# Enhancing the resilience of the Swedish food system with regenerative methods

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## Abstract

Sweden is currently facing its most serious security policy situation since World War II, with global pandemics, geopolitical conflicts, and extreme weather events. These events have shown the vulnerabilities of a food system built on "just-in-time" distribution and heavy reliance on external inputs. This thesis explores the mindset of regenerative food systems and analyses how regenerative methods and regenerative agriculture with its focus on restoring soil health, increasing biodiversity and improving farm profit, can enhance the resilience of the Swedish food system. The objective of the study is to identify key vulnerabilities related to climate change and resource dependency and investigate how regenerative methods can address these challenges.

Adopting an exploratory, qualitative approach, the study combines a literature review with 18 semi-structured interviews featuring a diverse range of actors, including farmers, industry, research, advisor services, industry organisation, retailers, municipality and banks. The results indicate that regenerative methods such as reduced tillage, diverse crop rotations, and integrated pest management provide critical ecosystem services that reduce the need for synthetic fertilizers, agrochemicals, and fuel, thereby increasing farm-level independence and resilience against extreme weather.

However, the research identifies several bottlenecks to a regenerative transition, including a lack of a standardised definition or label, an "upside-down pyramid" of profitability where farmers receive a disproportionately small share of food prices, and a significant administrative burden. The study concludes that while regenerative methods are a viable solution for building a resilient food system, a successful regenerative transition requires increased demand for crop diversity from processors and consumers, improved infrastructure for systems like intercropping, and a redistribution of financial responsibility across the entire supply chain.

**Keywords:** regenerative agriculture, soil health, regenerative food systems, resilience, food system vulnerabilities

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# 1.0 Introduction

This chapter gives an overview of the Swedish food system, its dependency on external inputs and key vulnerabilities. It introduces regenerative agriculture which has gotten attention globally and in Europe due to it being an agriculture system less dependent on external inputs. It has also been recognised by its capability to build agro-ecosystems resilience, increase primary production profitability and for its contribution to climate action plans. Furthermore, the chapter introduces the mindset of a regenerative food system and presents the aim, objective and research questions of the study.

## 1.1 Background

“Sweden is not at war. But there is no peace either”. It was with this sentence the Swedish prime minister Ulf Kristersson began his speech at the People & Defence conference in January 2025 (Swedish Government 2025). Sweden is currently facing its most serious security policy situation since World War II (Swedish Food Agency, Swedish Board of Agriculture, National Veterinary Institute 2025). Global pandemics, geopolitical conflicts, extreme weather events and depleting natural resources in recent years has impacted the insecurity of the global food system, highlighting the need to create a more resilient food system (Durand et al. 2025). The food system includes all elements and activities related to food production, processing, distribution, preparation and consumption, and the outcomes of these activities, including nutrition, socio-economic growth and environmental sustainability (Röös et al. 2023; Goncalves et al. 2021; IPCC 2019). Food and water security is crucial in order for the society to function, and in times of war and crisis it is important that Sweden has a strong and resilient food system (Swedish Food Agency, n.d). A well functioning food system depends on accessibility to farmland for crop production and animal husbandry, but also access to water, feed, fertilizer, agrochemicals, fuel, electricity, IT, processing facilities, transportation, trade channels, payment methods, staff, waste disposal and packaging materials (Swedish Government 2024a). A resilient food system comes from a system where companies are competitive and profitable in peace, because they are then capable of managing and operating in crises (Swedish Food Federation 2025; Swedish Government 2024a).

According to the Federation of Swedish Farmers (Swedish: Lantbrukarnas Riksförbund [LRF] report ‘The food crown’ (2025), 9% of the retail price of food in Sweden goes to the farmer, 25% to the industry and 33% to the retailers. Furthermore, from a historical perspective, farmers' profits have decreased from about 20% in 1995 to 9% in 2025.

There are 55 000 registered agriculture companies in Sweden 2025, that is a decrease by 23% between 2010 and 2025. Since 1990 the number of agricultural companies have almost halved (Swedish Board of Agriculture, 2025a). 90% of the agricultural companies are sole traders and 53% of them are owned by people older than 60 years (Swedish Board of Agriculture, 2025a). Swedish farmers have the lowest average monthly salary within all professions in Sweden, and the primary production suffers from low profitability (Röös et al., 2023; European Commission, n.d.g). Many farmers have therefore an employment outside of the agriculture business (Swedish Board of Agriculture, 2025b).

Since the 1960’s, the farms have grown bigger and specialised in areas like cereal production, dairy, egg or pig production (Goncalves et al., 2021; Stockvall Carlsson, 2021; Röös et al., 2023; Berninger et al., 2026). Many primary producers are organised in cooperatives in Sweden, with integrated food processing (European Commission, n.d.g). A more fragmented sector is the fruit

and vegetable section, with only 20% produced nationally (Röös et al. 2023). Table 1 shows the distribution of the most common agricultural crops in Sweden 2025, and how much of the agricultural land that was used to grow them (The Swedish Board of Agriculture, 2025b).

*Table 1: The distribution of the most common agricultural crops in Sweden 2025*

| Crop | Hectare, 2025 | Percentage of the total arable land |
|---|---|---|
| Cereals [1] | 1 010 100 | 40,0% |
| Pasture and animal feed [3] | 1 134 000 | 27,0%[4] |
| Lay-land | 116 900 | 3,9% |
| Rapeseed and Rybs | 111 600 | 3,7% |
| Legumes [2] | 43 600 | 1,7% |
| Others [5] | 48 700 | 1,6% |
| Potatoes | 26 100 | 0,9% |
| Sugar beets | 25 500 | 0,9% |
| Unspecified land [6] | 10 500 | 0,4% |

[1] Includes wheat, oat, barley, rye and mixed grains
[2] Includes peas, beans, brown beans, canned peas, fababeans and others
[3] Includes corn and green forage
[4] Calculated by extracting pasture land and divided the remaining sum with total arable land
[5] Includes seed cultivation, seed flax, energy forests, horticultural crops and all other minor field crops not mentioned in the table
[6] Un-specified land that no EU funds are applied for.

Furthermore, four big companies rule over 95% of the retail market and have retail shops all over Sweden, but the storage and transshipment centers are all located in the southern parts of Sweden (Swedish Food Agency, Swedish Board of Agriculture, National Veterinary Institute 2025). In Sweden, the big companies with 250+ employees have the majority of turnover but over 90% of the food processing companies and retailers have fewer than 20 employees (Röös et al. 2023).

Municipalities and regions serve about 3 million portions of food Monday to Friday in public kitchens. It is an important societal function that one fifth of the Swedish population rely on on a daily basis (Swedish Government 2024b). Municipalities and regions therefore have an important responsibility to prevent, handle and withstand crises and accidents, both in peace and in crisis (Swedish Food Agency, Swedish Board of Agriculture, National Veterinary Institute 2025).

According to the report "Recipe for resilience”, published by The Swedish Food Federation (Swedish: Livsmedelsföretagen), an association that represents 750 Swedish food companies, there are six crisis scenarios that threaten the Swedish food system. These include 1) extreme weather events, which threaten crop production, water resources and risk damaging agricultural land. 2) Infrastructure collapse, which would affect the consumer’s access to food if there is power supply shortage, borders or ports close, or roads or railways get damaged. 3) Digital infrastructure collapse, which could shut down both production and supply chain since the Swedish food sector is highly digitalised. 4) Geopolitical crises, which involves trade sanctions

and international conflicts, which would affect import and export and could lead to increased food prices and shortages of certain produce. 5) Epizootics, that can wipe out large parts of animal production and 6) Pandemics, which risk affecting labor and logistics across the entire food system (Swedish Food Federation 2025).

The current Swedish food system is built on just-in-time production and distribution, making it vulnerable in times of crises and war (Swedish Food Agency, Swedish Board of Agriculture, National Veterinary Institute 2025). The Swedish government assesses the risk of import and trades being completely shut down in crises and war as unlikely due to Sweden's membership in EU and Nato. But, recent experiences from the Covid-19-pandemic and the war in Ukraine showed the big impact and vulnerability of the supply chain, when parts of it were disrupted.

Multiple sources have defined regenerative agriculture as a system less dependent on external inputs, using practices to restore soil health, sustainable water management, increase biodiversity and carbon storage (BSAG, n.d; Daverkosen et al. 2022; Stockvall Carlsson 2021; Gosnell et al. 2019; Anderson and Rivera-Ferre 2021). Regenerative agriculture has also received attention from researchers, politicians, producers and retailers in recent years because of its contribution to climate action plans (Newton et al. 2020; Daverkosen et al. 2022; Gosnell et al. 2019). There is no published definition of regenerative agriculture (Newton et al. 2020; Daverkosen et al. 2022; Shennan-Farpón et al. 2025) but the Intergovernmental Panel on Climate Change (IPCC) recognised regenerative agriculture as a sustainable land management practice that can build resilience of agro-ecosystems (IPCC 2019). Furthermore, EIT Food - a knowledge and innovation community established by the European Institute of Innovation and Technology (EIT), has initiated a series of activities for farmers, consumers and agri-food businesses to promote and support the transition towards regenerative methods in Europe. The initiative is collected under the collective term 'Resilient Agriculture' and supports activities at farm, landscape and system scale, making food systems more adaptive and less fragile while reducing climate and production risks (EIT Food, n.d)

However, since the word 'regenerative' means "the capacity to bring into existence again" (Rhodes, 2017), it highlights that regeneration cannot rely solely on farm-level practices, but requires the entire food system to be regenerative. A regenerative food system requires the current food systems focus on profits and yields (Anderson and Rivera-Ferre 2021) to be replaced by methods that shift the business mindsets to include regenerative success additionally to the current financial success (Keesstra et al. 2018). Furthermore, linear flows must be replaced by circular flows that considers the complexity of the multi-level system (Selvefors and Renström 2024) and that keep the resource consumption within planetary boundaries (European Commission, n.d.a). This highlights the need to view regenerative methods as a shared responsibility among all actors, rather than primarily a responsibility of farmers.

Table 2 defines key conceptions used in this report. The key conceptions have been included in previous research within this research area, which has analysed how regenerative agriculture affect farm-level resilience (Gosnell et al. 2019), how food systems can build resilience (Rimhanen et al. 2023; Singh & Dwivedi 2025), and the relationship between resilience and sustainable food systems (Arimany-Serrat et al. 2024; Paredes-Rodríguez et al. 2024). This study will analyse how regenerative methods affect the food system from "fork to farm". The aim of this study is presented in section 1.2.

*Table 2: Key conceptions used in this report*

| Keyword | Conception | Reference |
|---|---|---|
| Resilience | refers to a system's long-time capacity to deal with disturbance or change while maintaining its basic functions and structures, and to continue to develop | (Gonçalves et al. 2021) |
| Sustainable | something is sustainable if it can be maintained over time without depleting resources or compromising future conditions. It is commonly understood as the capacity to endure or continue | (Rhodes 2017) |
| Regenerative | the word 'regenerative' means "the capacity to bring into existence again" | (Rhodes 2017) |
| Regenerative food systems | A food system approach that goes beyond sustainability by aiming to actively restore and improve ecological, social and human health. It focuses on creating multiple forms of value, strengthening ecosystem self-renewal, enabling circular resource flows and supporting long-term resilience through collaboration among food system actors | Anderson & Rivera-Ferre (2021); Salvefors & Renström (2024); Keesstra et al. (2018) |
| Regenerative agriculture | In this report, the definition provided by EARA (2023) in section 3.2 will be used when referring to regenerative agriculture | EARA (2023) |

### 1.2 Aim

The aim of this study is to analyse how regenerative methods can strengthen the resilience of the Swedish food system, with respect to food production capacity and resource independence during climate-related and geopolitical crises.

### 1.3 Objective and research questions

The objective of this study is to identify the key vulnerabilities in the Swedish food system related to climate change and resource dependency and investigate how regenerative methods can address these vulnerabilities.

This study, therefore, aims to answer the following research questions:

*How can regenerative methods contribute to increased resilience in the Swedish food system, and what challenges arise in the value chain after primary production?*

*Sub-questions:*

1. *What characteristics of regenerative agricultural methods contribute to resilience at the farm level?*
2. *How do regenerative methods affect flows, volumes and standardisation in the downstream stages of the food system?*
3. *Which actors are identified as keys and bottlenecks in a regenerative transition?*
4. *What types of investments and responsibilities emerge in the literature and interviews?*

# 2.0 Methodology

The study was conducted during the Spring Semester of 2026 at Lund University. The study is an exploratory, abductive qualitative study that combines a literature review with semi-structured interviews (Patel & Davidson 2019, p. 27, 52–56, 74, 105). A qualitative approach was selected because the purpose of the study was to understand how regenerative methods can contribute to increased resilience in the Swedish food system, including the perspectives, experiences and challenges of different actors involved in the transition. Since food system resilience is influenced by social, economic and practical factors, a qualitative design was considered suitable for exploring relationships and underlying mechanisms rather than quantifying isolated variables.

