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[21] Recall also Anna's reflections in narrative 2.

[22] Ley crops (vall) are not a strict requirement of the current EU Organic regulations, however a farmer must have a varied crop rotation with legumes. KRAV rules require that farmers grow ley crops or green manures (including legumes).

[23] See a more detailed version of Torsten's reflection at Appendix 8.8, Reflection 19.

"When you grow you always make heaps of compromises because reality intervenes, you don't always do what you intended to do … the certification means that there is no part [of farming] that we are not engaged with, where we just kind of let it be. We have to comply with the regulations there as well."

Torsten also reflects:

"It's clear that being certified has taught me certain things, I have learned how to think more in relation to nutrient balances and also about eutrophication and ley crops and many other things in order to adapt to the rules. It is clear that it has taught me even about these kinds of things that one perhaps hasn't thought so much about."

Further, while Patrik expresses that he sees organic certification as simply a part of running his business, his company website also outlines the way practices on the farm have changed as a result of the auditing process:

"Since 2015, we have changed the way we see our sheep. We acquired sheep in 2006 for the purpose of grazing a few pastures around the farm. They grazed well but after a few years, pasture parasites came like a letter in the post. The KRAV auditor didn't think that giving de-worming two to three times was the correct way to manage the animals. This objection seemed tough, for how were we to have the sheep without using de-worming treatment? In 2015, we moved the sheep out to our fields, and they are now integrated into our crop production. This means that they only graze on new pastures without parasites and help to minimise weeds and stimulate the plants to produce higher harvests."

Representatives from SBA who are involved with administering the EU Organic rules in the Swedish context express to me that new organic rules, such as the rule that all seed used in organic farming must be certified organic by 2036, provide opportunities to change practices in the organic industry.[24] One representative from SBA describes how it has, for example, been very difficult to establish a market for organic seed potato in Sweden in the past. With new requirements for farmers to use a percentage of organic seed potato and increase this percentage gradually over time,[25] the new rules can facilitate the development of new practices and a new market for organic seed. Johan also highlights that the new rules around organic seed have led to their involvement in a new publicly funded project focusing on the on-farm production of organic seed in Sweden.

Another amendment to the rules that I discuss in interviews with the farmers concerns the inclusion of additional requirements for growing green manures and a more diverse range of crops in organic greenhouses. The amendments seek to lessen the intensity and improve soil management in greenhouse production. I discuss the changes with Johan, who sees the value in the new rules in attempting to address intensification trends in organic agricultural practices. He describes their on-farm experiments with crop diversity and green manures in the greenhouse and tunnel areas in light of the new requirements, and how they have been adjusting their practices. I ask Johan whether the certification rules influence the way in which he experiments and he answers:

"Yes.. to some extent maybe it does, like the new amendments this year regarding crop rotation in tunnels or greenhouses. For example, it causes us to have green manures [in

[24] The relevant amendments described further at Appendix 8.3.

[25] To date, it has been permitted to use conventional seed potato due to the absence of organic seed potato.

the tunnels/greenhouse] as well. The rules cause us to think about it. We probably would have already met the requirements in the regulations that applied in any case. We already had crop rotation in the greenhouse and so on. So we would probably have met the rules if that's all that was required. However, it's still sort of an indication in which direction [we should go], and so we try to do it as well as possible, and preferably a little more. But in that way, it's a signal from the outside that we're going in a certain direction, that we should try to work in that direction. And then we have the collaboration with Hushållningssällskapet. For this, we test undersown cover crops in our vegetable crops, among other things. The fact that they [Hushållningssällskapet] are interested is also because the certification is paying attention to it."

However, Johan also wonders whether these measures are in fact the solution to broader trends of intensification in organic agriculture, or whether introducing a small amount of green manures in the crop rotation in the tunnel/greenhouse areas is more symbolic than actually addressing this problem.[26]

Representatives from SBA note the hesitation of farmers to experiment with their greenhouse production to meet the amended rules given this is an area of both high production and costs, and therefore also high risk. They also tell me that farmers nowadays want advisors to outline for them, for example, exactly how they can meet new requirements, and note how farmers are much less inclined to experiment where they risk losing financial payments they receive as organic farmers. They express their concerns with the new requirements, because they are intended to cover all EU countries with extremely varied growing conditions and don't necessarily suit the Swedish context. SBA representatives see one of their main roles nowadays as simplifying a hugely detailed and complex system for farmers to navigate in practice. They highlight how the detailed and complex rules also cause different organic principles to clash, which leaves farmers to decide between conflicting values and interests.[27]

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What can we learn from the farmers' experiences in the context of certification*?*

The above reflections from farmers regarding their experiences with certification illustrate one of the core tensions for organic production going forward. On the one hand, the legitimacy of the organic certification is dependent on farmer compliance with regulations, secured through mechanisms such as third-party certification audits. On the other hand, the value of organic agriculture is also grounded in its ongoing presence as an alternative and innovative system of farming (Rahmann et al., 2017). Organic agriculture has historically been described in research as somewhat of a 'double phenomenon', existing both as a set of unambiguous codified requirements, and a "workshop of ideas for the development of new knowledge and perspectives" (Seppännen and Helenius, 2004 translating and citing Østergaard, 1998:54). It is a system maintaining its integrity, value and relevance not only through compliance, but also through innovation and research (Rahmann et al., 2017). It is possible to see from the farmers' reflections the tensions that can arise between meeting the plethora of highly

[26] See also Kerstin's experience with the new greenhouse rules at Appendix 8.8, Reflection 20.

detailed rules and maintaining an innovative and experimental outlook. It is also possible to see the difference between the dynamics of the farmers' experiences in the organic system in the 1990's, and nowadays as they navigate a heavily codified system.

Despite these concerns, the farmers' interactions with the certification system are also additional opportunities for experience. The experiences of Patrik, Torsten and Johan in navigating the rules and certification audit processes play a part in shifting their attention to different aspects and relations in the farming system, with the potential to change and stabilise new practices. Nonetheless, the plethora of certification rules and their detailed, and at times conflicting, nature can also cause farmers to be cut off from experience and excluded from processes of reflection and learning, which as Lars describes above in narrative 2, are integral to the ongoing development of farming practice. The tensions between compliance and innovation are important to consider for future iterations of organic, such as Organic 3.0 (Milestad et al., 2020; Arbenz et al., 2016).

6 Conclusions

In the following section, I relate the above results and discussion points to relevant research concerning dynamics of change in relation to agricultural practices, as well as broader food system transformation. I also include reflections on using an interpretive approach and employing a practice perspective guided by the conceptual framework at Figure 5, and point to areas of interest for future research.[28]

6.1 Epistemic barriers and distance in farming systems

As illustrated by the famers' experiences, organic farming practices are constantly in a dynamic tension with other more conventional and industrialised farming practices that tend to prioritise short-term economic rationalities, such as uniformity and high production (Carolan, 2006). These short-term rationalities can enhance productivity and performance yet ignore processes of long-term harm that are harder to perceive, such as deterioration of soil health and condition. Carolan (2006) discusses this dynamic in terms of 'epistemic barriers' and 'epistemic distance'. What Carolan (2006) seeks to describe with these concepts is the aspects of farming systems that are not readily revealed by direct perception, in contrast to those that are. In their paper, Carolan (2006) specifically refers to the relative invisibility of ecological qualities associated with sustainable forms of agriculture, such as improved soil condition and higher levels of soil microbial activity. On the other hand, immediate benefits of conventional farming methods, such as increased yields, weed-free fields and pest-free crops, are readily visible to farmers. Yet costs associated with these methods, such as long-term detrimental

[27] See also Lars' reflections on EU organic rules at Appendix 8.8, Reflection 21.

processes for soils, are relatively invisible and externalised. In other research, Sundqvist and Milestad (2005) explore epistemic distance and barriers in terms of the masking or disregarding of detrimental ecological feedback loops in farming systems. Sundqvist and Milestad (2005) also point out that environmental labelling, such as organic, can provide a mechanism for rendering visible the connections between forms of agricultural production and their ecological impacts.

We can see from the farmers' reflections how visible benefits (or costs) are central to the formation of farmer identity and influence what it means to be a good farmer. Sutherland and Darnhofer (2012), in exploring how farmer perceptions change through the process of organic conversion for farmers in England, illustrate how the conversion process can influence ideals and norms associated with 'good' farming and in turn change farmers' practices. In their study, drawing on practice theory and Bourdieu's concepts of habitus, Sutherland and Darnhofer (2012) also illustrate how change processes take place in the cultural domain by changing the 'rules of the game'. Conversion to organic therefore leads to opportunities for farmers to move away from conventional symbols of good farming (e.g. higher crop yields, and neat, lush and weed-free fields). This reminds us of, for example, Patrik and Malin's reflections on the way changing and experimenting with their practices influenced the way they see farming, the farm, and themselves as farmers.

The above research illustrates the complex and intertwined dynamics of change in social-ecological systems, and how meaning, including cultural and symbolic meaning, shapes aspects of farmer identity and in turn can have tangible impacts on the functioning of agroecosystems. The contribution of the current study to the above research, is the application of an interpretive approach that examines aspects of hermeneutic and dialogical meaning. In particular, the current study explores how farmers acquire knowledge of their farming system through practice, and develop and change their interpretation of and approach to organic farming in dialogue with their practices and biophysical aspects of their farming systems, including soil. Using this perspective, biophysical aspects are rendered visible and attributed with agency and capacities; directly interacting with, and either enabling or restricting farmers' practices. This study therefore contributes to "efforts in the environmental and sustainability sciences to develop relational understandings of people and nature" (West et al., 2019:402). It also aligns with other emerging areas of research regarding the 'good farmer' concept that draw on both Bourdieu's practice theory and assemblage theory (based on a relational ontology) in seeking to highlight the role of 'more-than-human actants' in the construction of farming identity (Sutherland and Calo, 2020).

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[28] Further reflections are included in Appendix 8.1.

6.1.1 Epistemic barriers and distance created through practice

Carolan (2006) also highlights that epistemic distance can be created in practice, recognising that socio-material or social-organisational arrangements (e.g. the arrangements of the certification system) shape how farmers know what they know, and see what they see. A practice approach looks at the influence of these arrangements through the "entwinement of agency and structure in practice" (Behagel et al., 2019:482). The challenges concerning stabilisation of organic practices illustrate how barriers to changing farming practice are not only related to the subjective perceptions of farmers, but go beyond the phenomenological to aspects of socio-material/socio-organisational relations (Carolan 2006). This also applies for the policies and rules framing certified organic farming and how farmers interact with them in practice. Certified organic farmers are embedded in social-ecological systems, which shape and inform practice and how practice changes over time. Lamine and Bellon (2009) highlight that research on organic agriculture, in particular, organic conversion, has underestimated the role of actors such as organic advisors and certification auditors. The limited research I located on the role of organic audit practices in upholding organic values highlights the potential (yet underappreciated) role of audits in continuing the evolution of organic farming based ón principles of system redesign (Seppännen and Helenius, 2004). Results in the current study, including reflections from both farmers and Lina (auditor), indicate the potential value in exploring this aspect further in Sweden and Europe more broadly.

Carolan's (2006) paper is powerful in its exploration of epistemic distance from socio-biophysical (or social-ecological) objects, effects and relationships in practice. It reminds us that individuals practicing farming are doing so in systems that are persistently shaped by hegemonic values and institutions, which dictate what is important (read visible) in that system. What different actors and stakeholders choose to value and place focus on in agroecological systems, is therefore a political act. Ongoing tension exists between which social-ecological objects, effects and relationships are visible and invisible in farming systems. Tensions also arises as farmers navigate values and principles associated with farming organically, and the economic realities of running a farm (Darnhofer et al., 2010). However, rather than seeing these tensions as problematic, it is in fact in highlighting these tensions that opportunities for innovation and transformative change in relation to farming practice may arise. This research illustrates how organic farming and certification can provide mechanisms for drawing out and grappling with these tensions in practice.

6.2 Cultivating transformations

The conceptual framework I developed for this thesis enabled me to access and consider the underlying mechanisms at play in the dialogue between farmers and their practices. These mechanisms illustrate the importance of practical action in relation to individual and collective sense-making, and how change is a series of complex, non-linear and unpredictable processes involving farmers learning

from a myriad of different experiences as they solve problems and adapt. From this perspective, the nature and direction of change, including transformative change, is something that is gradually cultivated through practice. Therefore, if organic farming and certification are going to have value in terms of changing and potentially transforming agricultural practices, then these concepts and systems must continue to give rise to meaningful experiences. In other words, they must continue to support opportunities for experience in which farmers can continue to develop and adapt their practices.

These findings provide insights in relation to Scoones et al.'s (2020) emancipatory and enabling perspectives on transformation covered in the introduction to this thesis. To remind ourselves, an enabling perspective on transformation focusses on agency and practice, and in particular, the capacity of people to change how they act and how this can potentially generate transformative change. Using this perspective allows us to pay attention to *how*, as well as *where,* transformation takes place in a system, including an appreciation of how change is in fact experienced by people within systems. Duncan et al. (2018:3) describe this as the acknowledgement that transformation is "experienced" rather than simply "delivered", and point to the importance of studying practice-based encounters to uncover the "unseen internal and experiential dimensions of transformation". As Scoones et al. (2020) point out, it involves paying attention to heterogenous values, forms of agency, processes and capacities that underly potentially transformative change, rather than simply focussing on uniform or normatively 'good' outcomes.

This study, through an interpretive approach, a focus on practice and the use of ethnographic methods to collect and analyse data on farmer sense-making and experience, has explored an enabling perspective on transformation. A potential criticism of this perspective is that it contains a bias towards privileging local perspectives and lacks sufficient attention on how agents at this scale can bring about needed structural or systemic change (Scoones et al., 2020). Therefore, it is important to reiterate the potential complementarity of enabling, systemic and structural perspectives on transformation. Considering these perspectives in conjunction with each other in the current context can inspire us to ask new types of questions. For example: *which systemic or structural perspectives on transformation can ensure that the capacities of soil, as a living and dynamic entity, are visible in the future food system? Further, which of these perspectives can support organic farmers' relations with soil as living and dynamic in practice?* Asking these questions reveals new possibilities for cultivating transformative pathways towards desired futures in the food system, starting importantly, with the soil and its health.

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8 Appendices

8.1 Reflections on study

8.1.1 Epistemology and ontology

Before farming, I had a short career as a lawyer. When both studying and working with law, I was interested in the implications and outcomes of rules, regulations and policies in practice. In particular, I paid attention to the unintended consequences that these tools often gave rise to when implemented in different contexts. While studying at the SRC, I saw how these unintended consequences emerge from the complex and intertwined dynamics of social-ecological systems. I therefore became interested in finding new ways to study policy that acknowledge this fact. This was one of my main motivations behind taking an interpretive approach (inspired by interpretive policy analysis) and also relying on a relational ontology. I sought to study concepts, rules and policies as emergent features of SES, rather than something simply applied to them. I found the relational ontological approach fundamental in shifting my view of organic agriculture and certification, and recognising their existence as continually evolving collections of relations, interactions and processes.

An interpretive approach is grounded in the idea that the researcher, usually a part of the social phenomena under study, develops a practical and cognitive sense of the research puzzle they would like to study through experience (Wagenaar, 2011). I saw a puzzle in my own practice as an organic grower, which related to many concerns academics are currently exploring in the field of sustainability science, and decided to explore this further. I therefore didn't start with a specific theory, method, or area of sustainability science research in mind, and this presented a number of practical, methodological and theoretical challenges along the way, which seemed to unravel in parallel with each other as I moved through the different stages of research. This forced me to be critical and reflexive about the direction of the research and the data I collected, as well as what the data enabled me to say, both in relation to organic agriculture and certification, and in the broader context of transformation. Overall, I felt this study could primarily contribute a different perspective on organic farming, organic certification and change processes, and inspire new types of questions about social-ecological transformation and what it entails.

Taking an interpretive approach focussing on meaning and interpretation, and using a practice perspective grounded in a relational ontology, are all methods for engaging with the dynamics of complexity and emergence in SES (West et al., 2020; 2016). Using a relational philosophical approach is challenging. I found I often fell back into a substance ontology due to the fact that I am familiar with thinking about and using language to describe interactions between different entities, rather than in terms of the relations and processes that constitute them. On reflection, I could have incorporated a stronger focus on relational aspects during data collection and interviews, however, at the start of my thesis I focussed more on meaning and practice, and on learning how to take an interpretive approach to the study.

I was also challenged by my approach during data analysis. I made a number of iterative attempts at analysing and drafting the results for this study in order to understand which format was the most effective and appropriate for both 1) understanding the data, and 2) communicating the findings of the study. The challenge primarily revolved around finding a way to communicate the complexity and detail of the data that was accessible for the reader. To resolve this, writing and iterative drafting became an important tool for my own sense making.

8.1.2 Practising research and researching practice

As an organic farmer, I obviously see organic farming as a farm management system with value and as something that is normatively 'good'. This point of view therefore had the potential to influence my approach to the research. However, I also felt that given my practical experience with organic farming and certification, I also had a detailed understanding of the weaknesses and challenges associated with certified organic farming and certification in practice and was able to be critical and reflexive about these aspects. It was important to maintain reflexivity throughout the study and remind myself that I see organic agriculture in a particular way because of the experiences I have had with this farming system. Rather than feeling the need to step back, or remove myself from the study context, I felt that my position enabled useful reflections. The guidance on interpretive research design from Schwartz-Shea& Yanow (2011) was very useful. The method of accidental ethnography, involving systematic reflections on my own experiences in practice, was also valuable as it provided me with the opportunity to reflect on the perspectives and experiences of farmers and my own experiences in relation to the broader intersubjective context. Two examples of these reflections are included below:

- *Two weeks after my visit to Anders I travel to a conference on the future of research for organic farming. There, a project team presents a recent project that received funding in 2018 to explore the performance of old-breed varieties in organic growing systems in Sweden.*[29] *The project is transdisciplinary and includes researchers specialising in food and meal science, as well industry actors, such as a baker. I think of farmers such as Anders and Bosse and how valuable their years of practice and related knowledge regarding the old-breed varieties are. I also see the announcement for an industry conference on old-breed varieties in spring 2023 with a focus on "diversity for the landscape, soil and human health". I hadn't expected the selection of varieties and availability of seed to be such a strong theme in my research, however, following fieldwork, attendance at the conference and further research, I see how important this aspect is to the optimal functioning of organic farming systems.*
- *During the certification audit on our own farm, I ask the auditor what the requirements for crop rotation and green manures in greenhouse production will be going forward. It seems like the certification bodies are taking it pretty slowly, treading carefully given farmers' concerns with the new requirements. When I talk to the representative of SBA, they express their concern with the new requirements, and the fact that they don't suit Swedish growing conditions. Still, I see other farming colleagues slowly starting to integrate early spring and late autumn crops in their greenhouses, experimenting with what might be possible in the Swedish context. In our greenhouse, we do the same. From the results, I can see it is going to take a while to develop this new practice. I notice how tension and resistance are necessary elements in processes of innovation and am interested in exploring this further in future.*