The exploratory design was chosen because regenerative food systems represent an emerging field where definitions, applications and implementation pathways are still developing. The abductive approach enabled an iterative process between existing scientific knowledge and empirical observations, where the literature review provided concepts and theoretical perspectives that guided the interviews, while the interview findings contributed to a deeper understanding of how regenerative methods would affect the Swedish food system (Patel & Davidson 2019).

The research approach is hermeneutic, with the aim of interpreting and understanding how different actors perceive opportunities and challenges related to a regenerative transition (Patel & Davidson 2019, p. 32–35). A hermeneutic perspective was therefore suitable since the study investigates multiple perspectives from actors positioned differently within the food system.

The literature review was conducted to establish the theoretical foundation of the study by identifying characteristics of regenerative methods, their potential contribution to resilience, and challenges related to implementation. However, understanding a transition towards a regenerative food system also requires knowledge of practical conditions, actor relationships and potential barriers within the food system. Therefore, semi-structured interviews were conducted with actors from different parts of the Swedish food system to capture empirical insights and experiences.

The combination of these methods was selected to address the research questions by connecting theoretical knowledge with practical perspectives. The literature review contributed to understanding how regenerative methods may influence resilience, while the interviews enabled investigation of how these methods relate to actors, responsibilities, investments and potential bottlenecks throughout the food system. Together, the methods provided a broader understanding of both the opportunities and challenges associated with developing a more regenerative and resilient Swedish food system.

## 2.1 Literature review

The literature reviews were conducted using Scopus. The inclusion requirements were peer reviewed articles published between 2000-2026, and subject areas within environmental science, agricultural and biological science, and social science. Soil research conducted outside of Europe and in non-temperate regions were excluded.

The following keywords were used when conducting the literature review: ‘regenerative’, ‘regenerative agriculture’, ‘agriculture’, ‘definition’, ‘meaning’, ‘soil health’, ‘integrated weed management’, ‘many little hammers’, ‘profitability’, soil carbon sequestration’, ‘carbon

farming', 'soil carbon credits', 'biodiversity', 'soil biodiversity', 'knowledge', 'soil', 'adoption', 'soil carbon credits', 'grazing'.

'Grey literature' was also found through the Swedish government and government assigned agencies, European Union, universities and industry organisations' published reports and student papers, and from sources used as references in these.

Additionally, workshops within the topic were attended, see table 3 for specific details.

*Table 3: Information about attended workshops*

| **Workshop** | **Organisation** | **Details** | **Reference** |
|---|---|---|---|
| How can tomorrow's farmers ensure a sustainable food supply? | Formas | Online, 12th of February 2026 | (Formas 2026) |
| Pathways towards regenerative agriculture | Mistra Food Future Transition lab | Online 27th of February 2026 | (SLU 2026) |
| Regenerative food value chains | Regenerator | Online 27th of March 2026 | - |
| Discussions on emergency preparedness | Skurups municipality | In-person, 16th of April 2026 | - |
| Public procurement and Swedish dietary guidelines | The federation of Swedish farmers (Swedish: Lantbrukarnas riksförbund [LRF]) | Online 23rd of April 2026 | (LRF 2026b) |
| Processing and alternative sales channels | Swedish carbon storage (Swedish: Svensk kolinlagring) | In-person at Kullabergs Vingård. 23rd of April 2026 | - |

### 2.2 Semi-structured interviews

The semi-structured interviews followed the five step guide provided by Kallio et al. (2016), to ensure alignment between the research questions and the interview design. The five steps included investigating the appropriateness of using the semi-structured interview method, conducting a literature review to deepen the theoretical background, conducting a preliminary interview guide which included primary and secondary open-ended questions, pilot-testing the interview guide, and finalising the interview guide, based on the insights from the pilot-testing (Kallio et al. 2016).

The pilot-interview guide was structured around ten main topics with primary and secondary open-ended questions. The themes were identified through the literature review and the research questions, with the aim of developing broad questions applicable to all actors within the Swedish food system. The main topics are presented in appendix 2. The questions were designed to allow different actors to provide their perspectives on the topics based on their own experiences and position within the food system.

After pilot-testing the interview guide, adjustments were made to improve the relevance and clarity of the questions and separate interview-guides were developed depending on which actor got interviewed. For example, questions related to regenerative methods were modified depending on whether the interviewee represented primary production, industry, retail, research, or another part of the food system. The pilot interview also showed the need to further distinguish between farm-level effects and downstream value chain effects, which resulted in more specific follow-up questions for different actors. Appendix 2 provides a condensed version of the different interview guides.

The interviewees were selected based on their role in the Swedish food system, and the aim was to include actors connected to the study's intended focus and research questions. The interviewees included actors from primary production, processing industries, research, advisor services, industry organisation, retailers, municipality and banks. Figure 1 gives an overview of how the food system is built and which areas have been included in the study. The excluded areas presented in figure 1 were excluded from the study due to the limited scope and timeframe of the thesis. Including these actors would have expanded the study beyond its intended focus and required additional methods. In particular, consumers were excluded because understanding consumer behaviour, preferences and willingness to change would require a quantitative approach to generate representative insights at the population level. Since this study applied an exploratory qualitative design focusing on key actors within the food value chain, consumer perspectives were considered outside the methodological scope of this research.

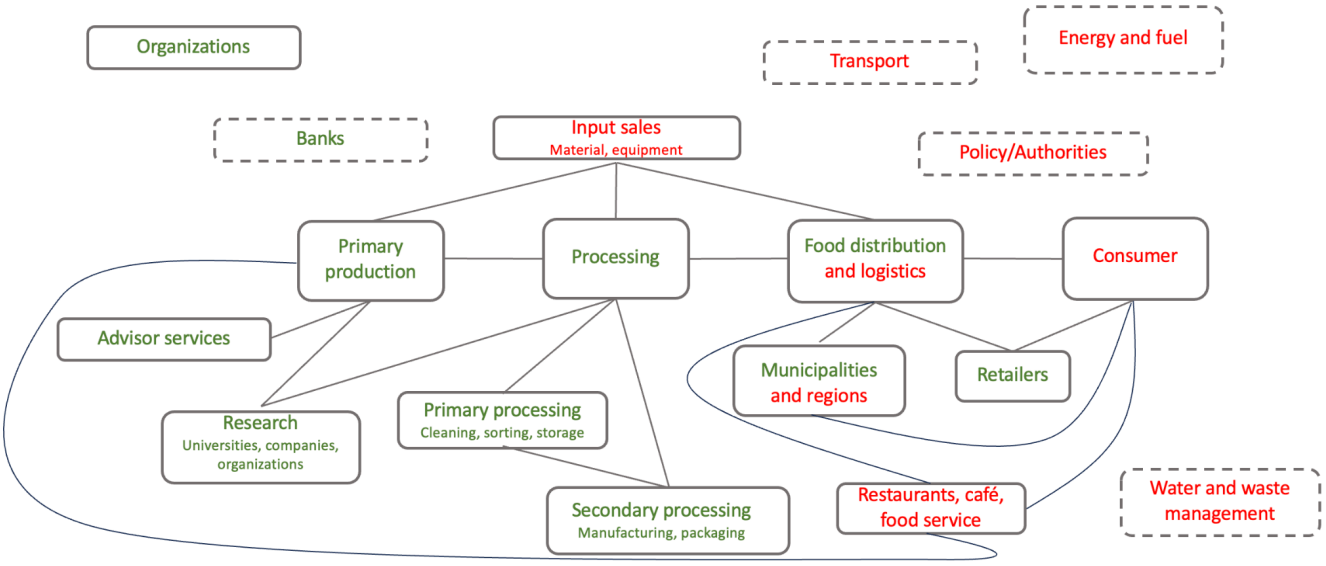


*Figure 1: An overview of actors in the food system, based on four central areas in the food system identified by EIT Food. Areas written in green texts are included in the study. Areas written in red text are excluded in the study. Areas with dotted outlines are involved in more than three areas of the food system.*

The interviewees were found through attendance in workshops, personal network and google searches. Some interviewees were recommended when conducting the interviews. All companies were researched before being contacted, to make sure that the interviewees provided a diverse variety of backgrounds and experiences. The initial goal was to have one large and one small

actor from the same part of the food system to represent both perspectives. Although the author's personal network was used to identify potential interviewees, the network primarily served as a gateway to relevant actors within the Swedish food system rather than as a source of direct personal contacts. Individuals within the author's network who possessed extensive professional connections in the food sector were asked to suggest relevant actors. Consequently, most interviewees had no prior personal relationship with the author. The only exception was the family farm farmer who had a family connection to the author. To minimise the risk of bias, the same interview procedure and interview guide were applied to all participants regardless of how they were recruited.

The interviewees were contacted through email, phone or social media. In total 27 people were contacted and asked to be interviewed. Out of them, two answered saying they were not able to participate due to time constraints. One answered that they did not have enough knowledge about regenerative methods to represent the company in an interview. Five people forward the email to colleagues more suitable for the interview. Three actors did not answer the email that was sent out. In total, 18 replied and agreed to be interviewed (62%).

The interviews followed the ethics of science and included an informative introduction (see appendix 1). The participants were informed about how the data would be used, that it was allowed to end the interview at any time and that the questions were not mandatory. If the participants gave consent to this, the interview was conducted (Patel & Davidson 2019, p. 84). The interviews were conducted in March and April 2026, lasting 32-66 minutes. The interviews were conducted online through Zoom, phone call or in person, and were recorded with consent. 17 of the 18 interviews were conducted in Swedish and have been translated in this report. The audioclips were transcribed using Klang.ai, an AI technology that is developed and operated in Sweden with models adapted to European data protection requirements (Klang, n.d).

The material was analysed according to the phenomenographic analysis method, which includes an analysis divided into four stages (Patel & Davidson 2019, p. 38). The stages include analysing the collected data, identifying keywords and topics, categorising the keywords into descriptive categories and studying the underlying structure of the categories (Patel & Davidson 2019, p. 38). This was supported by the use of NotebookLM, an AI-based tool for organising and exploring qualitative data, where the uploaded material remained private (NotebookLM, n.d.). The chat function was used to ask specific questions related to the research questions and identify relevant sections within the interview transcripts. The tool provided responses with traceability to the specific sections in the uploaded material, see appendix 3.

The AI-generated responses were not used as the basis for the analysis, instead the original transcript sections referred to by the tool were reviewed and interpreted by the author. This approach was applied to reduce the risk of AI-related limitations, such as oversimplification, loss of context, or misinterpretation of interviewees' statements. To further reduce this risk, similar questions were asked using different formulations and repeated throughout the analysis process to identify whether the same patterns and perspectives emerged across the dataset.

The use of AI also provided additional support by identifying details and connections within the transcripts that could have been overlooked during manual analysis. However, the categorisation, interpretation and final analysis of the material were conducted by the author. Due to the design of the interview guide, key topics and keywords were already identified, while the analysis

remained iterative and additional dimensions emerged throughout the process. Table 4 describes the interviewees and presents the personal identifiers used in this study.

*Table 4: Information about the interviewees*

| **Role in the food system** | **General background about the company / organisation*** | **Role in the company / organisation** | **Products** | **Interview details** |
|---|---|---|---|---|
| Farmer, 32 years old<br><br>**Personal identifier**<br>*FF farmer* (family farm) | Family farm, 380 hectare, conventional agriculture | Farm manager, machine operator, handles the accounting.<br><br>Has a side business of collecting sugar beets. | Wheat, rapeseed, barley, sugar beets, ley, peas, potatoes, red clover (+cover crops) | In person<br><br>36 minutes |
| Farmer, 44 years old<br><br>**Personal identifier**<br>*CA farmer* (conservation agriculture) | Family farm, 440 hectare, conservation agriculture | Farm operator | Wheat, barley, oat, rapeseed, grass seed (+cover crops) | Online<br><br>50 minutes |
| Farmer, 64 years old<br><br>**Personal identifier**<br>*CF farmer* (collaborative farm) | Three big farms collaborate together as one company, 1500 hectare, conventional agriculture | CEO, chairman at Swedish Grain Association | Wheat, spring wheat, barley, spring barley, sugar beets, fava bean, ley, seed production (+cover crops) | Online<br><br>58 minutes |
| Farmer, 37 years old<br><br>**Personal identifier**<br>*RA farmer* (regenerative agriculture) | Bought the farm in 2020 25 hectares, has 1100 chickens and a small hurdle of cows. Conducts rotational grazing on pasture. Regenerative agriculture farm | Animal caretaker | Eggs | Phone call<br><br>57 minutes |
| Advisor, worked in the role since 1997<br><br>**Personal identifier**<br>*Advisor* | Member-led agricultural organisation that leads projects, field trials, and work on developing rural areas and Swedish agriculture. | Crop cultivation advisor for mostly conventional farmers | - | Online<br><br>46 minutes |
| Researcher, former advisor within conventional and organic agriculture, agronomist<br><br>**Personal identifier**<br>*Researcher* | Research institute<br><br>Collaborates with academia, business and the public sector, nationally and internationally. | Researcher in digitalising and innovations in the agricultural sector | - | Online<br><br>44 minutes |