Finally, as I was preparing the thesis for submission, I briefly reflected with my supervisor, Jamila, about working in and doing research about farming. She shared some of her own experiences and also noted the appearance of her work desk during her own research process. I laughed to myself, looking down at my own desk, which was littered with equal parts research papers and seed packets. Spring 2023 had been a challenging collision of sowing, digging, writing, thinking, watering, planning, changing plans, saving plants and constantly improvising. Somewhere out of this collision came a better understanding of the unpredictable and often chaotic forces in practice that give rise to new

[29] The project is called "Old-breed cereals in the food of the future" and seeks to explore the role of old-breed varieties in organic production. See https://www.slu.se/centrumbildningar-och-projekt/centrum-for-biologisk-mangfald-cbm/forskning/forskningsprojekt/forskningsprojekt-vid-cbm/historiska-sadesslag/ for further information.

insights, change and innovation. I'm still trying to articulate for myself what it is exactly that is so valuable about being on the bridge between farming research and farming practice, but it is perhaps the way it forces you to put down intellectual thought every day, go outside, and directly interact with your senses and practical intuition to feel your way towards answers in complex and constantly shifting social-ecological situations. Being able to then articulate insights from these experiences in a clear and accessible way is the next challenge. It was perhaps the biggest challenge of writing this thesis and something I am eager to continue working on.

8.2 Critical reflections - methods and data sources

For the thesis, I relied on a range of methods for data collection, including interviews, farm walkabout and observations, as well as systematic reflections on my own involvement in the industry as an organic farmer through accidental ethnography. I have the following critical reflections about methods and data sources:

- There were a number of occasions during the study when my plans and intentions for the research design and data collection could not be executed due to different practical hurdles. I have outlined the differences between intended and actual research design in Table 4 below.

Plan for data collection	Reflections on what actually happened
Farm visits on farms, potentially over a number of days to allow for observations, 2nd visit in early 2023	Farmers weren't keen on multiple days/visits, agreed to single visit of approx. ½ day, observations limited by snow storms/weather
Attend up to 4 farms over multiple days	Attended 8 farms over ½ day. "Accidental ethnography" important
Conduct a "walkabout" interview before or after sit-down interview	Worked well and inspired new topics of conversation, allowed for limited observations
Use timeline as interview tool and mention to farmers	This was a very useful tool for guiding the interview discussion, I have a lot of data that travels over time.
Iterative data collection and analysis	Very useful, helped to improve my approach and frame questions for other actors
Agree to contact participants again at later date	Thankful for this arrangement in case I need to clarify meaning etc.

Table 4: comparison of plan for study design and actual outcomes.

- I was interested in accessing farmers' subjective experiences and sense-making in relation to organic farming and certification. I felt that conducting interviews and 'walkabout' tours with farmers in their home/farm environment could contribute to the validity of the data of farmers own experiences collected (Polkinghorne, 2007). I agreed with farmers to make follow up contact after farm visits and some farmers also made contact again after interviews. I also interacted informally with one or two participants through my work in the industry. Once I had selected direct citations for use in the thesis results, I checked these quotes with participants for their input and feedback. Finally, I felt that the fact that farmers were aware of my involvement in the organic sector in Sweden helped them to feel comfortable about sharing their experiences with organic practices and certification.
- I relied on farmer's own historical accounts of changes in their practices, through experiences such a conversion. Bellon and Lamine (2009:661) highlight the importance of keeping in mind "that time and experience change the interpretation one has of one's own trajectory". Polkinghorne (2007) also points out that felt meanings about an experience are always greater than a person can recount/reflect on. At times, I sensed that recollections of past events could be oversimplified or influenced by broader narratives regarding trends in organic and I therefore had to pay particular attention to this and ask for clarifications, or additional

explanations. For interpretive research, and in using ethnographic methods, I understand the value of being able to conduct longitudinal, in-depth studies in accounting for temporal and more complex aspects of interpretation and sense-making. I had originally modelled my study to revisit certain farms but quickly realised in the responses from farmers, who are extremely busy, that it would be more realistic to conduct shorter, single, visits to farms.

- Accessing hermeneutic and dialogical forms of meaning in interpretive research entails different methodological considerations (West, 2016). For example, participant observation is usually used in accessing dialogical meaning as it involves the interaction between practical action and knowledge/sense-making/interpretation (Wagenaar, 2011). I had therefore incorporated a number of methods into my research plan that would, for example, enable me to observe and record aspects of dialogical meaning (e.g. observing farmers and their practices on-farm). However, as outlined by the practical challenges in Table 4, this was not always possible due to the weather, season and farmer preferences. In response to this, I drew on methods such as accidental ethnography and reflected on my own experiences as an organic farmer to assist with my interpretation and analysis of data. I also discussed farming practices and methods with farming colleagues to ensure my technical/practical understanding of farmer practices was accurate.
- I speak Swedish as a second language and this obviously entailed a series of challenges, especially in a study so heavily focused on subjective perceptions and interpretations. I received support from Swedish speakers (including two of my supervisors) with review of interview questions or clarifications of meaning and translations, and this enabled me to feel more confident in the validity of my approach. Given more time to conduct the research (and if it was practically possible for the farmers to be more heavily involved), I would have preferred more continual forms of contact with study participants than I had. This could have also turned the study into more a knowledge co-production process.
- The exploratory nature of the study obviously had implications for the findings I could make in the study. Overall, my main focus was on illustrating how my research design and approach can enable us to ask different types of questions and access different perspectives in relation to social-ecological change and transformation.
- In relation to the presentation of the results in narrative format, I reflected on Polkinghorne's (2007) guidance on validity in relation to narrative research and the types of knowledge claims that could be made in the study. In line with Polkinghorne (2007), I felt that the narrative format allowed me to incorporate aspects of context, my own role and perspective as researcher-practitioner, as well as highlight the fact that the data collected and results were both artefacts of interviews and researcher-farmer interactions. Further, during analysis, I took an inductive approach and paid attention to farmer descriptions of meaning and action to ensure that I stayed close to and allowed myself to be guided by the data.

8.3 Developments in organic agriculture and certification

1) Evolution of organic agriculture in Europe

The origins of organic agriculture in Europe can be traced back to the 1940's when Lady Eve Balfours and Albert Howards (founders of the Soil Association in England), as well as Hans Müller, Maria Biegler, and Hans-Peter Rusch (founder of biological organic farming in Switzerland), articulated different ideologies related to agriculture that were grounded in the biological basis of soil fertility and its links to health (Rahmann et al., 2017; Markuszewska and Kubacka, 2017). The ideologies behind organic farming were also linked to Rudolf Steiner's concept of biodynamic farming initiated in the 1920's in Germany, which continues under the 'Demeter' certification today (Markuszewska and Kubacka, 2017). By the 1970's-1980's, organic agriculture and certification became the domain of different private and public standard setting organisations in European countries, before it was later harmonised into a common framework at the EU level in the 1990's to facilitate regional and international trade (Pekdemir, 2018). Nowadays, 'organic' is a legally protected and heavily regulated policy domain in the EU (Fouilleux and Loconto, 2017).

2) Organic agriculture and certification in Sweden - 1985 to present

The development of a formal sector for organic agriculture and certification in Sweden can be broken down into three time periods, namely 1) 1985-2000: the early days of organic certification in Sweden, when KRAV formed, and Sweden later joined the EU; 2) 2000-2015: the early 2000's and onwards as the system for certification evolved and expanded rapidly and farmers continued to develop their organic practices amid changing industry, social and environmental condition; and finally 3) 2015- present: the period involving the development of current system, including the introduction of new organic rules, which seek to draw organic farming back towards its principled roots. The table below covers developments under these periods that are relevant to the study, rather than all general developments for organic agriculture and certification in Sweden.

This information was collected through review of academic literature and national/EU policy documents, as well as interviews with relevant actors and stakeholders in the system.

PERIOD	
1) 1985-2000	
1985	The farmer representative body, the National Association of Alternative Farmers (now known as the organic farmer association 'Ekologiska Lantbrukarna'), is formed and establishes a body for organic standard setting and certification named KRAV (Kontrollföreningen för Alternativ Odling), in 1985. KRAV's first set of organic certification rules are created. The KRAV rules cover less than one A4 page (personal communication, Lina (auditor), 2023.01.09) (Kenne et al., 2013).