| | | | | |
|---|---|---|---|---|
| Agronomist doctor<br><br>**Personal identifier**<br>*Interest organisation* | Membership-based organisation for farmers and agricultural businesses | Work with research and development questions within the agricultural sector | - | Online<br><br>32 minutes |
| Industry<br>(large scale)<br><br>**Personal identifier**<br>*Cereal industry* | Agricultural cooperative, operates within agricultural, bioenergy and food production. Has its own sustainability programme and connected label | Coordinator for internal sustainability programme | Cereal industry | Online<br><br>49 minutes |
| Industry<br>(small scale)<br><br>**Personal identifier**<br>*Beverage industry* | Started 10 years ago, produces organic-certified, fermented, sparkling non-alcoholic beverages | Founder and CEO, chief technical officer | Fermented beverages | Online<br><br>49 minutes |
| Industry<br>(large scale)<br><br>**Personal identifier**<br>*Bread industry* | Big bread producer in Sweden, family owned business | Two interviewees: 1: Sustainability manager<br><br>2: Business developer on an subsidiary company | Bread and sandwiches | Online<br><br>50 minutes |
| Industry<br>(large scale)<br><br>**Personal identifier**<br>*Cereal mill* | Cereal mill that has initiated a cooperative regenerative agriculture programme | Sustainability manager | Cereal industry | Phone call**<br><br>21 minutes |
| Retailer<br>(large scale)<br><br>**Personal identifier**<br>*Large retailer* | One of Sweden's leading retail chains. | Agronomist, part of the sustainability team with the focus on biodiversity and sustainability within agriculture, aquaculture and fisheries | Standard retailer assortment, slightly differentiated depending on store concept | Online<br><br>37 minutes |
| Retailer (small, independent actor) and restaurant<br><br>**Personal identifier**<br>*Local retailer* | Small local retail shop "a country market hall", with café, bakery and restaurant in the same building | Two interviewees:<br>1: Operational manager<br><br>2: Environmental manager | Offers a small selection of standard assortment and a bigger assortment of products from small, local producers | In person<br><br>66 minutes |
| Farmer, industry and retailer<br><br>**Personal identifier**<br>*Rapeseed industry* | Family farm, 85 hectare, cold-press oil industry producer, farmshop | Administrator, quality and customer service | **Farm**: barley, wheat, linseed, black and white oats, rapeseed, willow<br>**Industry:** Cold-pressed rapeseed and linseed | Written answers in a document ** |

| | | | | |
|---|---|---|---|---|
| | | | oil<br><br>**Retail:** Cold-pressed rapeseed oil products such as sauce, flavoured oil, personal care products | |
| Municipality<br><br>**Personal identifier**<br>*Municipality* | Municipality in southern Sweden. Part of the Viable Cities programme | Environmental strategist, works with environmental and sustainability related questions in the municipality.<br><br>Previously worked at the county administrative board, the Food Academy and with carbon credit consulting | - | Online<br><br>40 minutes |
| Bank<br>(top 10 biggest in Sweden)<br><br>**Personal identifier**<br>*Large bank* | Swedish bank owned by its customers through an economic association. Most of the bank's customers are family or privately owned agricultural or forestry businesses. Profit goes back to Swedish agriculture and forestry. | Two interviewees:<br>1: General Counsel & Chief Sustainability Officer<br><br>2: Member of the sustainability team | - | Online<br><br>47 minutes |
| Bank<br>(small)<br><br>**Personal identifier**<br>*Local bank* | Local bank where locally chosen trustees are ultimately responsible for the bank's operations. Profit is invested in the local community | Two separate interviews:<br>1: Head of marketing & development, and sustainability coordinator<br><br>2: Handles agriculture customers | - | In person<br><br>1: 53 minutes<br><br>2: 42 minutes |

*information in this column has partly been conducted through company/organisation websites
**Were only asked part of the questions in the interview guide

## 3.0 Literature review

This chapter summarises the results from the literature review. It describes the mindset of regenerative food systems, regenerative agriculture and practices commonly used in regenerative agriculture. Additionally, carbon farming and carbon credits are introduced. Furthermore, it describes EU frameworks and regulations related to agriculture and circular economy. The chapter addresses sub-question 1: *What characteristics of regenerative agricultural methods*

*contribute to resilience at farm level?* and partly addresses sub-question 4: *What types of investments emerge in the literature?*

### 3.1 A regenerative food system

A sustainable food system can be centered around four narratives: producing enough food, producing enough nutritious food, achieving global food security and building a system that does not harm the environment (Röös et al. 2023). A regenerative food system goes beyond the sustainable system by also addressing the health of social systems, aiming to positively support community, human and environmental health (Anderson and Rivera-Ferre 2021; Selvefors and Renström 2024). Keesstra et al. (2018) describes the mindset of regenerative economics developed by Kate Raworth, as asking the question 'how many diverse benefits can we layer into this [activity/design/product/service]? Instead of the mainstream business mindset that asks the question 'how much financial value can we extract from this [activity/design/product/service]? This highlights the need to shift the current way of valuing business to include regenerative success additionally to the current financial success (Keesstra et al. 2018). This mindset opens up for exploring new ways of creating value and operating business that must consider the complexity of the multi-level system (Selvefors and Renström 2024). The focus must be to evaluate the long-term effects of the operation, to provide an ecological buffer which supports ecosystem self-renewal. In order to do this, linear resource flows must be exchanged by circular flows, while keeping in mind that a regenerative system is an ongoing process with no end date (Selvefors and Renström 2024). The current food system however, has its focus on profits and yield (Anderson and Rivera-Ferre 2021), and a short-term predatory competition worldview, that rapidly concentrates markets vertically and horizontally (EARA 2023).

Circular economy can be centered around the so-called "R" framework - regenerate, refuse, reuse, re-purpose, recycle, recover and reduce (Pakseresht et al. 2023). However, some circular systems may raise food safety concerns when reusing recycled materials, or food waste hazards such as contamination and zoonotic disease spread. It is therefore important that the circular system remains within regulatory boundaries (Pakseresht et al. 2023).

To keep the resource consumption within planetary boundaries the EU needs to transition to a regenerative growth model (European Commission, n.d.a). This transformation however, is highly dependent on individual food system actors today (Röös et al. 2023).

### 3.2 Regenerative agriculture in Sweden and Europe

Regenerative agriculture, as mentioned previously, does not have an agreed, published definition. In EU literature, phrases like 'sustainable farming practices', 'conservation tillage', 'integrated pest management', 'improve soil organic matter', 'use of cover crops' or 'reduction of fertilizer use' are commonly used, without the mention of regenerative agriculture (Shennan-Farpón et al. 2025). Shennan-Farpón et al. (2025) mentions two global literature reviews who researched how regenerative agriculture was defined in peer-reviewed published papers. One of which was conducted by Newton et al. (2020), who found that the definitions and descriptions could be categorised into three themes: processes (including practices and/or principles) outcomes, or a combination of the two. Practices that were frequently mentioned were 'working with nature', 'soil fertility practices', 'integrated crop-animal systems', 'integrated pest management' and 'carbon sequestration practices' which includes cover crops, compost, no-till, raised beds, among others. The most mentioned outcomes were 'carbon sequestration', 'improved soil health', 'water resources' and 'social and/or economic wellbeing of communities', and 'increased

biodiversity' aspirations. And articles that combined the two referred to processes that 'reduced or eliminated the use of chemical inputs', 'restore holistic, regenerative resilient systems by supporting ecosystem functionalities', including terms such as 'soil water retention', and practices such as 'crop rotation', 'biological pest control' and 'reduced tillage' (Newton et al. 2020).

European Alliance for Regenerative Agriculture (EARA), an European organisation founded by regenerative farmers that provides guidance for public and private stakeholders with the regenerative perspective, mentions four main principles for regenerative agriculture: 1) contributing to ecological, social and economic safety and health 2) being context-specific rather than based on universal practices, 3) representing an ongoing life-enhancing process rather than a fixed end state, and 4) taking a systemic approach to regeneration (EARA 2023). The context-specific approach allows synthetic pesticides as a temporary necessity. This allows the focus to be achieving the overall health of the farm and ecosystem over externally determined allowed practices, but the long term goal should be a phased-out approach of synthetic pesticides (EARA 2023).

Al-Kaisi and Lal (2020) highlights the importance of looking beyond yield per hectare, to instead look at margins within the agricultural system. The economic advantage with regenerative systems is connected to the low-input system that has high soil nutrient supply, lower need of agrochemicals and less need of equipment and the labor cost connected to it. The research identified four factors that positively influenced the economy for regenerative farmers, which included 1) ⅓ lower operating costs 2) more resilience in extreme weather events, 3) higher net income if implementing direct sales with consumers and 4) higher net income where premium prices are available (Al-Kaisi and Lal 2020). EARA (2023) reported in their white paper 'Together for regenerative agrifood ecosystems' a 70% higher on-farm profit and 45% higher nutritional density in the crops grown, compared to before regenerative practices were introduced (EARA 2023).

Rhodes (2017) describes regenerative agriculture as a system that not only sustains but improves soil, that is; 'does no harm' to the existing soil, but enhances and regenerates soil, the soil quality and ecosystem services. A transition towards a regenerative farming system revolves around three main themes: financial, knowledge related, and social-political and cultural (Shennan-Farpón et al. 2025). Drivers for a shift include socio-cultural and individual values such as ecosystem services, increased biodiversity, visual identities of agricultural landscape and political ideology. However, several barriers have been identified in such a transition which may explain its low adoption across Europe. These include financial barriers that involve investment costs due to the need of new, specialised equipment, investments in educated labour and financial risks due to uncertainty around yields and productivity (Shennan-Farpón et al. 2025; Sher et al. 2024). Furthermore, the lack of an agreed definition of regenerative agriculture leads to multiple barriers including the uncertainty of acceptance of synthetic inputs in a regenerative system, such as herbicides, specifically glyphosate, which some farmers argue would make a regenerative system very challenging and resource heavy. The lack of an agreed definition also hinders the farmers and the scientific understanding of its potential benefits, impacts and limitations which also contributes to difficulties in verifying and monitoring the outcomes and effectiveness of the regenerative agriculture methods. Concerns have also been raised about the risk of the term being misused, which could cause 'greenwashing' by companies in the food system (Shennan-Farpón et al. 2025).

### 3.3 Sustainable soil management practices

Soil has many important functionalities and is the foundation of agriculture and food production. Sustainable soil management is defined as a system that maintains or enhances soil health, biodiversity, soil fertility and resilience (Hvarregaard Thorsøe et al. 2023). It includes practices such as crop diversification, no-till, crop residue management and cover cropping (Johansson et al. 2025). IPCC (2019) identified bottlenecks and barriers that slows down the transition towards sustainable environmental and land practices. They include 1) limited access to information, knowledge and finance for scaling up within the area, which includes new technologies, payments for ecosystem services and insurance. 2) Weak enabling environment from policies, legal and institutional framework and 3) Inadequate learning from project cycles, especially in areas regarding monitoring and evaluating the project impacts (IPCC 2019). Furthermore, due to the profitability challenges among farmers, implementing sustainable soil management that has not been proven productivity or yield stability is often not possible (Hvarregaard Thorsøe et al. 2023).

Soil management is a complex area that often includes trade-offs between yield optimization, greenhouse gas emissions and biodiversity protection. The large diversity of soils and soil properties as well as different pedo-climatic conditions and chemical, physical and biological processes in the soil adds complexity to soil management. Additionally, each farm has access to different machinery, inputs and grows different varieties of crops (Hvarregaard Thorsøe et al. 2023). The following sections will review literature describing practices or outcomes that are mentioned when describing sustainable soil and land management, regenerative agriculture and/or are mentioned in the European Common Agriculture Policy (CAP).

#### *3.3.1 Soil health*

The phrase soil health is often mentioned in various contexts when discussing or describing sustainable soil management or regenerative agriculture (Röös et al. 2023; Newton et al. 2020; European Commission, n.d.e; Barrineau et al. 2025; BSAG, n.d; Daverkosen et al. 2022; Stockvall Carlsson 2021; Gosnell et al. 2019; Anderson and Rivera-Ferre 2021; Shennan-Farpón et al. 2025; EIT Food, n.d; EASAC 2022; Marcelino et al. 2024; Keesstra et al. 2018; Hvarregaard Thorsøe et al. 2023; Mooney et al. 2023). Soil health describes the capacity of soil to act as a dynamic, living system that sustains productivity, maintains environmental quality, and promotes plant, animal, and human health. This is conducted through interactions that support ecosystem functions, biodiversity, and resilience over time (Lasina et al. 2025; Campbell et al. 2025). One way of maintaining soil health is through addressing degradation threats (Campbell et al. 2025). Soil degradation affects about 70% of the soils in Europe, caused by various processes that impact soil function and structure (Lasina et al. 2025; Hvarregaard Thorsøe et al. 2023). These include pollution, erosion, compaction and loss of soil organic matter and biodiversity which affect the soil functionality and the chemical, biological and physical characteristics of soil (Campbell et al. 2025; Hvarregaard Thorsøe et al. 2023). In Northern Europe, the most challenging areas that have big knowledge gaps are soil structure optimization, avoiding nitrous oxide/methane emissions, improving soil nutrient retention and nutrient use efficiency (Hvarregaard Thorsøe et al. 2023). Furthermore, there is a lack of long-term experiments evaluating soil health when using different management practices. There is also limited knowledge in three main areas: 1) organic matter and nutrient management 2) crop systems and diversification, and 3) the impacts of tillage and compaction on soil processes, carbon storage and greenhouse gas emissions (Hvarregaard Thorsøe et al. 2023).

Different indicators can be used for assessing the soil health or soil quality, to assess the capability to deliver specific functions or ecosystem services (Lasina et al. 2025; Campbell et al. 2025). Which indicators that are suitable to measure highly depends on which crop, type of soil, climatic zones and several other variables, which typically requires a diverse set of indicators to be used when making the assessments (Campbell et al. 2025).

### *3.3.2 Soil organic matter*

Soil organic matter (SOM) contains about 58% carbon (Behaderovic & Råberg 2023) and has many important functionalities. It contributes to the soil's water holding capacity, affect the soil structure and acts as an organic fertilizer and nutrient source for soil microorganisms (Behaderovic & Råberg 2023; Maenhout et al. 2024; Marcelino et al. 2024; Keesstra et al. 2018). The SOM balance is highly affected by environmental and ecological circumstances and the addition of carbon that is applied. Soils in temperate regions with low temperatures and regular rainfall generally have high soil organic carbon content (Al-Kaisi and Lal 2020). Carbon can be applied in the form of organic material, plant residue and/or manure and environmental circumstances impact the decomposition rate of carbon, which accelerates with increasing temperature (Keesstra et al. 2018; Maenhout et al. 2024). A widely reported method for improving SOM is no-tillage, which slows down on-field decomposition of organic matter (Latini et al. 2025). Another method is mulching, which involves applying organic material on top of the soil. This suppresses weeds, act as a nutrient source for beneficial bacteria, insects and fungi, stabilizes soil temperature and reduces soil erosion without competing for water, nutrients and light for the growing crop on the field as cover crops do (Marcelino et al. 2024; Latini et al. 2025; Birthisel et al. 2021).

### *3.3.3 Cover crop*

Cover crops are primarily grown between main crop cycles and are used to improve soil health, enhance soil fertility and reduce erosions (Latini et al. 2026; Maenhout et al. 2024). The plants provide soil microbes with food by releasing compounds such as sugars, amino acids and organic acids through their roots (Latini et al. 2026). By incorporating cover crops in the production, preferably a mix of species, more diverse compounds will be released in the soil which enhances microbial community diversification. This will enhance microbial functions such as nutrient cycling and organic matter decomposition and stabilization (Latini et al. 2026; Maenhout et al. 2024). Although the effect varies depending on soil type and climatic conditions, results shows that long term use of cover crops increased SOM, soil microbial biomass and soil biodiversity as well as improves carbon sequestration and physical properties in the soil, compared with soils without cover crops (Latini et al. 2026; Maenhout et al. 2024). Furthermore, cover crops can be an important weed management tool (Birthisel et al. 2021).

### *3.3.4 Biodiversity*

Human actions have negatively impacted the biodiversity on the planet the last 50 years. Biodiversity is a collective term for all variations in habitats, organisms and organism communities that affect the ecosystem (Berninger et al. 2026). Biodiversity positively impacts nutrient cycling, biological control of plant diseases and pests, crop pollination, carbon storage and soil quality and structure (Berninger et al. 2026; Marcelino et al. 2024; Keesstra et al. 2018). High biodiversity is achieved when the organisms do not have to move long distances between a big diversity of elements such as plants, water, hedges, trees and buildings that can act as habitats

(Berninger et al. 2026). Estimations predict that one species is extinct every seven minutes globally (EARA 2023), and there is a consistent decline in soil biodiversity all over Europe caused by the pressure of intensive agriculture (Keesstra et al. 2018). Climate change, bigger farms, over exploitation of natural resources, reductions in habitat areas by covering ditches, specified farms and less un-touched land areas have decreased biodiversity globally (Berninger et al. 2026; Marcelino et al. 2024).

Life below ground hosts nearly 59% of the Earth's biodiversity, and contributes to the maintenance of multiple critical ecosystem functions and services such as water regulation, carbon storage, erosion control and food production (Köninger et al. 2026; Keesstra et al. 2018). The soil ecosystem also improves the quality of SOM and the mineral interaction of the soil that positively impacts carbon fixation in the soil (Keesstra et al. 2018; Latini et al. 2025). Additionally, it contributes to plant disease control, by competing with the habitat of pathogenic microbes and/or producing toxic (for the pathogens) compounds. Furthermore, plant species have been shown to collaborate with beneficial microbes to improve plant resistance to plant diseases (Berninger et al. 2026). Additionally, legumes and nitrogen-fixing microorganisms form symbiotic relationships that improve soil nitrogen levels (Al-Musawi et al. 2025).

Non-organic fertilizer has been associated with ecosystem disturbance and biodiversity damage that may negatively affect birds, earthworms and microorganisms. By partly replacing synthetic fertilizers to organic fertilizers like manure, biochar, plant residues and compost, the biodiversity damage gets reduced while improving soil properties and soil carbon sequestration (Marcelino et al. 2024).

### *3.3.5 Integrated pest management and biological pest control*

One of the main agricultural practices that is known to cause pollinator decline is pesticide use (Marcelino et al. 2024). Köninger et al. (2026) analysed how pesticide residue impacts the soil biodiversity across Europe. The research found that a critical driver of soil biodiversity are pesticide residues, affecting more than intended targets. Not all effects were negative, highlighting the complexity of the ecosystem and the need to extend the current single-species tests when conducting ecotoxicological assessments (Köninger et al. 2026).

Europe has implemented Integrated Pest Management (IPM) which became mandatory in EU Directive 2009/129/EC (Lankinen et al. 2024). The aim with the directive is to reduce the use of agrochemicals and implement more sustainable and diverse production. This is achieved by using different low risk, low toxicity methods and using synthetic pesticides as a last alternative. Furthermore, when using synthetic pesticides, the aim is to manage the pest population to levels where the negative impact is kept to the minimum, not terminate the population (Lankinen et al. 2024). In Sweden, farmers have to go through training and have the right permits before being allowed to use agrochemicals in a professional setting. Furthermore, the equipment needs to be approved by an authorised inspector, and there are rules regarding storage, safety distances, documentation and potential permits or notification when using specific pesticides in certain areas (Swedish Board of Agriculture, n.d).

Biological control is a method that can replace pesticide use, which involves suppression of pests by their natural predators. Cover crops, flowering strips, trap plants, host plants for predators, repellant plants and biodiverse hedgerows all stimulate biodiversity which can enhance pest biological control and prevent crop losses (Marcelino et al. 2024; Berninger et al. 2026).

### *3.3.6 Crop rotation and diversification*

Designing the cropping system with a large diversification of crops is a well-developed form of sustainable farming (Maenhout et al. 2024). Another sustainable agriculture method is crop rotation, which restores soil quality while breaking pest cycles, increasing yields and reducing soil degradation. Crop rotation refers to a planned sequence of diverse crops, grown in the same field during different years (Al-Musawi et al. 2025). Crop diversification and crop rotation stimulates nutrient cycling and biological activity while improving soil properties. Furthermore, including legumes, perennials and cover crops in the cropping system, can positively impact SOM and prevent carbon losses from the soil (Maenhout et al. 2024; Al-Musawi et al. 2025). However, in farm-trials, the SOM remained unchanged in cropping systems that mainly included cereals (wheat, barley, maize), and less frequently included grass, grain legumes, forage legumes and tuber crops (potato or sugar beet) (Maenhout et al. 2024).

### *3.3.7 Reduced tillage and integrated weed management*

No-till or reduced tillage is when the soil is disturbed as little as possible (Marcelino et al. 2024), which reduces labour and fossil fuel consumption due to less need of machinery on the field (Maenhout et al. 2024). This reduces soil erosion and compaction and increases soil organic carbon stocks (Maenhout et al. 2024), but increases weed pressure (Johansson et al. 2025). No-till or reduced tillage allows slow decomposition of organic matter on the field, while reducing surface water evaporation, improving SOM, soil quality, biological activity, and water infiltration (Latini et al. 2026; Marcelino et al. 2024; Birthisel et al. 2021). However, the in-field decomposition also promotes bacterial and fungal community growth (Latini et al. 2026) and most no-till or reduced tillage systems heavily depend on herbicides as weed management tools (Birthisel et al. 2021).

Although weeds are unwanted in agricultural systems due to its impact on yield loss as well as water and fertilizer competition, a broad diversity of weeds is expected to be less competitive to the crop (Marcelino et al. 2024). Westbrook et al. (2024) describes the integrated weed management strategy known as ‘many little hammers’, developed by Liebman and Gallandt 1997. This replaces strong filters such as non-selective herbicides like glyphosate, high levels of fertilization and tillage, with multiple weaker ones that stress weeds at critical points of the life cycle (Westbrook et al. 2024; Birthisel et al. 2021). Weaker filters include mulching, cover cropping, strategic species and cultivar selections with fast-growing traits, transplanting or seedbank management by stimulating germination and then terminating the growth prior to crop planting (Birthisel et al. 2021). Using a combination of weaker filters will reduce the strength of selection on problematic weed traits such as fast-growing, annual and herbicide-resistant weeds that are damaging to crops, while promoting weed diversity. Diverse weed communities are often associated with desirable agronomical and environmental outcomes that can promote and preserve ecosystem services such as pollination and biological pest control. But, more research is needed within the area (Westbrook et al. 2024).

### *3.3.8 Carbon sequestration*

Carbon sequestration refers to mid- to long-term carbon storage in the soil through plants or other organic matter (Latini et al. 2026; Maenhout et al. 2024). This has been suggested as a method to reduce climate change mitigation on agricultural land that is cost-effective and sustainable (Maenhout et al. 2024). The amount of soil organic carbon can be used as a soil quality indicator, as it has an impact on ecosystem services and soil functions. But, the carbon

cycle is closely linked with the nitrogen cycle, resulting in a complex situation with trade-offs between $CO_2$ reduction and potential nitrogen leaching or $N_2O$ emissions. Microbial deterioration of chemical fertilizers, manure and legume crop residue all result in nitrogen inputs on agricultural land, but also contributes to $N_2O$ emissions (Latini et al. 2025; Maenhout et al. 2024; Behaderovic & Råberg 2023), a gas 298 times stronger than $CO_2$ (Latini et al. 2025). However, when crops and microbes simultaneously compete for available nitrogen, $N_2O$ emissions tend to decrease (Latini et al. 2025).

#### *3.3.9 Grazing*

30% of Europe's agricultural area are permanent grasslands (Gilmullina et al. 2020). Grazing animals on pasture is a way to improve biodiversity, decrease greenhouse gas emissions and increase carbon sequestration (Gilmullina et al. 2020; Mooney et al. 2023). Rotational grazing refers to livestock being frequently moved over the pasture, which allows the crops in the grazed area to recover while minimising the risks of soil compaction, nutrient depletion and plant biodiversity loss. Furthermore, nutrients and organic matter are introduced to the area through animal manure, which benefits soil biodiversity, improves SOM and enhances enzymatic activity (Al-Musawi et al. 2025). Furthermore, livestock can reduce agricultural systems' vulnerability to extreme weather events, fostering farm resilience and self-sufficiency on fertilizer, while the animals feed on grass that stimulates carbon sequestration when re-growing (Mooney et al. 2023).

### 3.4 Carbon credits

A key part of the EU’s strategy to reach the climate neutral goal by 2050 relies on carbon farming (European Commission, n.d.h). Carbon farming involves carbon sequestration by plants, which also contributes positively to soil health, as previously described. Economic incentives is the most effective way of removing barriers for sustainable land management practices together with policy implementation (IPCC 2019). In the current CAP (2023-2027), it is possible to apply for yearly payments for implementing cover crops for carbon sequestration (Behaderovic and Råberg 2023). Johansson et al. (2025) describes carbon credits through carbon farming as the fastest-growing project categories on the voluntary carbon market, where individuals and companies can compensate for their emissions by purchasing carbon credits (Johansson et al. 2025). This opens up for new socio-environmental dynamics for the agricultural sector, however, uncertainties related to verification, measurements and predictions raises concerns regarding the climate-mitigation reliability (Johansson et al. 2025; Behaderovic and Råberg 2023).

It is estimated that one tonne of $CO_2$ remains in the atmosphere for 100 years, compared to $N_2O$ that breaks down in less than 10 years. Because of this, it's suggested that the sequestered carbon in the carbon credits that is not permanent, should be divided on a 100 year period (Behaderovic and Råberg 2023; Johansson et al. 2025). Furthermore, it is suggested that the emission reduction should be caused by the carbon farming programmes, not by general land management practices. Additionally, no leakage or additional emissions should be caused by the carbon credit programme, which requires reliable and affordable scientific measuring methods, that does not yet exist (Johansson et al. 2025; Behaderovic and Råberg 2023). However, there are different certifications and actors on the market with diverse requirements on carbon credits, which is why the EU commission highlights the need of monitoring, verification and reporting (MVR), to improve the quality of carbon credits and MVR methods (Behaderovic and Råberg 2023).