	In the early years of organic certification in Sweden, KRAV is responsible for both drafting the organic standards and conducting certification audits, without any form of involvement from the Swedish Government (Kenne et al., 2013). At this time, the organic movement is seen as a form of resistance to centralised regulation and state control of agriculture in Sweden (ibid).
1989-early 1990's	In 1989, financial conversion support for farmers willing to try farming organically is introduced. At this time, the number of certified farmers expands rapidly and KRAV needs to enlist independent advisors in order to manage the increased audit workload (personal communication, Lina, 2023.01.09). KRAV later hires its own auditors in the 1990's (Kenne et al., 2013). Before Sweden joins the EU in 1995, the country enters a European Economic Area Agreement (EEA), which involves the EU Organic regulations applying nationally. State agencies such as SBA become involved with the administration of organic certification rules and payments (personal communication, representatives from SBA, 2023.01.30) (Kenne et al., 2013). KRAV receives authority from the State as the agency to ensure that the EU Organic regulations are followed. KRAV holds this authority until 2006 (ibid).
1995	Sweden joins the EU. SBA works with reference groups constituted by a broad range of industry members to navigate the EU Organic rules. These reference groups also include farmers and farmer-representative organisations (personal communication, representatives of SBA, 2023.01.30). Following the introduction of EU Organic rules, KRAV needs to decide on the role of its private certification on the Swedish market in relation to the organic certification system at the EU level (personal communication, Henrik (representative of organic certification body), 2022.12.05).
2) 2000-2015	
Early 2000's	Processes for auditing organic farms in Sweden are influenced by regulatory and market developments at both the EU and international levels, as well as further structural developments in Sweden (Kenne et al., 2013). Developments include an increase in the number and detailed nature of the organic rules and changes in the nature of auditing processes (personal communication, representatives of SB, 2023.01.30 & Lina, 2023.01.09). KRAV also stops overseeing audits and this function is instead outsourced to a market of accredited certification organisations (Kenne at al., 2013) (personal communication, Henrik, 22.12.05). This shift is intended to improve conditions for the KRAV certification for farmers by, for example, drawing down the cost of certification (Kenne et al., 2013). Reactions to this change are mixed, with some parties feeling that the increased competition between certification organisations introduces the risk of diminishing the integrity of certification audits (personal communication, Lars, 2022.11.29), and third-party certification as increasing the distance between KRAV and its member farmers (personal communication, Henrik, 2022.12.07).
3) 2015-present	

	A new set of EU Organic regulations, EC Regulation No. 2018/48, introduces a set of amendments to earlier EU Organic rules. The amendments are intended to respond to the perceived watering down of organic rules and practices following a period of steady expansion in organic farming in Europe over the last two decades (EU Commission, 2021). The amendments introduce more stringent rules and remove certain exceptions, with the intention of drawing organic production back to its founding principles and objectives. For example, amendments address observed trends of intensification for organic greenhouse production. The amendments seek, among other things, to ensure organic greenhouse practices are more closely aligned with organic principles by requiring that organic crops are grown in soil and provided nutrients from the soil ecosystem on the farm, and that organic greenhouse practices support the ongoing health and quality of the soil through the use of green manures and crop rotation. There are also changes regarding the use of organic/non-organic seed in organic certified farming. Concerns are raised that amendments such as the new greenhouse rules are very detailed in their scope, yet do not suit Swedish growing conditions. These rules are intended to cover all EU countries, including countries such as Spain, where the season for growing crops is much warmer and longer than in Sweden. Growers in Sweden are required to experiment with and implement new practices that are potentially unsuitable to the Swedish context in their greenhouse production, which is considered a high risk and high-cost area of production on organic farms (interviews, Anna (organic advisor)2022.11.30 & representatives of SBA, 2023.01.30).

8.4 Extracts from EC Regulation No. 2018/48

EC. Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on Organic Production and Labelling of Organic Products and Repealing Council Regulation (EC) No 834/2007. Off. J. Eur. Union L150, 1–92.

[Highlighted text: own emphasis]

CHAPTER II

OBJECTIVES AND PRINCIPLES OF ORGANIC PRODUCTION

Article 4

Objectives

Organic production shall pursue the following general objectives:

(a) contributing to protection of the environment and the climate;

(b) maintaining the long-term fertility of soils;

(c) contributing to a high level of biodiversity;

(d) substantially contributing to a non-toxic environment;

(e) contributing to high animal welfare standards and, in particular, to meeting the species-specific behavioural needs of animals;

(f) encouraging short distribution channels and local production in the various areas of the Union;

(g) encouraging the preservation of rare and native breeds in danger of extinction;

(h) contributing to the development of the supply of plant genetic material adapted to the specific needs and objectives of organic agriculture;

(i) contributing to a high level of biodiversity, in particular by using diverse plant genetic material, such as organic heterogeneous material and organic varieties suitable for organic production;

(j) fostering the development of organic plant breeding activities in order to contribute to favourable economic perspectives of the organic sector.

Article 5

General principles

Organic production is a sustainable management system that is based on the following general principles:

(a) respect for nature's systems and cycles and the sustainment and enhancement of the state of the soil, the water and the air, of the health of plants and animals, and of the balance between them;

(b) the preservation of natural landscape elements, such as natural heritage sites;

(c) the responsible use of energy and natural resources, such as water, soil, organic matter and air;

(d) the production of a wide variety of high-quality food and other agricultural and aquaculture products that respond to consumers' demand for goods that are produced by the use of processes that do not harm the environment, human health, plant health or animal health and welfare;

(e) ensuring the integrity of organic production at all stages of the production, processing and distribution of food and feed;

(f) the appropriate design and management of biological processes, based on ecological systems and using natural resources which are internal to the management system, using methods that:

(i) use living organisms and mechanical production methods;

(ii) practice soil-related crop cultivation and land-related livestock production, or practice aquaculture which complies with the principle of the sustainable exploitation of aquatic resources;

(iii) exclude the use of GMOs, products produced from GMOs, and products produced by GMOs, other than veterinary medicinal products;

(iv) are based on risk assessment and the use of precautionary measures and preventive measures, where appropriate;

(g) the restriction of the use of external inputs; where external inputs are required or the appropriate management practices and methods referred to in point (f) do not exist, the external inputs shall be limited to:

(i) inputs from organic production; in the case of plant reproductive material, priority shall be given to varieties selected for their ability to meet the specific needs and objectives of organic agriculture;

(ii) natural or naturally-derived substances;

(iii) low solubility mineral fertilisers;

(h) the adaptation of the production process, where necessary and within the framework of this Regulation, to take account of the sanitary status, regional differences in the ecological balance, climatic and local conditions, stages of development and specific husbandry practices;

(i) the exclusion from the whole organic food chain of animal cloning, of rearing artificially induced polyploid animals and of ionising radiation;

(j) the observance of a high level of animal welfare respecting species-specific needs.

Article 6

Specific principles applicable to agricultural activities and aquaculture

As regards agricultural activities and aquaculture, organic production shall, in particular, be based on the following specific principles:

(a) the maintenance and enhancement of soil life and natural soil fertility, soil stability, soil water retention and soil biodiversity, preventing and combating loss of soil organic matter, soil compaction and soil erosion, and the nourishing of plants primarily through the soil ecosystem;

(b) the limitation of the use of non-renewable resources and external inputs to a minimum;

(c) the recycling of waste and by-products of plant and animal origin as input in plant and livestock production;

(d) the maintenance of plant health by preventive measures, in particular the choice of appropriate species, varieties or heterogeneous material resistant to pests and diseases, appropriate crop rotations, mechanical and physical methods and protection of the natural enemies of pests;

(e) the use of seeds and animals with a high degree of genetic diversity, disease resistance and longevity;

(f) in the choosing of plant varieties, having regard to the particularities of the specific organic production systems, focussing on agronomic performance, disease resistance, adaptation to diverse local soil and climate conditions and respect for the natural crossing barriers;

(g) the use of organic plant reproductive material, such as plant reproductive material of organic heterogeneous material and of organic varieties suitable for organic production;

(h) the production of organic varieties through natural reproductive ability and focussing on containment within natural crossing barriers;

(i) without prejudice to Article 14 of Regulation (EC) No 2100/94 and to the national plant variety rights granted under Member States' national law, the possibility for farmers to use plant reproductive material obtained from their own farms in order to foster genetic resources adapted to the special conditions of organic production;

…

ANNEX II

DETAILED PRODUCTION RULES REFERRED TO IN CHAPTER III

Part I: Plant production rules

1.9. Soil management and fertilisation

1.9.1. In organic plant production, tillage and cultivation practices shall be used that maintain or increase soil organic matter, enhance soil stability and soil biodiversity, and prevent soil compaction and soil erosion.

1.9.2. The fertility and biological activity of the soil shall be maintained and increased:

(a) except in the case of grassland or perennial forage, by the use of multiannual crop rotation including mandatory leguminous crops as the main or cover crop for rotating crops and other green manure crops;

(b) in the case of greenhouses or perennial crops other than forage, by the use of short-term green manure crops and legumes as well as the use of plant diversity; and

(c) in all cases, by the application of livestock manure or organic matter, both preferably composted, from organic production.

8.5 Interview guide – farmers

INTERVIEW GUIDE (SWEDISH / ENGLISH)

Tack för att du har tagit dig tid till att medverka i min forskningsstudie för min mastersuppsats. I min uppsats vill jag förstå mer om utvecklingen av ekologiskt jordbruk och certifieringen i Sverige ur olika människors perspektiv, inklusive olika aktörer och lantbrukare. Jag är särskilt intresserad av att höra mer om hur du experimentera för att utveckla nya metoder med avseende på markens bördighet och hälsa och hur ekologisk certifiering kan påverka dessa aktiviteter på olika sätt.

Idag är jag här på besök för att prata med dig och se hur du jobbar på din gård. Jag är mest intresserad av att höra mer och lära mig om vad du gör i praktiken och din förståelse för varför du gör vad du gör och hur det har förändrats över tid.