## 3.5 Regenerative EU policies, regulations and strategies

Rising global temperatures will cause major climate change impacts to the ecosystems, people and economies. This is already causing floods, droughts, extreme heat, forest fires and agricultural losses in Europe today (European Union, n.d.a, EIT Food, n.d). The European Union is therefore committed to reach climate neutrality by 2050, which includes multiple policies collected under the European Green Deal. The policies include all areas of society, and diverse strategies have been developed within the areas to address the transition towards a greener European Union (European Commission, n.d.i). The Circular Economy Action Plan aims to separate resource use from economic growth, to reduce resource extraction and processing and therefore address the biodiversity loss and water-stress caused thereof. This supports a regenerative growth model (European Commission, n.d.a). The Farm to Fork strategy aims to ensure a resilient, sustainable and competitive EU agriculture. The aim is to provide support systems to stabilise farmer income, attract young people to start agricultural business and facilitate investments towards a sustainable and innovative agriculture sector (European Commission n.d.f). The Biodiversity strategy has led to the launch of the EU's first ever Nature Restoration Regulations, which includes objectives for long-term nature recovery in the EU (European Commission, n.d.g). However, some policies provide trade-offs, for example conversion of arable land to grassland to reduce $CO_2$ levels and increase biodiversity, which results in a decrease of food production (EASAC 2022).

According to Gosnell et al (2019), more and more research indicates that a fundamental change in agriculture is needed, including social, psychological and economical aspects of decision making, in order to improve the overall resilience of the agricultural ecosystem (Gosnell et al. 2019). A statement that is backed by reports published by organisations within the food systems, including IPCC (2019), EARA (2023) and EIT Food (n.d). Shennan-Farpón et al. (2025) highlight the limited discussion of how policy and practice interact in relation to sustainable or regenerative agriculture. Previous studies indicate that these discussions tend to prioritise economic outcomes, while farmers' decision-making receives less attention. This suggests that a better understanding of farmers' motivations is necessary for the effective design and implementation of policies (Shennan-Farpón et al. 2025).

### *3.5.1 Sustainability goals*

In 2015, Agenda 2030 was signed and agreed by the United Nations which includes 17 global Sustainable Development Goals (SDG) and 169 associated targets (United Nations, n.d). Several of the SDG and its associated targets relate to agricultural production and sustainable agriculture, specifically goal 2, 12, 13, 15 (EASAC 2022) and goal 6, 9 and 11 relates to different parts of the food system, see appendix 4 for further details.

### *3.5.2 The EU's Common Agricultural Policy (CAP)*

The EU's Common Agricultural Policy (CAP) is funded and managed at European level and is a partnership between European agriculture, farmers and society. The aim with the policy is to support European farmers while ensuring there is a stable supply of affordable food and improved agricultural productivity. The policy also addresses climate change and sustainable management of natural resources (European Commission, n.d.d).

According to the European Commission (n.d.d), farmers' income is about 40% lower than other non-agriculture sectors and there are big risks associated with the work since the production

cycles are long and the weather highly affects the yield and quality of what is produced. CAP therefore supports farmers through direct payments to ensure income stability, rural development programmes and help with market fluctuations to prevent market crises (European Commission, n.d.d). The ten key objectives for CAP 2023-2027 include preserving landscapes, biodiversity and environmental care, promote climate change action, ensure a fair income for farmers and improve their position in the food chain, support generational renewal and increased competitiveness, protect food and health quality and foster knowledge and innovation (European Commission, n.d.c). The goal is to advance EU agriculture towards a more sustainable agricultural system, where each EU member state elaborate their own strategic plan suitable for the national production conditions and production types (European Commission, n.d.e).

However, a literature review conducted by Gemtou et al. (2024), showed that even though existing EU policies increase European farmers' economic viability and have the potential to positively influence farmers to adopt sustainable soil management practices, the policies also contribute to barriers. Barriers related to complex and bureaucratic procedures that are resource heavy on time and knowledge, with big penalties for mistakes, and financial support that does not cover the costs. Furthermore, the lack of long-term governmental vision and context differentiation payments sometimes hinder sustainable soil management adoption by farmers (Gemtou et al. 2024). Additionally, EARA (2023) presses that CAP is receiving criticism for being unjust, overly bureaucratic, short-term focused, practice-based, and co-responsible for the ill-functioning current agriculture system. At the same time, it is being accused of promoting groups in the current system that own the concentrated market while undermining the interest of people and farming communities, and the ecosystem health (EARA 2023).

### 3.6 Summary

Regenerative food systems present a systematic shift in the business mindset from mainly focusing on extracting financial value to a mindset that considers the complexity of multi-level systems and replaces linear flows with circular flows. Furthermore, regenerative systems go beyond sustainable systems that aim to ‘do no harm’, by also restoring and regenerating the systems. The core practices mentioned in regenerative agriculture are reduced tillage, cover crop implementation, diverse crop rotation and integrated pest management, with the aim to improve soil health and biodiversity. This reduced the dependency of external inputs, created improved resilience against extreme weather events and improved farm profits. Several EU policies collected under the European Green Deal support the implementation of regenerative methods, however the complex and bureaucratic procedures are time consuming with big penalties for mistakes. Furthermore, the financial support the EU provides for farmers does not cover the costs of the operations.

## 4.0 Empirical Results

This chapter presents the empirical results obtained through the semi-structured interviews. The themes presented in this chapter were identified through the analysis of the interview transcripts and were guided by the structure of the interview guide. The initial themes were based on the main topics and keywords identified from the literature review and the research questions, which were used to develop the interview guide. During the analysis process, recurring patterns, similarities and differences between the interviewees’ perspectives were identified and organised into descriptive categories, resulting in the final themes presented in this chapter.

The chapter complements the literature review by providing perspectives and practical insights from key actors within the Swedish food system. Furthermore, it provides insights into what is required to scale up regenerative methods within the food system and addresses the objective and sub-questions presented in section 1.3.

### 4.1 General understanding of regenerative agriculture and regenerative food systems

The majority of the interviewees describe regenerative agriculture related to core practices such as reduced tillage, direct seeding, cover crops implementation, increasing biodiversity, crop rotation, nutrient cycling, soil organic matter, soil health and carbon sequestration. *RA farmer* and *CA farmer* also mentioned the inclusion of animals, *CA farmer* described that the difference between regenerative agriculture and conservation agriculture is animal incorporated into the system, which they do not have. *Interest organisation* mention regenerative methods as a scale, rather than organic or conventional that is either or. *RA farmer* describes regenerative agriculture as a way to work with nature as a guide and *Local retailer* describes it as a system that grows stronger instead of being degraded. *Bread industry* describes it as a system that not only sustains a stable, sustainable level over time, but also regenerates by continuously improving and restoring, thereby creating an upward trajectory. *CA farmer* describes regenerative agriculture and conservation agriculture as replacing steel with biology - that is, using roots and plants to work the soil instead of machines. *Researcher, CF Farmer* and *FF Farmer* all mention that not all methods are suitable for all types of soils, sandy soils for example needs tillage while heavy clay soils benefit from reduced tillage.

The majority of the interviewees mentioned the lack of definition of regenerative agriculture. However, most interviewees agreed that it is based on the principle of rebuilding the ecosystem, regenerating the soils, and maintaining soil fertility. *Interest organisation, Advisor* and *FF farmer* all say that most farmers already work with at least some of these methods. *RA farmer* sees regenerative agriculture as a necessary shift that everyone someday will be forced to make. *CA farmer* mentions that he started with conservation agriculture because he “has not inherited the land from his parents, he is only borrowing it from his children”. *Advisor* sees regenerative agriculture as a new name on already existing good, agronomical praxis, arguing that “there is no business on a dead planet”.

*Local retailer* and *Local bank* describes regenerative systems as circular systems that considers more than natural resources, and also includes the local community. *Rapeseed industry* mentions the importance of motivated staff who feel pride and a sense of belonging, as this encourages individuals to go the extra mile and inspires others. *Bread industry* and *Cereal mill* highlight the importance of collaboration, and *Cereal mill* says that sustainability is a topic that connects businesses across the chain and opens up doors for collaboration.

### 4.2 Regenerative label

Many of the interviewees are conflicted regarding the question: Is a regenerative label necessary? *Researcher, Municipality, Interest organisation, Local retailer* and *Large retailer* questions if the consumers really want another label? *Interest organisation* mentions ‘Svenskt Sigill’s’ attempt and failure to agree on a Nordic regenerative definition and *Cereal industry* asks what baseline should be set for the products to be allowed to be called regenerative if regenerative agriculture is not defined? *Cereal industry* mentions that the further away from the primary production you get, the more the word ‘regenerative’ is used, making them not wanting to implement it to their programme in the risk of it being a trend that soon will be replaced by

another trend. *CA farmer* and *Interest organisation* suggest a scale where the farmer can tick boxes and the more boxes ticked, the higher the sales price for the farmer. *Cereal mill* and *Beverage industry* question this reasoning related to a label, if you apply tillage "sometimes" or use chemical pesticides "sometimes", how do you communicate that to the consumer? *Interest organisation* and *Cereal industry* mention the risk of companies using it as 'greenwashing', due to the lack of definition, certification and available framework. Both banks highlight the importance of third-party verification of potential claims being made, while *Cereal mill* highlights the problems connected to the lack of available frameworks on how to calculate data, and the difficulty of verifying data.

*Advisor* do not think a label is necessary because the practices used in regenerative agriculture do not largely differentiate from common practices used by Swedish farmers today. *Large retailer* do not see the need for a regenerative label, saying that the average consumer does not know what regenerative agriculture is, and that the consumer communication should be centered around 'healthy soils' or similar expressions.

*Interest organisation* says that one benefit of not having a definition is that regenerative farmers would not become a new group of farmers, that once again divide the farming community, causing conflicts like organic and conventional did. *Cereal mill* mention this too, they prefer to not use the word regenerative in their communication to farmers because the word is so foreign to many farmers, and the most extreme versions of regenerative agriculture is far away from their farmers normal practices. On the contrary, *Interest organisation* mentions that if it is not defined or a label is not developed, there is a big risk that food companies use the word regenerative on their products and in marketing, selling the product as a premium product without the farmers getting paid for the extra effort, causing greenwashing.

*Rapeseed industry* and *Bread industry* both think a label is necessary to motivate a higher price for the consumer and *Bread industry* says that a label would enable science-based facts to be communicated. *Rapeseed industry* highlights that sustainable labels are requested from their consumers to help consumers navigate in their purchases. *Local retailer* says that labels need to be easy to communicate, and well known labels like KRAV creates trust in the consumer. *Beverage industry* says credibility is important, and instead of creating a new label, it would be better to integrate it into an existing one, such as KRAV.

### 4.3 Profitability challenges

The low profitability associated with cereal-crop farming potentially hinders farmers from implementing new methods that potentially reduces yield (*FF farmer; CF farmer, CA farmer*). The low profitability of barley crops has made *FF farmer* look at other crops with higher margins. The high price on external inputs and low sales price of produced products has made *CF farmer* grow flowers or ley on pieces of land that is not as profitable due to low water holding capacity. The CAP subsidies on flowers and ley makes it more affordable to grow non-food on these plots (*CF farmer*). *RA farmer* mentions that as a relative newcomer to the business, she actively chose not to do 'traditional farming' due to the high investment cost in expensive machines, the need for large areas of land and the low margins. Not having the big loans connected to buying a big set of machines, and large amounts of land, make it possible to operate a different way compared to the farms that have gotten bigger and bigger over the years (*RA farmer*). *CA farmer* who transitioned to conservation agriculture ten years ago did not notice a yield loss, and said that it did not come with any additional cost either because they were in the

shift of replacing old machines with new ones, and chose machines suitable for the new way of operating. *CA farmer* says that the margins have increased due to less in-field operations with machines, which has almost halved their diesel consumption. Additionally, he has been able to decrease the amount of fertilizer he applies, because of the use of cover crops, crop rotation, and nutrient cycling in the field. *RA farmer* says that the rotational grazing by the animals on ley and pasture have made them not having to plough or re-seed the fields since planting four years ago, the plants have instead grown stronger.

### 4.4 Suggestions on how to increase farmers profitability

The banks both mentioned that their customer risk-assessment is based on the customers likelihood of being able to pay back the loan. A farm that has implemented agricultural methods or made investments which improves farm resilience against extreme weather and is less dependent on external inputs, are more likely to be able to pay back the loan. They could therefore theoretically get a lower interest rate (*Local bank; Large bank*). *Cereal mill, Rapeseed industry* and *Cereal industry* all offer programmes that are voluntary for the farmers to join, where they can choose from a list of practices or methods that benefit biodiversity, reduce greenhouse gas emissions and improve soil health, while getting rewarded with a premium price on their products. *Large retailer* say that they can help farmers transition or implement sustainable methods through sales agreements, for example, if farmers use organic fertilizers instead of synthetic fertilizers and that shift costs more, they get paid that amount extra to cover the cost of the transition. *Municipality* mentions how they as a municipality through public procurement can request specific, locally grown produce such as legumes, or products packaged in a specific way that benefits local producers. *Local retailer* minimise the stages from farmer/producer to consumer, increasing the profitability for both their business and the producers. *RA farmer* sells all her eggs though their farm shop or delivers the eggs personally to restaurants and local small stores. Additionally, she collaborates with a friend who runs his own business and grows vegetables on the farm, while using the animal manure and compost from *RA farmer's* business. Collaboration in different ways are also mentioned by the other farmers, *FF farmer* and *CA farmer* share machines with neighbour farms and *CF farmer* have big grain dryers, so they buy cereals from local farmers and dry it before *CF farmer* sell it. This has caused them to only produce 'export quality wheat' due to logistical and administrative reasons.