Jag vill också genomföra en intervju med dig. Intervjun kommer inte ta mer än en timme och jag vill spela in intervjun för att undvika att jag missar något viktigt som du säger. (**recording**)

***

Thank you for taking the time to participate in my study for my master's thesis. In my thesis, I would like to understand more about the development of organic agriculture and certification in Sweden from the perspectives of different people, including different actors and farmers. I am particularly interested in hearing more about how you experiment to develop new methods in relation to soil fertility and health and how organic certification can influence these activities in different ways.

Today, I am visiting your farm to talk to you and see how you work. I am particularly interested in hearing and learning more about how you work in practice and your understanding of what you do, and how what you do has changed over time on your farm.

I would like to complete an interview with you during the visit. The interview will take about one hour and I would like to record the interview in order to avoid missing anything important that you say (recording consent).

Ethics

- Go through consent form, address any questions – voluntary consent and free to withdraw consent at any point (consent form was sent to interviewee one week before interview for their review)
- Confirm level of anonymity (as outlined in signature section)
- Confirm ok to take photos during observations

NOTES FOR TIMELINE – use sheet of paper with timeline on it

Questions/frågor	**Notes**
Work with interviewee to outline a timeline of events in life of farm – changes in the life of the farm (focus on certification and experimentation regarding soil management and health)	Promotes reflection regarding the reasons for decisions/actions.

○ Timeline of certification/farming methods ○ När började du med ekologiskt jordbruk? / When did you start farming organically? ○ När certifierade du gården som en KRAV/ekologisk gård? / When did you certify your farm as organic? ○ Varför bestämde du att certifiera din gård? / Why did you certify your farm as organic? ○ Nör började du att experimentera med nya metoder kring jordens hälsa och markens bördighet? / When did you start experimenting with new methods in relatino to soil health and soil fertility/condition?	

Frågor om gård / jordbrukaren (either at start or end of interview/during walkabout) **Questions about farm / the farmer**	
Skulle du kunna beskriva din gård? Produktion (djur, växtproduktion mm.) storlek, jordart Could you describe your farm? Production (animals, crop production etc.) size, type of soil etc.	
Hur länge har du jobbat som jordbrukare/drivit gården? How long have you worked as a farmer/run this farm? Jobbar du heltid inom jordbruk? Do you work full-time with agriculture? Hur lärde du dig att driva jordbruk? How did you learn how to work in agriculture/run a farm?	
Varför driver du jordbruk? Why do you farm?	

STAGE 1 -walkabout (Strang, 2010; Cooke & Lane, 2015)

Focus for walkabout is to see how the farm is set out, understand more about how the farmer works and the types of production he/she works with, as well as locate sites for experimentation and trial in relation to soil management and health.

Key question: Skulle vi kunna gå någonstans som har betydelse för dig med tanke på hur du jobba med/experimentera med/utveckla dina metoder kring jordhälsa? **Could we go somewhere that has meaning for you in relation to how you work with or experiment/develop new methods in relation to soil health?**

OBSERVATIONS FROM WALKABOUT / NOTES FOR INTERVIEW

Experimentering / metoder

Experimenting /methods

Certifiering

Certification

Questions on methods and experimentation regarding soil health	
Hur ser du på jorden på din gård? How do you see/think about soil on your farm? Hur tänker du kring jorden på din gård? How do you think about soil on your farm? Vad har jorden för betydelse på din gård? What meaning does soil have for your farm? När reflektera du över jorden på din gård? When do you reflect over the soil on your farm?	I want to understand how farmers see/relate to soil on their farms as part of their farming system. social-ecological relationships.
Hur skulle du beskriva jordhälsa? How would you describe soil health?	

Hur jobbar du med jordhälsa? How do you work with soil health? Varför jobbar du med jordhälsa? Why do you work with soil health? (Hur jobbar du med jordhälsa i växthuset?) (How do you work with soil health in the greenhouse?)	This may arise when we walk around the farm, I am looking for descriptions of methods/practices here.
Hur har ditt sätt att se på jorden/hantera jorden på din gård förändrats över tid? (**timeline**) How has your way of seeing soil/managing soil on your farm changed over time? (**timeline**)	
Experimenterar du med nya metoder för att förbättra jordhälsa? Do you experiment with new methods to improve soil health? Varför experimenterar du med nya metoder med avseende på jordens hälsa? Vad har inspirerat dig? Why do you experiment with new methods in relation to soil health? What has inspired you?	
Har det hänt någonting specifikt som ledde till att du började fundera mer kring jordhälsa? How something specific happened that caused you to start thinking more about soil health?	
Hur går det till när du experimentera med nya metoder? Kan du ge mig ett exempel? How do you experiment with new methods? Can you give me any examples?	
Hur får du reda på om dina metoder/experiment ger de resultat som du vill ha? How do you work out if the methods or experiments that you are doing give the results you would like?	
Hur vet du att sättet som du jobbar med jorden på är bra eller dålig? Vilken information eller metoder använde du för att förstå det? How do you know that the way that you work with the soil is good or bad? What information or methods do you use to understand this?	
När reflekterar du över dina jordbruksmetoder?	

When do you reflect over your farming methods? Hur ofta reflekterar du över dina jordbruksmetoder? How often do you reflect over your farming methods?	
Kommer du ihåg när du senast reflekterade över jordhälsa? Do you remember when you last reflected over soil health? Hur bestämmer du vad du ska göra näst? How do you decided what you will do next?	
Hur lär du dig om jordhälsa? How do you learn about soil health? Vilka föreningar/myndigheter/personer (rådgivare) stödjer dig i ditt arbete med odling och jordhälsa? Which organisations, agencies, people support you with your work with growing and soil health? Hur tar du beslut kring utvecklingen av dina jordförbättringsmetoder? How do you take decisions about the development of your farming methods?	Sense-making, what resources are used, is there tacit knowledge here developed through everyday practice?
Hur påverkar certifieringsreglerna dina metoder för att förbättra jordhälsa? Finns det några exempel? Do certification rules influence your methods to improve soil health? Are there any examples?	Trying to access interactions between farming practices and certification.
Hur skulle du säga att dina metoder har förändrats sedan gården blev certifierad? How would you say that your methods have changed on the farm since you have been certified?	

STAGE 2

Questions regarding organic certification	
Vad betyder ekologiskt jordbruk för dig? What does organic agriculture mean for you? Hur skulle du beskriva ekologiskt jordbruk generellt?	

How would you describe organic agriculture generally?	
Vad betyder det för dig att vara ekologisk bonde? What does it mean for you to be an organic farmer?	
Vad innebär det för dig att vara certifierad? What does being certified involve for you?	
Hur påverkas ditt sätt att driva gården av reglerna för ekologisk certifiering? Kan du ge något exempel? How do the rules for organic certification influence the way in which you work on the farm? Can you give any examples?	
Stämmer din uppfattning av vad det innebär att vara ekologisk jordbrukare med din uppfattning om certifieringen? Does your understanding of being an organic farmer match with your understanding of organic certification?	
Påverka certifieringsreglerna ditt sätt att experimentera med nya odlingsmetoder? Do the certification rules influence the way that you experiment with new farming methods? Främjar certifieringsreglerna och systemet ditt sätt att experimentera? Om det inte gör det, vad skulle du önska i form av stöd? Do the certification rules and system support your way of experimenting? If they don't, what would you wish for in terms of support?	
Hur påverkar det dig att det kan komma någon från ett certifieringsorgan för att granska gården? How does it influence you that someone comes from a certification body to audit the farm?	
Lär du dig någon genom att vara certifierad? Do you learn anything through being certified? Känner du att du har blivit en bättre jordbrukare genom att vara certifierad? På vilket sätt – kan du ge något exempel? Do you feel like you have become a better farmer due to being certified? In which way – can you give any examples?	

Är det någonting som har hänt inom certifieringssystemet eller reglerna under tiden din gård har varit certifierad som du reagerade på, antigen positivt eller negativt? Is there anything that has happened in the certification system or rules during the time your farm has been certified that you have reacted to positively or negatively?	
I Artikel 6 av EU reglerna om ekologiskt jordbruk står följande princip kring markens bördighet: Article 6: *Marklivet och jordens naturliga bördighet, jordens stabilitet och biologiska mångfald skall bibehållas och förstärkas, jordkompaktering och jorderosion skall förebyggas och bekämpas och växter skall huvudsakligen ges näring genom markekosystemet.* Tycker du att eko-reglerna främjar den här principen i praktiken? Hur? The following principle is included in Article 6 of the EU rules on organic agriculture: *organic production shall, in particular, be based on the following specific principles: (a) the maintenance and enhancement of soil life and natural soil fertility, soil stability, soil water retention and soil biodiversity, preventing and combating loss of soil organic matter, soil compaction and soil erosion, and the nourishing of plants primarily through the soil ecosystem…* Do you think that the organic rules support this principle in practice? How?	
Hur har du lärt dig att odla ekologisk? How have you learnt to farm organically?	
(If relevant: Du pratar om regenerativ odling på din gård – vad tycker du är skillnad mellan att odla regenerativ och att odla ekologisk?) (If relevant: you talk about regenerative agriculture on your farm – what do you think the different is between growing regeneratively and growing organically?)	

Har de nya EU-reglerna för ekologiskt jordbruk som kommer nu i år påverkat dig på något sätt? Hur? Have the new EU- rules for organic agriculture that come now this year influence you in any way? How?	
Om du/ni inte var certifierad ekologisk skulle du gör någonting annorlunda när det gäller hur du jobbar med jordhälsa? If you weren't certified, would you do anything differently in relation to how you work with soil health?	
Vad tycker du är några av de viktigaste saker som måste utvecklas vidare inom det ekologiska jordbrukssystemet? What do you think are some of the most important aspects that must be developed in the organic farming system going forward?	

OBSERVATIONS FOLLOWING VISIT

Experimentering / metoder

Experimenting /methods

Certifiering

Certification

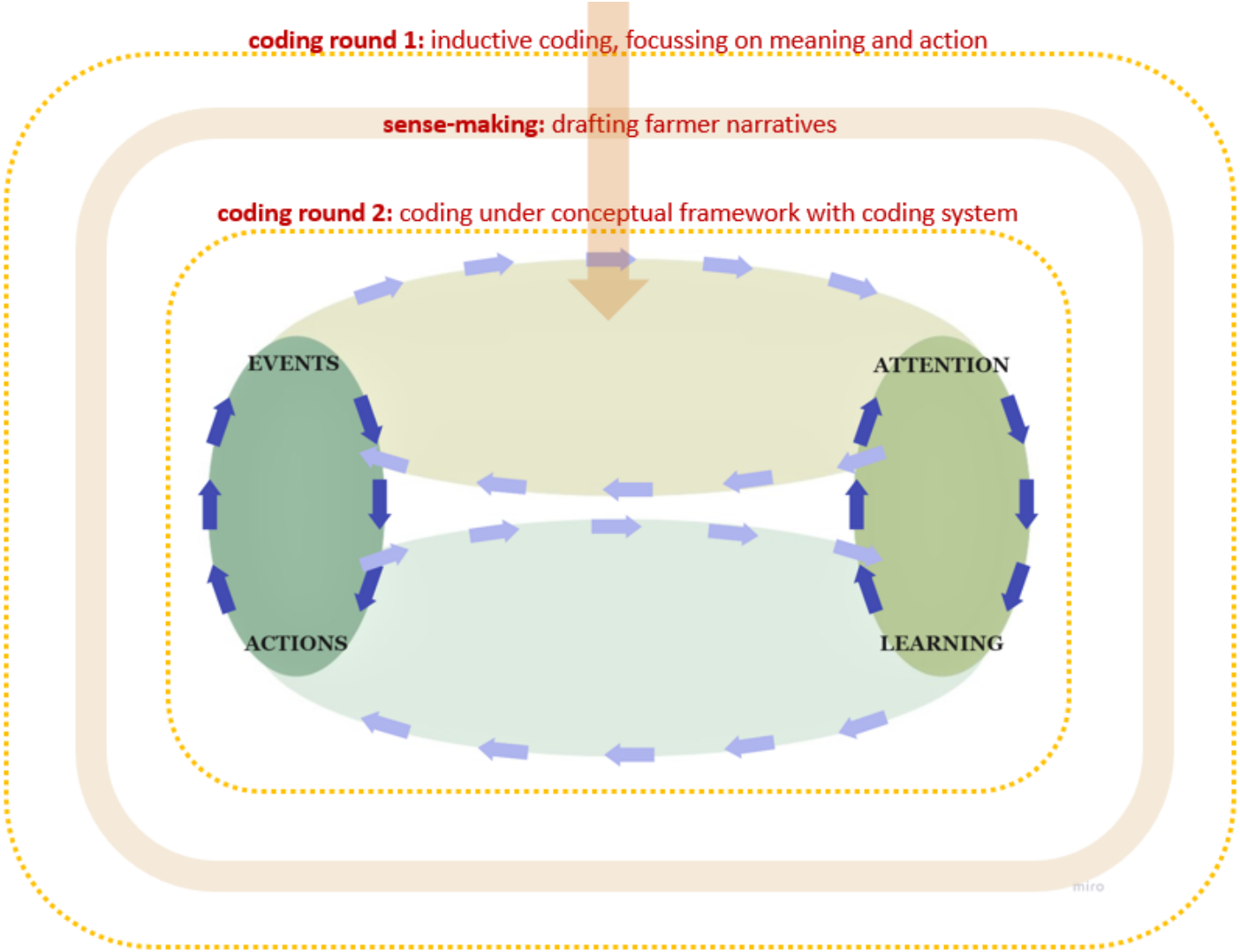
TIMELINE

8.6 Coding system for conceptual framework

Codes developed to support analysis under conceptual framework	Clarifications
Collective action/relations	Code to capture the role of collective action/relations among farmers and in farming industry that play a role in change processes/experiences.
Withdrawal	Codes to capture concept of withdrawing practices/artefacts as a mode of innovation
Withdrawal > Making new connections	
Withdrawal > Adjusting to change	
Withdrawal > Innovation through withdrawal	
Withdrawal > Rendering visible/invisible	
Stabilisation of practice	Codes to capture when and how practices may be stabilised (or not) in farming systems
Stabilisation of practice > Resources/machinery	
Stabilisation of practice > Norms and values	
Event	
Event > Interpretation	
Event > Interruption (events leading to other events)	
Learning	
Learning > Learning from action	
Learning > Learning from event	
Attention	Codes to capture shifts in farmer attention and underlying mechanisms
Attention > "Inkling" leading to paying attention	
Attention > Learning to pay attention	
Attention > Paying attention to something new	
Attention > Describing paying attention	

Action	
Action > Experimentation	
Action > Collective action	
Action > Learning to act differently	
Action > Mechanisms of action	
Action > Solving problems	
Action > Changing practice	
Action > Hypothesis making and testing	
Experience	Codes to capture different dynamics and underlying mechanisms of farmer experience
Experience > Meaning of experience	
Experience > Direction/outcome of experience	
Experience > Reconnected with experience	
Experience > Cutting themself off from experience	
Experience > Cut off from experience	
Experience > Opportunities for experience	
Experience > Describing experience	
Experience > Describing experience > Inspiration	
Experience > Describing experience > Challenges	
Experience > Describing experience > Soil and soil health	
Experience > Describing experience > Farming practices	
Experience > Describing experience > Organic certification	
Experience > Describing experience > Organic farming	

8.7 Iterative approach to analysis



Examples of coding for sections 5.1-5.3
Section 5.1
Round 1 example: describing change of practice → converting to organic Round 2 examples: innovation → innovation through withdrawal attention → paying attention to something new stabilisation of practices → resources/machinery
Section 5.2
Round 1 examples: Exploring soil health → knowledge through practice Meaning/intention → organic Round 2 examples: Action → experimentation/solving problems Collective action/relations Experience → cutting themselves off from experience
Section 5.3
Round 1 example: Certification system → change practice? Round 2 examples: Event → interruption Experience → describing experience → certification Experience → cut off from experience

8.8 Additional reflections from farmers

5.1 OPPORTUNITY FOR EXPERIENCE: CONVERTING TO ORGANIC		
Additional reflections for farmers under section 5.1		
Code → sub-code examples	Farmer	Quote/reflection
Reflections 1-3		
Withdrawal → Innovation through withdrawal	Lars	*"It [organic agriculture] has promoted many things in many ways, especially in relation to the limitations it creates, on the one hand they do limit and on the other hand they call for creativity. If one looks at two very simple things, firstly, that one doesn't use synthetic fertilisers, and secondly, that one doesn't use herbicides, these are very strong limitations and they have forced organic farmers to pursue a lot of different kinds of experimentation. And now people are talking a lot about intercropping and so in connection with regenerative agriculture, but that's something organic farmers have worked with as long as I can remember, it isn't anything new at all. And there was even research conducted on that in the 1980's that people seem to have forgotten, for now they are looking at that again…"* *"I'm pretty convinced that conventional agriculture in Sweden would have been much worse without organic agriculture. It has developed both practical methods for managing things better, new machinery that has been developed for organic farmers, new methods for organic pest control. For example, Lantmännen [Swedish agriculture cooperative], now have a warm water treatment for seed without chemicals. This is not something new in and of itself, this is something people did 100 years ago but it was commercially dead until organic farmers arrived and needed some kind of treatment for seeds. Now it's a massive product, they export seed with this type of treatment. It [the influence of organic agriculture] is partly direct, but also indirect via the public debate between conventional and organic, which has created a pressure for conventional agriculture, that it must at least show that it is as good or better than organic agriculture and that is something that I will gladly work with. I believe that this had played a really big role and has been positive."*
Withdrawal → Making new connections		*"The self-imposed limitations in organic agriculture have in part made organic farmers more skilled in handling nutrient supply at the farm level, minimising leakage of nutrients and using biological fixation of nitrogen, place-based nitrogen production one can call it. And that through a higher level of diversity, better crop rotations and so on, limit the effects of pests. One still always gets pests but both the size of the damage and the effect of the pests are minimised if one has a more diverse production. And I believe that that in itself is a good condition for resilience."*