### 4.5 Administrative burden

*Interest organisation* mentions that a dairy farmer has 850 rules to cope with. *CF farmer* says that "ten years ago I spent 20% inside at the office and 80% on the field. Now it is the other way around". *CF farmer* says that the financial penalty if he does something wrong with the administration is worse than something going wrong when growing the crops. *FF farmer* agrees, if something is wrong in the documentation, that can lead to penalties per mistake, or heavy reduction of CAP subsidies which is a crucial income for the farm. *CF farmer* also mentions that the CAP always is "one CAP behind", it struggles to keep up. *CA farmer, FF farmer* and *CF farmer* all use external help when applying for CAP subsidies due to the complicated system.

### 4.6 Policies and legislation

*FF farmer* and *Researcher* both say that legislation hinders circular flows of sewage slugs despite the high nutrient content. *RA farmer* mentions that the legislation for packaging eggs is made for big scale producers, not even having small scale producers in mind. This makes it hard

to navigate as a small producer. *Rapeseed industry* decided to extend their business and was met by a massive pile of documentation requirements from different regulatory authorities, with a handling time of up to five years! “That can make anyone give up” (*Rapeseed industry*).

*CA farmer* highlights that the Swedish government gets re-elected every four years which can drastically change the rules farmers have to obey, while having a crop rotation schedule of seven years or longer. *Interest organisation* say the same about CAP, it has a big impact on farms and farm economy, however the progress of updating it moves very slowly (*Interest organisation; CF farmer*). *CA farmer* argues that several elements of the updated CAP (2023-2027) align with practices he had already adopted when transitioning to conservation agriculture in 2016/2017. He further argues that agricultural policy has gradually evolved in their favor, with instruments such as Eco-Schemes now offering financial support for previously uncompensated practices. Furthermore, *Interest organisation* mentions the EU's ongoing project with Carbon removal Carbon Farming (CRCF), where they are working on developing clear frameworks on how farmers can sell carbon credits. *CF farmer* highlights how different governmental and EU goals stand in direct conflict to each other. For example, the Swedish government's goal of increasing national food production and implementing emergency food stockpiles, stand in direct contradiction to the current CAP that wants the amount of arable land to decrease and lay in fallow.

### 4.7 Knowledge gaps

Most farmers and *Interest organisation, Advisor, Researcher* and *Large bank* mention that the lack of field trials in Swedish conditions and on a large diversity of Swedish soils probably hinders the implementation of regenerative agriculture. The lack of field trials causes uncertainties regarding financial and practical outcomes of regenerative agriculture implementation. However, *Advisor, Cereal Industry* and *Researcher* reports that they conduct their own field trials or in collaboration with companies or researchers, on pilot-farms to evaluate biodiversity trials, cultivars, fertilizers, substances and agricultural methods.

*Cereal industry* mentions that the field trials conducted on regenerative agriculture researched specific methods under specific conditions, making it difficult to compare the results. *Cereal industry* specifically requests more research about $N_2O$ emissions. *Advisor* requested more soil research and mentioned specifically research regarding heavy metal buildups, agrochemicals and resilience, PFAS and insecticides. *CA farmer* mentioned that they have Danish advisors, because the Danes have longer experience with cover crops and catch crops implementation due to stricter Danish regulation. *Researcher* mentioned that there are big knowledge gaps about soil biology, both among farmers, advisors and scientists. *Large bank* mention the difficulties in data collection and verification, but also question the use of having all that data for the farmers, especially since they get the extra workload. *Municipality* argues that there are major knowledge gaps regarding agriculture and the ecosystem as a whole. *Cereal mill* mentions that the transition towards a regenerative agriculture system that uses reduced or no-till may require the farmers to develop new methods on weed handling. *Cereal industry* and *Advisor* both mention the lack of knowledge in consumers, and *Cereal industry* argues the need for the distance between farmers and consumers to decrease, in order to get consumers more motivated to pay a premium price on sustainable produced products. *Local retailer* mention that it is very hard to access information about production methods, sustainability aspects etc., when ordering products through wholesalers, which is one of the reasons why they prefer to buy it directly from the producers when possible. *Bread industry* mentions the need for process innovations that confidently can

handle a larger diversity of raw material quality and ingredients without compromising product quality. Their current system is dependent on standardised processes where the gluten in the wheat behaves exactly the same each time, but extreme weather events and climate change can potentially reduce the amount of wheat reaching that quality. Since they have the 'From Sweden' label on all of their products, they need to develop more knowledge on how to reduce this vulnerability in their production (*Bread industry*).

### 4.8 Knowledge sources

Farmers mentions advisor services, industry magazines, agrochemical advisors, farming communities, podcasts and social media as their primary knowledge sources. *CA farmer* reached out to Danish advisors and conservation agriculture practitioners internationally. Both *CA farmer* and *RA farmer* said that an important learning is being at the farm and seeing how the soil reacts, seeing the insects and wildlife interact and adapt when necessary.

*Large retailer* and *Municipality* both mention that within their team, not many people have deep knowledge about agriculture or farm operations, so they happily share their knowledge with colleagues. Other actors mention universities, research institutes, industry associations, workshops and colleagues as their source of new information. Some actors work in companies that conduct their own field trials, which is also mentioned as a main channel of information.

### 4.9 Community

The majority of the interviewees highlighted the importance of collaboration. *Cereal mill, Cereal industry, Bread industry* and *Large retailer* all highlighted the need for collaboration between the different actors in the supply chain. The farmers mentioned machine sharing collaboration with neighbour farms. *Municipality* talked about a project they initiated where local advisors, universities, food industries, banks and farmers connected and attended workshops to develop business models with the focus on sustainability. *Local retailer* describe themselves as a village hub, a place for the locals to meet, celebrate and buy locally produced food. *Rapeseed industry* mentions local organisations that arrange workshops and meet-ups, making it possible for local actors to connect and initiate collaborations. *Large retailer* mentioned being involved in different projects working towards reducing the dependence on fossil fuels, reducing food waste and increasing biodiversity. *Advisor* sees advisors as 'the spider in the center of the web', that enables innovation and ideas to spread between the farmers due to their large network. *Large bank* acts as the link between investors and agricultural business owners, highlighting their role in providing knowledge about Swedish food production to investors, as well as offering investment opportunities in the green transformation. *Local bank* reported having collaborations with consultants in the industry that can help their customers to calculate their environmental footprint and get advice on how to operate more eco-friendly.

### 4.10 Barriers due to the structure of Sweden's food system

*Cereal industry, Advisor, CF farmer, Interest organisation* and *Large bank* all mention that farmers get a very little portion of the sales price of food products sold in retail stores and referred to LRF's report 'the cost of a green transition in agriculture' (LRF 2026a). The report states that the farmer only gets 3% (0.97 kr) of the retail cost of a piece of bread that cost 30 kr. Furthermore, according to the report, it would cost 1% more (0.19 kr) for the farmer to implement methods to increase biodiversity, improve soil health and shift to non-fossil fuels (LRF 2026a). However, since companies after the primary production apply a percentage on the

price, this small cost at the farm level quickly increases in later stages which “makes sustainable products unreasonably expensive for the consumers” (*Advisor*). *CF farmer* says that the retailers decide the price of the food the consumer is willing to pay, and then the farmer has to be able to produce it at that cost, while following rules and regulations set by the government and EU. This has caused an impossible situation for the farmers, which has caused many organic producers to quit (*CF farmer*). *Cereal industry* and *CF farmer* both mention the unbalanced distribution of costs in the supply chain, *Cereal industry* describes it as an up-side-down pyramid, where farmers get the smallest piece and retailers the biggest. *Rapeseed industry* mentions that a shorter chain of actors in the supply chain with fewer middle hands would make a regenerative transition easier.

*Beverage industry* mentions the difficulties of being a small producer in the big retailers system, with short notice on big orders. *Beverage industry* also mentions that they try to have a circular system with their glass bottles but it is very hard to implement within the big retailers system, while the system is possible to introduce when delivering to local shops. *Large retailer* mention that they have different concept stores within their business concern, making it possible for a larger diversity of producers to be suppliers within their chain. *Large retailer* also mention that it is not always the volume that is the deadbreaker when making an agreement, but the ability for the producer to deliver consistently. *Local retailer* mention that it is impossible to compete with the big retailers' prices, their agreements with the wholesaler can not match the large chains agreements.

### 4.11 Barriers with regenerative agricultural products after leaving the farm

*CF farmer* mentioned that when he read about regenerative agriculture, he saw that farmers combined different crops on the same field, called intercropping. He mentions that this would potentially lead to it all being sold as animal feed, as there is currently no sales channel in Sweden that would accept a mixed crop batch. *Bread industry* and *Large retailer* both mention that if they encourage farmers to grow a large diversity of crops, they as businesses also need to develop products that include a larger diversity of ingredients, or collaborate with other businesses that request these products.

### 4.12 Vulnerabilities and resilience

*Interest organisation, CF farmer* and *Advisor* all mention that Sweden does not have its own fertilizer production, and is dependent on importation of fertilizer, agrochemicals and fuel. *RA farmer* said she is dependent on animal feed for the chickens as well as fuel and packaging material for the eggs. *CF farmer, FF farmer* and *CA farmer* reported dependency on fertilizer, agrochemicals, fuel and seeds, although *CF farmer* has its own grain cleaner machine. *Advisor* mentioned Sweden’s agricultural system division, with animal husbandry in semi-rural areas and crop cultivation in cropland regions, making circular flows of manure more difficult. *Bread industry* reported dependence on food ingredients, packaging material, energy, water, technical equipment and staff.

*CF farmer* and *CA farmer* both mentioned that they have made investments to increase storage space to reduce the impact of market price fluctuations on external inputs, and *CF farmer*, *CA farmer* and *FF farmer* all said they have bigger inventories at the farm now compared to a few years ago. *Large retailer* and *Local retailer* both stated that their companies have not extended their storage space. *Rapeseed industry* has made investments in increased storage space, self-sufficiency on energy and water, and has changed their routines regarding staff and work

responsibilities. The last year they have actively rotated and taught each other work assignments so the business gets less vulnerable if their workforce gets reduced. *CF farmer* and *CA farmer* have invested in different energy production systems at the farm.

*RA farmer* advocates many small scale producers as a way to spread the risks and reduce the vulnerability of the food system. *RA farmer* business model with direct sales to consumers, allows them to change prices if needed because of increased cost of inputs or other reasons, while having the opportunity to communicate the reasons directly to the consumers. That makes their business a lot less vulnerable to market fluctuations compared to many other farmers. *RA farmer* also mentions that regenerative systems can open up for more "home-made" solutions, allowing farmers to be creative and come up with systems that may be regenerative in itself, involving the local community and economy, instead of buying standard equipment. *Researcher* and *Large bank* highlight how technology and precision farming can distribute fertilizers and agrochemicals smarter, exactly where they are needed, instead of spreading it over the whole field which would reduce the amount needed. *CF farmer* and *CA farmer* mention that more and more farmers have started saving and sorting part of the harvest to build their own seed stock, as a way to reduce the farm's vulnerability. *Bread industry* and *Large bank* see regenerative agriculture as a method to increase farm resilience against climate changes. *Municipality* sees regenerative agriculture as a system less dependent on external inputs, which increases farm resilience.

### 4.13 The future of Swedish food production

The majority of the farmers, *Advisor, Interest organisation, Researcher* and *Large retailer* think that Sweden will have an important role in the global food production in the future due to climate changes. However, *Advisor, CF farmer* and *Interest organisation* all highlight that Sweden also will face consequences due to climate change. *Beverage industry* mentions that international free trade agreements can make it very difficult for Swedish producers to compete on the global market. *Rapeseed industry* has noticed a higher demand for Swedish produced products by their customers, and *Beverage industry* says that Swedish consumers are willing to pay a premium price for Swedish produced products.

*Advisor, Cereal mill* and *Bread industry* all identified farmers as having a central role and being the actual solution to climate change. Advisors also play an important role (*Researcher; Advisor*) and the industry mentions their role in creating the demand and contributing with financial aids for a transformation *(Bread industry; Cereal mill; Cereal industry*).

*FF farmer, CF farmer, CA farmer, Advisor* and *Interest organisation* all mention that the profitability in primary production must increase if Sweden should have a food production in the future. The younger generation will not enter the primary production if it does not provide enough money to live by (*FF farmer; CF farmer; CA farmer; Advisor*; *Interest organisation*). However, *CA farmer* says that since he started conservation agriculture, his average yield has increased, the good years yield stays the same but the bad years yield has increased. Furthermore, *FF farmer* mentions that the price of agricultural land is no longer connected to its capability to produce, making it very hard for younger people to enter the sector. *FF farmer* and *CA farmer* mentioned the difficulty of finding employees due to the better working agreements in the contracting industry.