Reflections 4-5		
Withdrawal → Making new connections	Bosse	We discuss the experience of converting to organic and Bosse expresses that it was mostly psychological, that he wondered "what will folk say". This is something he feels again now that he has converted to biodynamic, but not in the same way. With growing biodynamically, he expresses that it has been hardest with the biodynamic preparations[30] because this wasn't something that initially attracted him to growing biodynamically. Rather, it was the thought of a holistic approach. However, now that he has come into the system more, he sees how it makes sense with the preparations and also that cow manure would be composted in the cow horn. For the cows are born on the farm and they have eaten from the farm, and so all life is in that cow horn. But again, he reflects, the challenge with changing is mostly psychological.
Stabilisation of practice → Norms and values machinery/resources		Bosse shares a similar experience to Anders in relation to the old-breed varieties and their availability. He describes first being able to access bags of 25kg or 50kg of spelt grain and Öland's wheat, which he had to work with over time in order to develop his own collection of seed. He also describes the way in which growing the old-breed varieties led him to establish the mill in the barn and be a part of the collective for sale of organic flour and other products from old-breed grain. He reflects: *The knowledge [about old-breed varieties] is not available, you can't contact Länsstyrelsen [The County Board] or something, and instead you have to acquire the knowledge yourself. And that, that's a lot to do. We have had a small Nordic cooperation with other farmers that are growing old-breed varieties, and then there's a Danish advisor, who has a PhD in common bunt/stinking smut,[31] he is very knowledgeable on that topic. He has been able to come and hold courses with us. That's something I've realized the longer I've been a farmer, what if research could have assisted us? [For example], I was at a meeting one time about organic seed and it was after 2018, when they had realised that perhaps it wasn't so successful with those conventional varieties [e.g. Dacke]. They presented all the things they were going to research and described how they were aiming to develop new seed to suit a specific seeding machine in the industry, and that this was how we were meant to grow … yes but, I thought about it, this is the wrong way to go, why should we lock ourselves into a system?"*
Reflection 6		
Withdrawal → Making new connections	Bosse	Bosse describes how through converting to organic, and then later to biodynamic, his idea of his farm as a holistic/circular system has increased. In the early 2000's he started experimenting with making compost of materials that were earlier considered waste on the farm, for example, the husk of the grains. He describes how the husk, which is 30% of the grain, gets circulated on the farm and added back to the soil. Gradually, he developed the thought that everything that is "waste" on the farm should be added to the compost. He blends the grain husks with other materials, such as clover and cow manure, and silage. He describes using the compost as "medicine" for the soil where he sees that the growth on the fields is suffering the most.

[30] Biodynamic preparations are combinations of plant, mineral and animal substances used by biodynamic growers as vitalising additions for soil and plants.
[31] Common bunt/stinking smut is a fungal disease affecting wheat.

5.2 EXPERIENCES WITH ORGANIC PRACTICES AND SOIL HEALTH		
Additional reflections from farmers under section 5.2		
Code → sub-code	Farmer	Quote/reflection
Reflections 7-12		
Round 1 – meaning → organic Intention → organic Round 2 – Experience → Meaning of experience Direction/outcome of experience	Johan	*"The concept of "circulation agriculture" that Artur Granstedt has talked a lot about; the idea of the farm as an organism from biodynamic. This is in some way the prototype for organic I think. The maintenance of plant nutrition is central and this should be solved locally, preferably on-farm or in cooperation between farms in the same area. That is what it is."*
	Patrik	*"For me it means, it is without mineral fertiliser and it is without agrochemicals, but also for me it is related to the fact that one farms with nature and not against nature. I believe in supporting, I believe that living organisms want to be healthy and the question that one should ask themselves is why they become sick. I don't believe in a form of agriculture in which one should need to protect crops from their surrounding environment. So for me, organic agriculture is that one doesn't have to protect and instead is attentive to that which wants to live."*
	Bosse	*"For when we grow organic it's a completely different system and I've come a little bit along the way… and also in the way I don't buy any external inputs and that I try to maximise the farm itself and what I can harvest from it. However, there's still the fact that I plough and everything like that and that's not the best for soil life, there's still a long way to go to have it like a self-playing piano."*
	Malin	*"Organic, in any case for me, it is that one lives with nature, one has circulation of resources, one uses only natural things, and tries to do everything as well as possible. For both humans and animals, for nature and the soil and so."*
	Lars	*"If we're talking about agriculture then I think for me it is a way of doing agriculture that tries to make use of natural processes as much as possible. Where one sees the way things function in nature and considers 'how can I use this in a sensible way in our system?'"*
	Torsten	Torsten took over an organic farm from his parents, however he describes how he worked solely with conventional farms as an advisor (agronomist) from 2007 and then successively moved over to advising more and more for organic farms over the years. *"I think that the biggest difference is that conventional agriculture tends to fixate very quickly in product advice, there is a lot of advice concerning fertilisers, amounts of fertilisers, pesticides and herbicides, how much and when one should spray, which kind of*

		chemical one should spray and so on. There is quite a lot of product and not much biology and soil and ecology. While organic growing concerns more how one can get out as much as possible from the system one is in and how one can build up in the long-term a functioning system without just getting weeds or problems with bad quality crops or pests or whatever it might be. It feels like more of a holistic thought process with natures conditions… and that is why I am drawn to it as well because I think it is interesting, both organic and a little more management."
Reflection 13		
Experience → Direction/outcome of experience	Johan	Many farmers, including Johan, express to me the damage their ploughing practices have had for the soil on their farms. Johan explains how he ploughed for a number of years before, in around 2012-13, they had an American volunteer working on their farm with them who asked why they didn't have a broadfork. A broadfork is a farming tool for aerating the soil without disturbing it through extensive digging or ploughing. It is a tool often used on small-scale farming systems that focus on minimizing soil disturbance in the aim of improving soil health over time. Johan hadn't heard of a broadfork before his experience with the volunteer and there weren't any broadforks available in Sweden at the time. After this encounter, Johan started experimenting and exploring the idea of minimising ploughing and digging on the farm. This led to a process where they adapted their practices, and continue to adapt their practices, to minimise the extent to which they disturb the soil on their farm. He expresses that this experience led to a complete shift, describing a "revolutionary change" in the way they approached soil health on the farm.
Reflections 14-16		
Meaning of experience Direction/outcome of experience	Torsten	*"I would say that that which we call regenerative today is grounded in the origins of organic production, in relation to biodynamic thinking and so, many natural processes, ecosystem services, and how one can optimize them. And also how to build a healthier system with less reliance on chemicals, medicines and everything, while organic production, there is a portion of production that is still there … but a lot of the large scale organic production today has been heavily influenced by conventional production in that it is a lot about getting KRAV-approved fertilisers into Sweden and very intensive processing systems and row hoeing and the like instead of chemicals. So that you adopt the same cultivation system but in other ways you have forgotten a bit of these biological and natural processes and don't work with them as much anymore. So I think that's a difference as well, that this [regenerative] is a way back to what nature can deliver…"*
Experience → Direction/outcome of experience	Patrik	*Quote from company website: "The goals in relation to harvest and economy must never be met at the cost of soil health and naturally healthy crops. I want be part of the development a kind of agriculture that benefits from nature's own ecosystem both over and in the soil. This is why we started our journey with that which is called regenerative agriculture in the year 2018, with the conviction that this is the road to a social, economic and environmentally sustainable entrepreneurship."*
Experience → Direction/outcome	Anders	*"…one can grow organically according to the requirements that are set if you are certified, and then you must do certain things … while I think perhaps that regenerative feels more like a level higher because then you must pay more attention to what happens*

of experience		*in the soil in order for it to function and what is required for it to function better, rather than farming organically and supplying all nutrients. It's the difference between having lay crops according to the rule book, or having a crop rotation so it can fulfill a function and instead improve the system."*
Reflections 17-18		
Collective action/relations Learning	Torsten	I ask Torsten about how he experiments with new methods, and he explains: *"There is no standard answer, I've built up my network of many people across the board that I talk to regularly and there we all experiment with different things … and then there are those who are very good in research or consulting or agronomy or on farms that I am very inspired by. So we try to see what knowledge is available, we pick ideas and see if we can try to build them into our systems and so on, so a lot is about developing these theories about how to work, like the 'schoolbook', and how we can implement bit by bit at the farm level. I do that both with the farms I work with, where I know there is an interest, and also here on my own farm, there is a constant discussion about this. Then there are projects, getting involved in different projects, I have been part of reference groups for different projects, I have had projects here on my own farm, that way you can then look at specific things and that's also interesting. And then there are various products, bio-stimulants, like this and various other things … there are many people who want to test things with me because I am interested in this. So I get a lot of offers, like try this and try this. So that is also a way. But I'm perhaps actually more interested in system changes than individual products and efforts, so I'd rather see that a product fits into a system, but if it's something that doesn't directly cause problems for me, I'm happy to try everything possible, as long as I don't see any risks."*
Collective action/relations Learning → Learning from event	Torsten	*"I came into contact with the regenerative ways of thinking and growing methods for 4-5 years ago and became very very interested, and the reason for my interest related to the question of how can one get much more with the resources one has in organic production without needing to buy in things or be dependent on fertiliser from conventional waste products[32] and these kinds of things, how can one get a system to function with what exists on a farm, with biology. And this is why I became very interested in regenerative and I have used quite a lot of energy, primarily back then, we travelled around to different countries and looked at thing and looked at how people work with these questions. Then I haven't really landed in what … how one should translate everything in a practical system, rather I continue to search after that and that's why I have a lot of contact with many others, not only in Sweden but also internationally … I would say that I have come longer mentally in my own journey, in my head I mean, than what I have done here at home because I can't handle everything, all the attempts and tests and all the risks. It feels like I do a few too many different things to be able to manage everything. I don't manage to develop my own growing as far as I want to, and therefore I take it a little bit safe. However, what I do, what I have changed as a big thing in my own practical work, it is that I have permanent crop cover on the soil and a lot of diversity instead of what we in the past would do with working*

[32] Organic-approved fertilisers can, for example, be produced from the crop residues from conventional crop production.