*Municipality* highlights that farmers have a lot of knowledge in a wide range of areas, making them underrated businessmen. *FF farmer* and *CF farmer* mentioned that farmers today are

running businesses, they are not just ‘farmers’. *Advisor* argues that younger farmers have different curiosity to try new methods, and willingness to be coached than the older generation of farmers. *RA farmer* and *Interest organisation* both mention that regenerative agriculture can attract a new type of people to the industry. *Interest organisation* mentions that regenerative methods can get people to feel a sense of purpose, and when introducing technology and digitalised tools in the production it can make farming seem like something new and modern. *RA farmer* argues that part of the regenerative agriculture movement is to collaborate, making it not a necessity to buy a farm yourself, but possible to rent a small piece of land and start on a small scale.

# 5.0 Discussion

## 5.1 What characteristics of regenerative agricultural methods contribute to resilience at the farm level?

One of the key characteristics of regenerative agriculture is allowing practitioners to implement regenerative methods suitable for the individual farm based on the individual conditions. That is, allowing a context-specific approach, as mentioned by EARA (2023) and multiple actors in the interviews. Research conducted by Höglind et al. (2021) indicates that organic agriculture lacks this approach, accusing it to be a system that is too narrow that does not account for the complexity of agriculture. Regenerative agriculture has a potential to bridge this gap in the current system, by focusing on the implementation of ecosystem-supporting practices. However, as emerged in section 4.2, there are positive and negative aspects of developing a regenerative label, and implementing an agricultural programme similar to the ones *Cereal industry, Cereal mill* and *Rapeseed industry* use, increase the administrative burden for the farmer. However, this is a way for farmers to increase profitability through premium prices, and implementing regenerative methods indicates that the farm-margins increase (Al-Kaisi and Lal 2020; *CA farmer*; Deep Seed 2026).

The literature highlighted soil health, biodiversity and improved water management as key characteristics of regenerative agriculture. Soil health and biodiversity are supported by practices that improve soil functionality such as cover crops and reduced tillage that increases soil organic matter and improve soil structure (Behaderovic & Råberg 2023; Maenhout et al. 2024; Marcelino et al. 2024; Keesstra et al. 2018; Latini et al. 2026; Birthisel et al. 2021). Biodiversity is consistently linked to ecosystem services such as improved water regulation, erosion control, carbon storage, pollination, pest control, and nutrient cycling (Köninger et al. 2026; Berninger et al. 2026; Latini et al. 2025; Al-Musawi et al. 2025). Furthermore, incorporating a diverse crop rotation, crop diversification, integrated weed management, and the inclusion of grazing animals, further enhance soil resilience, ecological complexity, and nutrient cycling within the system (Maenhout et al. 2024; Westbrook et al. 2024; Mooney et al. 2023; Gilmullina et al. 2020).

By implementing these practices, the dependency on external inputs decreases due to lower need of agrochemicals and high soil nutrient supply (Al-Kaisi and Lal 2020; Hvarregaard Thorsøe et al. 2023; Lasina et al. 2025; Campbell et al. 2025). This was confirmed by *CA farmer*, together with a halved fuel consumption due to biology working the soil instead of machines. This comes with economic advantages and contributes to higher margins per hectare and increased resilience in extreme weather events for the farmer (Al-Kaisi and Lal 2020). Furthermore, crop rotation and

crop diversification results in a larger variety of products to sell, which may reduce the impact of market price fluctuations.

*RA farmer's* rotational grazing and large inclusion of crop varieties have deepened the plant's roots on the pastures which has caused them to grow stronger. This has contributed to reduced workload in terms of ploughing and re-seeding, while providing resilient pastures containing nutritious, diverse food for the animals. However, moving the hens and the cows over the pasture regularly adds to the workload. However, *RA farmer's* collaboration with the vegetable farmer that rents part of their land, creates a circular system of manure and compost management, which reduces the vegetable farmer's dependency on external fertilizer. This collaboration also increases the amount of products they sell in their joint farmshop, which most likely increases the customer flow. This enables increased quantities of direct sales to local customers, which has been presented as a strategy by Al-Kaisi and Lal (2020) to achieve higher net income for regenerative farmers. This business model was also brought up in the workshop 'Processing and alternative sales channels' at Kullabergs Vingård the 23rd of April 2026, as an alternative to the conventional sales channel and a way to increase profitability for food producers.

To summarise, farm-level improvements in soil health and resource independence are not merely individual business advantages, they form a foundation for a national food system that can withstand external supply chain shocks.

### 5.2 How do regenerative methods affect flows, volumes and standardisation in the downstream stages of the food system?

*CA farmer* reported using similar sales channels as *CF farmer* and *FF farmer,* indicating that regenerative methods do not affect the flows, volumes or standardisation in the downstream stages of the food system. Although, *Large retailer, Cereal mill* and *Bread Industry* all emphasised that the demand for the larger varieties of crops must increase, to stimulate the farmers to include a larger diversity of crops in their crop rotation. This responsibility was also mentioned by Södertälje municipality in the workshop 'How can tomorrow's farmers ensure a sustainable food supply?', arranged by Formas the 12th of February.

However, as *CF farmer* mentioned, some regenerative farmers combine different crops in the same field. The Deep Seed podcast has multiple interviews with UK farmers who have transitioned to regenerative agriculture (Deep Seed 2026). In the episode released the 3rd of March 2026 with James Bucher, he mentioned having implemented this system, called intercropping. He combines grains and legume together, which reduces the need of nitrogen fertilizer application drastically, as well as inputs needed to control pests and diseases. The system comes with a separation step at the end, but he reports that the cost of it is a fraction of the inputs that would be needed if the crops were grown as a monoculture (Deep Seed 2026). This separation opportunity seems to be lacking in the Swedish infrastructure, as well as established market channels for intercropped harvests. This limits the scalability of intercropping systems in Sweden despite their agricultural benefits.

Another interesting aspect of regenerative agriculture was presented during the workshop at Kullabergs Vingård the 23rd of April 2026, by the farm's compost master Malena Larsson. She mentioned that the nutritional density in products grown regeneratively are much higher, due to the higher nutrient density in healthy soils. This is supported by EARA (2023) who reported that regeneratively produced products had 45% higher nutritional density compared to before regenerative practices were implemented. This aspect of regenerative agriculture has the

potential to influence downstream food system dynamics by shifting the value from volume to nutritional quality. More nutrient-dense food could result in higher farm profitability for regenerative farmers, if the view of value assessments shifts. However, a system based on nutritional quality requires investments in new quality testing technology and verification methods, and the need for all downstream actors to implement changes in agreements and standard operating procedures.

To summarise, to enable a regenerative transition, the demand for larger crop varieties must increase. Furthermore, there is an opportunity to develop the infrastructure of intercropping systems in Sweden, and shifting from volume to nutritional density value assessments has the potential to accelerate a regenerative transition of Sweden's food system.

### 5.3 Which actors are identified as keys and bottlenecks in a regenerative transition?

The empirical results highlighted that multiple actors in the food system have central roles for driving the transition. Farmers are seen as the foundation of the transition, but advisors, interest organisations, food industries, retailers, banks, municipalities and consumers all play an important role in enabling the shift. Some bottlenecks were identified during the interviews, among them the financial structure described as an upside-down pyramid of the food system, with retailers on top and the farmers at the bottom. This uneven distribution of money along the supply chain and the low profitability in the primary production is seen as a major bottleneck for a regenerative transition (*Cereal industry; Interest organisation; Researcher; FF farmer; CA farmer; CF farmer*).

Another bottleneck is bureaucracy and authorities. *Rapeseed industry* reported that authorities' processing time can be up to five years before expansion plans get approved. Furthermore, the workshop ‘How can tomorrow's farmers ensure a sustainable food supply?’ arranged by Formas the 12th of February highlighted that some EU funding schemes are only available for large scale producers, which hinders small scale businesses to start or develop their business. *RA farmer* reported the difficulties of navigating in a system where the bureaucracy has developed the frameworks around the large-scale industries. *FF farmer, CF farmer* and *CA farmer* all reported that the increased administrative burden takes time from field work. This may hinder a transition due to time constraints, time that could be used to research, implement or track the effects of new management practices.

*Bread industry* mentioned the highly standardised processes the food industry has, which demands consistent quality of the raw materials. These strict frameworks and the need for absolute predictability, hinders a diversity and natural quality variations (*Bread industry*).

The workshop ‘Public procurement and Swedish dietary guidelines’ conducted by the Federation of Swedish farmers the 23rd of April 2026, provided tools on how sustainability demands can be included in public procurement agreements. By adding sustainability demands, municipalities can create frameworks that only Swedish producers manage to fulfill, which contributes to a more resilient Swedish food system. The workshop ‘Regenerative food value chains’ by Regenerator the 27th of March provided a space where the participants from different regenerative organisations could share their current regenerative projects in the Nordic countries, while sharing strategies and reflections from past projects. This community centered around how regenerative practices can be implemented in larger scales enables smart distribution of resources, and large network collaborations.

To summarise, the identification of the upside-down pyramid as a bottleneck suggests that the primary barrier to resilience is not a lack of farmer interest, but a financial structure that leaves primary producers with the highest risks and lowest rewards. This systemic imbalance must be corrected if the transition is to succeed.

### 5.4 What types of investments and responsibilities emerge in the literature and interviews?

Although both the empirical results and the literature review argues that there is no agreed definition of regenerative agriculture, most sources in this study referred to the same practices and outcomes found by Newton et al. (2020) global literature review of peer-reviewed publications. This gives the impression that regenerative agriculture actually has been defined, although there is a resistance against using the word 'regenerative'. The hesitation to use the term 'regenerative' may relate to the responsibility it implies. If regeneration is understood as "the capacity to bring into existence again" (Rhodes 2017), it highlights that regeneration cannot rely solely on farm-level practices, but requires the entire food system to contribute. This highlights the need to view regenerative methods as a shared responsibility among all actors, rather than primarily a responsibility of farmers. This mindset was presented in the workshop 'Pathways towards regenerative agriculture' by Mistra Food Future Transition lab on the 27th of February 2026. They conducted a project consisting of four workshops from November 2025 to February 2026 together with actors from the Swedish food system on how to create a regenerative and resilient food system in Sweden. The report that summarises their findings has unfortunately not been published before the finalising of this report (June 2026).

One barrier to transition to regenerative agricultural practices mentioned by Shennan-Farpón et al. (2025) and Sher et al. (2024) are the investment cost due to the need of new, specialised equipment. This is confirmed by *CA farmer*, who reported investing in alternative machines when transitioning to conservation agriculture (*CA farmer*). However, if this shift takes place when machineries are being replaced due to tear, these machines are not more expensive than the traditional ones (*CA farmer*). However, after the machines have been replaced, the biggest challenge is the management of the new agricultural methods. Due to the challenges that may arise, *CA farmer* said he wished they had enough funds to have both machine parks available during the transition period.

*CF farmer, FF farmer* and *CA farmer* all reported having made investments to increase on-farm storage, to handle market price fluctuations of essential external inputs. They also reported having made investments in renewable energy systems to increase self-sufficiency. *Local bank* reported approving loans to customers who invested in irrigation ponds and silage solutions that reduced the need for non-recyclable materials. *Large bank* have developed green bonds to attract international capital specifically for sustainable agricultural projects, such as precision farming or climate mitigation practices. *Advisor, Cereal industry, Cereal mill* and *Large retailer* all invest in pilot projects or "future farms" research and *Bread industry* emphasizes the need to invest in process knowledge to develop production lines that can handle bigger quality variations.

*Large retailer, Cereal mill, Cereal industry* and *Rapeseed industry* all mention their responsibility to pay farmers a premium price to cover the costs of practices implemented to reduce the climate impact or practices implemented to increase biodiversity. However, many actors, authorities and agricultural farming programmes require primary climate and biodiversity data collection from the farmers, data that then needs to be verified which requires third-party audits and extensive controls (*Advisor, Cereal mill; Rapeseed industry; Cereal industry;*

*Researcher; CA farmer; FF farmer; Large bank; Local bank*). Even though some of the data collection gets financially compensated through premium prices, *CF farmer* reported that since they buy and dry local producers harvest, they decided to sell all the harvest outside of the premium programmes due to reduced administration burden, even though some farmers implement practices included in the programmes.

*Large retailer* and *Bread industry* both mention a potential transition agreement, which must address the risk both actors are taking in this transition period. The farmers risk having reduced yields to sell, but the buyer also risks not getting enough raw material supply. The dilemma of this trade-off is presented by both banks. They want to encourage a transition to sustainable practices, but they still must evaluate the probability of repayment capacity. *CA farmer* mention area-and-quality agreements as a replacement for volume-and-quality agreements that are often used today. This provides security for farmers, because as long as the correct quality is achieved, low volumes due to drought or other weather conditions does not result in a breach of the agreement.