		[ploughing] the soil to avoid weeds and driving the farm more intensively in this way. These are big things for me, that I try to have more permanent crop cover and burn less diesel to fight weeds."
5.3 ORGANIC CERTIFICATION AND EXPERIENCE		
Additional examples and reflections under section 5.3		
Code → sub-code	Farmer	Quote/reflection
Reflection 19		
Experience → Describing experience → challenges Experience → Describing experience → organic certification	Torsten	I ask Torsten what he wishes for the way in which the certification system would deal with questions around soil and soil health. He answers *"… I would like it if both [organic] growing methods and certification found a way forward that wasn't so input intensive and was more ecosystem based. This would have been the vision for me, but as I said it can't go too fast because I don't really know if we can handle it or there will be a very small, niche production, left. I'm very divided on that question because I think that if you went harder there, it would perhaps be easier to sort of find a new identity for KRAV. But if you go harder, the risk is that the market will shrink a lot and my profitability in the short term would be worse because I would have to lose production and take much more money and so on. So I'm torn, as I said."* In relation to certification audits, he also reflects: *"It is easier if the person [auditor] that comes here is knowledgeable enough to understand how I think about my cultivation and, like, even that the auditor can understand my situation and what I have done, for example, if I have done something good or bad and why. It will be of course easier for them too if I understand that they need to have a certain framework and have to follow certain rules and such. So somehow we need to talk about it and understand each other, even if I have done something wrong and there is something to improve, it is possible to get there if you understand each other somehow."*
Reflection 20		
Experience → Describing experience → organic certification	Kerstin	I discuss the rule changes with Kerstin, an organic farmer with greenhouse tomato production, while sitting in the greenhouse in autumn with tall tomato plants towering in the beds in front of us. She reflects on how she can't see how other crops, such as green manures, would ever grow in the shade of the tomato crop. They have previously experimented with some cover crops with ineffective results. They have also experimented with covering the soil in the greenhouses using organic material to improve soil conditions, which led to the plants being burnt through the release of ammonia as the material started to break down. These experiences cause Kerstin to be wary of experimenting with new practices in the greenhouse production, which is both a significant source of income but also costs for the farm. Kerstin has been contacted by organic advisors looking for farms to experiment with developing new practices under the amended rules in the Swedish context. They had offered to cover the cost of seed for the experiments, however, Kerstin still felt that the risks to production were too great. Over nearly twenty years of greenhouse production, Kerstin has developed practices

		to maintain soil quality in the greenhouse with guidance from organic advisors and study visits to other organic farms. She has for all years, apart from during the COVID-pandemic, relied on the assistance of local sporting club members to come in late winter to help dig down both hay and composted manure from their own cows into the soil before the new growing season begins. Kerstin has also developed other important income streams using the greenhouse in winter months when the tomatoes aren't in production, which would possibly be affected by the new requirements. When I ask how often she reflects on her soil management practices in the greenhouse, she expresses that she hasn't reflected enough over the soil lately and was better at taking soil tests in the past. However, she also explains that after many years of growing, she sees that the soil's condition is good through how the plants look. This statement illustrates Kerstin's tacit knowledge and the way she pays attention to signs of plant health through practice. In addition to the greenhouse production, we discuss their on-farm experimentation with no-dig permanent beds in the vegetable fields and rotational grazing of the cows as additional efforts to improve soil management on the farm.
Reflection 21		
Experience → Describing experience → organic certification Experience → cut off from experience	Lars	I discuss the value of practice knowledge and the ability of farmers and people in general to make practical judgements with Lars. He feels that this type of skill and knowledge was diminishing. I ask him if he thought organic agriculture supported this kind of knowledge and he answered: *"Yes, I think it definitely does this in its original form, for it is built relationships between humans and animals and the soil. A relationship is always an exchange in some way. That's how I know it, however the conventionalization of organic growing leads in the other direction. It is those parts that disappear, even in organic agriculture. And the [organic] legal framework is even more like that, because it is built upon the premise that I should do things that someone else has decided upon. I don't do things because I experience that they are meaningful actions, rather I do them because someone has decided that I must do it."* He also reflects: *"But I think that these ideas that the rules should be the same at the European level and even worse, the global level, are wrong. The shouldn't be the same. Conditions are different. An organic adaptation involves one doing different things in different places. Not that everyone does the same thing."*

8.9 (Re)discovering and understanding soil

Following my interview with Torsten, we make our way outside to walk about the farm. Before making our way to the fields, Torsten makes his way to his car. I'm momentarily confused, until I see him draw out a shovel from the boot. Of course, we are going to dig in the soil. As we stand out in one of his fields, he starts to dig, pleased over the number of worms he comes across after just one or two spades full. As he digs, he explains:

> *"You want lots of roots. And then you want to avoid too much of that clumpy structure that looks like stones and gravel that just falls apart. Rather, it should be more like keso cheese, softer… as folk say. So it's about halfway there."*

Lars also describes digging and observing soil, as well as using senses such as smell to assess life in the soil:

> *"[To dig] is really valuable. It's some kind of combination of a physical assessment and everything else possible. If one trains it then one can read many things from the soil. One can definitely also determine from the smell if it is mycelium or bacteria that dominates the life in the soil."*

The practice of digging; looking, touching, smelling the soil, is a steady theme in my visits to farmers. However, this is not because it has been a steady practice through time, but because it seems to be (re-)emerging for many. During my interview with Anna, the organic advisor, she reflects:

> *"I can easily say that ten years ago, I had hardly dug a hole during a regular advisory visit [to a farm]. Of course, I often took up plants and studied their roots, but I didn't dig holes or put words or labels on what I saw in the soil. These days, we are much more knowledgeable when we dig a hole, and we look at the [soil] structure more closely. I would estimate that there has been as increase in soil health related questions [from farmers] from a 20 percent level to a 90 percent level. Before this we discussed physical aspects, such as soil compaction, and that was all. Now we look more at how the entire topsoil and subsoil look, everything from roots, worms, pores, soil layers, soil aggregate structure and smell and more. One tries to grasp the whole in another way."*

Similarly, when I interview Malin, she reflects on her time at agricultural college in Sweden, where there might have stood one or two sentences on worms in the soil, but she as a student was never taught about their importance. Rather, according to Malin, the education focussed mainly on chemical sprays and "modern" agriculture. I ask her what soil health means to her, and she answers that it is the rumble of life in the soil. She goes on to describe the soil processes she has been observing in their new rotational grazing experiments with the cows:

> *"For that's what I check now with regenerative, how long it takes for a cow patty [to break down], how many dung beetles we have, in other words, if the soil isn't balanced, then it takes a really long time before the cow patty breaks down. If there's good conditions in the soil, then it breaks down really quickly. And I think that's a pretty exciting thing, for people have done tests that show it's much more valuable if cows can shit directly [on the fields] than if the cow manure lies in the manure pile for a while and then gets spread out in spring. Plus, the cow's saliva is really important [for the growth of the grass]"*

In my interview with Johan, I ask him how he sees soil on his farm. He tells me:

"As something living, that forms the basis for everything we do. That's perhaps simple but, that's what it is."

His goes on to say that he has always had this view of soil in the farming system, yet has learnt over time how to understand it better. I ask him what it means to understand soil better and he continues:

"I know how it looks when it's well, I know how it looks when it isn't well. I know it. I know what it likes and what it doesn't like more today than twenty years ago when I moved here [to the farm]. But I feel like I still have a lot left to learn."

8.10 Ethical review – final review

I didn't update the original approved ethics review for the project.

All participants were provided with the Plain Language Statement (PLS) on first contact so they could consider the details of the project prior to confirming their involvement. I then provided a copy of the Consent Form to participants approximately one week prior to attending a farm or conducting an interview and asked participants to read through the details on the form. Finally, I provided participants with the opportunity to discuss the Consent Form prior to conducting and recording the interviews.

On reflection, the main challenge with the procedures I developed concerned the PLS and Consent Forms. While they were useful in outlining all relevant information for the project, I felt that they were too information heavy, and were not easy for the participants to interact with. There is a lot of information to include in the ethics forms and in hindsight, I think there could be a better and more reader-friendly way to communicate this information with participants. One could, for example, include access to an interactive website with all information, which a participant can refer to if they have any questions, rather than all of the information in the Consent Form.

I also included options regarding level of anonymity for participants, and I was surprised that most farmers were open to me using their name and details in my research. However, due to the fact that some participants also preferred anonymity, I decided the best approach was to use pseudonyms for everyone. The fact that farmers were willing to share their name and details made me feel unsure about what is best practice in terms of respecting and protecting the privacy/interests of research participants. I also saw how my engagement with farmers could have been more framed around a knowledge co-production process if I had designed the study differently (this was perhaps not realistic in the scope of the thesis, but I will reflect on this in future research).

I also agreed to share direct quotes with participants in case they were interested in providing feedback on them. This proved practically challenging as I had to find a way to share interview data with participants. After considering options and discussing with one of my supervisors, I elected to share via secure document link, which was only available to the relevant participant for a designated timeframe.

Visiting address: Albanovägen 28
Postal address: Stockholm Resilience Centre, Stockholm University, SE 106 91

info@stockholmresilience.su.se
www.stockholmresilience.su.se