*RA farmer* stresses the need for humans to reintegrate with the ecosystem. *CA farmer, RA farmer, Beverage industry, Cereal industry, Bread Industry, Local bank, Advisor* and *Rapeseed industry* all express the responsibility for future generations, emphasising the need to support practices that improve soil health and support ecosystem services. The research conducted by Al-Kaisi and Lal (2020) reported that the soil in temperate regions generally have higher soil organic matter, due to lower temperatures and regular rainfall. However, climate change has caused long drought periods to be more common together with increased yearly temperatures. With the changing climate, it is likely that the nordic and temperate regions must shift their current practices in order to maintain or increase the current levels. EFSA's report 'Climate change as a driver of emerging risks for food and feed safety, plant, animal health and nutritional quality' [CLEFSA], raised the concern of climate change and its impact on potential occurrence and intensity of foodborne diseases (EFSA n.d). This may indicate the importance of increasing the biodiversity in the ecosystem, to create a natural, well functioning habitat that has a stronger capability to withstand challenges like these. However, *Large retailer, Municipality, RA farmer* and *CA farmer* all mentioned that they think that the system needs to get more degenerated before actors realises the importance of regenerative systems. Although, the low profitability and increasing price of external inputs caused by geopolitical crises globally, may accelerate a transition. Bucher (Deep Seed 2026) mentions how Brexit has accelerated the transition towards regenerative agriculture in the UK, due to the lack of EU funding and regenerative agriculture's higher margins per hectare. And *CA farmer* mentioned how Denmark has more experience with regenerative methods due to stricter government legislation.

*Local retailer* talked about their responsibility towards the local community, acting as a hub for social interactions while offering sales channels for local producers. The importance of a collaborative community was also discussed during the workshop 'Discussions on emergency preparedness' arranged by Skurups municipality the 16th of April 2026. The workshop provided an opportunity for each individual to reflect on their emergency preparedness, which highlighted the importance of collaboration in times of crises. *RA farmer* mentioned that smaller businesses increase the resilience of the overall system, with a lower risk of food supply being majorly affected if any disruption occurs. This statement is supported by research conducted by Singh & Dwivedi (2025). This was also mentioned in the workshop 'How can tomorrow's farmers ensure a sustainable food supply?' arranged by Formas the 12th of February, both by the dairy farmer

Johan Daniels and by the researcher Rebecka Milestad. Daniels reported increasing local preparedness and resilience in the local community when having local industries and direct, local sales channels. Milestad talked about the vulnerability of large scale farms which require rationalised and often digital solutions which are very vulnerable against cyber attacks or energy shortages, together with the risk of new disease outbursts in monocultures which risk wiping out large food production areas.

To summarise, the word ‘regenerative’ implies that all actors in the food system share the responsibility for being regenerative and enabling a regenerative shift. The shift requires investments in machines, technology and knowledge, together with collaboration and a change in sales-agreements, to divide the risk of transitioning between different actors. The administrative burden of data collection and verification act as a bottleneck which needs to be addressed.

### 5.5 Trade-offs

All systems include trade-offs. Besides the trade-offs previously mentioned, one trade-off is no-till vs glyphosate usage. Ploughing is a widely known method used to suppress and reduce weeds (Johansson et al. 2025). When implementing no-till or reduced-tillage, most farmers rely more on glyphosate as a weed suppresser (Mesnage et al. 2021). Glyphosate is also used to kill cover crops or temporary grass ley before planting the main crop. But, glyphosate is linked with environmental harm (Mesnage et al. 2021), and in a regenerative system where the focus is to build soil health and biodiversity, it can be a bit contradictory to rely on a herbicide. Bucher (Deep Seed 2026) reported including his neighbours sheep to graze the fields, among other practices when transitioning to regenerative agriculture. The sheep are rotationally grazed on the cover crops and winter cereal, terminating the cover crops life cycle in the spring, and acting as a growth regulator and removing disease leaves on the wheat early spring. Simultaneously, they provide manure and therefore nitrogen on the fields. This presents alternative solutions to common agriculture practices used in Sweden today. However, the system division with animal husbandry in semi-rural areas and crop cultivation in cropland regions mentioned by *Advisor*, potentially hinders implementation of solutions like this due to logistical challenges and separate farmer communities. Furthermore, the grazing needs to be closely monitored to ensure the crops are not overly grazed, which would impact the yield negatively. This adds to the workload of the farmer.

The ‘many little hammers' strategy is, as mentioned previously, a combination of less aggressive weed management tools. Even though some strategies may be applicable on large-scale farms, some strategies are more realistic to implement on smaller-scale farms, such as applying mulches to suppress weed, and early seed germination and termination before main crop transplanting. However, instead of dismissing these strategies as strategies not feasible to implement in most agricultural businesses today, it does present alternative management practices that may help farmers get less dependent on external inputs. Due to the increasing price of fertilizers and agrochemicals, more farmers may seek alternative solutions.

Furthermore, a significant administrative trade-off emerged from the interviews. To receive premium prices or participate in carbon credit programs, farmers must provide extensive data and undergo third-party audits. This creates a dilemma where the time required for documentation and bureaucratic compliance directly impacts in-field observation and innovation. Additionally, intercropping systems may come with an allergen risk, as proteins in cereals and

legumes are listed on the European Food Safety Authority (EFSA) food-allergen list (EFSA 2025).

## 6.0 Conclusion

This study shows that regenerative methods act as a potential strategy for enhancing the resilience of the Swedish food system. In the primary production, regenerative methods that prioritize soil health and biodiversity through context-specific practices, provide ecosystem services such as improved water regulation, carbon storage, and integrated pest management. These methods reduce the primary producer's dependency on external and often imported inputs like synthetic fertilizers and fossil fuels which increases resource independence. This is vital for maintaining food production capacity during geopolitical or climate-related crises. However, the literature review and the empirical results together indicate that this transition cannot rely solely on farmers but requires a fundamental shift in how the entire food system operates.

The results show that one of the most significant hurdles to a regenerative transition is the current upside-down pyramid of financial distribution, where farmers bear the highest risks and administrative burdens but receive a disproportionately small share of the final consumer price. To secure the future of Swedish food production, profitability at the primary production level must increase to attract younger generations and cover the costs of implementing regenerative methods. This requires a redistribution of financial responsibility across the chain, potentially through premium pricing, sales agreements that share transition risks, and the development of alternative sales channels that allow producers to capture more value.

Furthermore, the study identifies systemic bottlenecks in infrastructure and regulation that must be addressed to support a more diverse agricultural landscape. Sweden currently lacks the necessary infrastructure for processing intercropped harvests, and the industry has highly standardised industrial processes that hinders natural variation in raw material. Additionally, this study indicates that the heavy administrative burden and bureaucratic frameworks currently hinders a regenerative transition.

Ultimately, building a regenerative and resilient food system is a shared responsibility that demands active collaboration between all actors in the food system. Success depends on increasing market demand for a wider variety of crops and shifting the mindset from extracting short-term financial value to include long-term ecological and social benefits. By addressing these systemic barriers, Sweden can move toward a food system that is not only less vulnerable to external shocks but actively restores the natural resources necessary for future food security.

### 6.1 Limitations

This study has several limitations related to the scope, methodological approach and complexity of food systems. Due to limitations in time and scope, not all actors and processes within the Swedish food system could be included. The study focused on gaining a broad understanding of opportunities and challenges across different parts of the food system rather than providing an in-depth analysis of each individual component.

The complexity of food systems means that multiple interacting levels influence a regenerative transition. Consequently, several areas that may influence the transition were outside the scope of this study. For example, detailed analyses of cultivation systems, processing requirements, material flows, consumer demand and economic distribution between actors would require additional methods and more specific research designs.

Furthermore, although the study aimed to include perspectives from multiple parts of the food system, many of the interviewed actors were connected to the cereal-based food system. Since approximately 40% of the crops cultivated in Sweden are cereals, this provided insights into an important part of Swedish agricultural production. However, it may limit the transferability of the findings to other production systems with different characteristics.

Another limitation concerns the use of qualitative interviews as the main empirical method. The approach provided detailed insights into actors' experiences, perceptions and expectations regarding a regenerative transition that many times aligned with the literature. However, it does not provide quantitative measurements of the potential effects of regenerative methods on production capacity, economic outcomes or environmental indicators. Furthermore, consumer perspectives were not included, as a representative understanding of consumer behaviour and preferences would require a quantitative approach beyond the methodological scope of this study.

### 6.2 Future Research

The limitations identified in this study highlight several areas where further research is needed to support the transition towards a regenerative and resilient food system in Sweden. Future research should investigate both the performance of regenerative methods and the system conditions required for their wider adoption.

In primary production, long-term field trials across different Swedish soil types and climatic conditions are needed to evaluate the effects of regenerative methods on yield stability, greenhouse gas emissions, biodiversity, soil health and resource efficiency. Further research could also investigate whether regenerative agricultural systems consistently contribute to increased nutritional quality, as this may influence how value is created and assessed within future food systems.

Future research should also examine how emerging technologies interact with regenerative principles. Precision farming and site-specific agrochemical application, highlighted by *Researcher* and *Large bank* in the interviews, may provide opportunities to optimise resource use and improve economic and ecological outcomes. However, these technologies also introduce challenges related to data requirements, investment needs and technological dependency. Further studies are needed to evaluate how such technologies can contribute to resilience without creating new vulnerabilities.

Beyond farm-level practices, research should investigate the infrastructure changes needed to scale regenerative systems. For example, intercropping systems may require new processing solutions, logistics and market structures before becoming widely implemented in Sweden. Understanding these bottlenecks is important for identifying where investments and responsibilities need to be distributed across the food system. The need or no need of a regenerative label should also be further explored.

Finally, future research should further explore the broader social and economic dimensions of a regenerative transition. This includes investigating how risks, responsibilities and value creation can be shared between actors, as well as how consumer demand, direct sales channels and alternative market structures influence adoption. The role of market concentration should also be examined, particularly whether the dominance of large retail actors creates barriers or opportunities for accelerating a regenerative food system transition.

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# Appendices

## Appendix 1: Email request to potential interview participants

Hello!

My name is Elin Andersson and I am a master student at Lund University and EIT Food.

I am currently writing my thesis project on how to build a resilient food system with the help of regenerative methods. As a part of my thesis, and a complement to published literature, I want to interview actors in the supply chain on how they work with these questions.

[Section on why I want to include them in my study]

The interview takes about 30-60 minutes, and I will ask questions regarding [suitable for that specific actor].

If you would be interested in being a part of the conversation and represent [XX] side of it in my thesis, please get back to me so we can find a date to do the interview!

I look forward to hearing from you,

Best regards,

Elin Andersson

[contact information]

**Appendix 2: Interview guide with primary and secondary questions**

1. Background and Role

**Primary Questions:**

- Can you describe your current role and your primary responsibilities?
- How long have you worked in the agricultural or food sector?
- *(For Farmers):* Can you describe your farm (size, production, orientation)?
- *(For Industry/Retail):* What types of products or raw materials do you primarily work with?

**Secondary Questions:**

  - What is your previous professional experience, and how does it influence your current work?
  - How has your work or role changed over time?
  - How do you define "local" in your specific context?

2. Perspectives on Regenerative Agriculture

**Primary Questions:**

- When did you first encounter the term "regenerative agriculture," and in what context?
- How do you define or interpret the term "regenerative" in relation to your work?
- Is there a consensus on this definition within the industry, or do interpretations vary?

**Secondary Questions:**

  - How does this concept differ from other terms like "sustainable," "organic," or "climate-smart"?
  - What motivated you (or your organization) to begin working with regenerative methods?
  - Do you believe there is a need for a specific "regenerative" label or certification on products?

3. Farm-Level Resilience and Raw Material Stability

**Primary Questions:**

- What characteristics of an agricultural system do you see as central to increasing resilience?
- How does dependency on external inputs (e.g., fertilizer, fuel) affect vulnerability?
- *(For Processors/Retail):* How does variation in raw material supply (due to weather or harvests) affect your operations?

**Secondary Questions:**

  - Have you observed specific farming methods that handle extreme weather or price fluctuations better than others?
  - Have you introduced specific measures to increase preparedness or self-sufficiency (e.g., storage, generators)?

- Do you see local production as a way to spread risk in your sourcing strategy?

4. Flows, Volumes, and Value Chain Requirements

**Primary Questions:**

- What are your primary sales or purchasing channels?
- What specific requirements are placed on products regarding volume, quality, and standardization?
- How do these requirements for predictability affect the ability to work with smaller or regenerative producers?

**Secondary Questions:**

- Can your processes handle raw material variation, or are homogeneous materials required?
- How do you manage seasonal variations and small volumes when sourcing locally?
- Do current sales requirements from customers deprioritize regenerative systems?

5. Actors, Relationships, and Bottlenecks

**Primary Questions:**

- Which actors in the food chain have the greatest influence or power to drive change?
- Where do you see the most significant "bottlenecks" or barriers to transitioning to alternative methods?
- *(For Municipalities):* Can the municipality influence local production through public procurement or land management?

**Secondary Questions:**

- Are there specific structures or regulations in the food chain that lock the system and slow down development?
- How would you describe the distribution of responsibility for system change among actors?
- Are there trade-offs (e.g., price vs. sustainability) that hinder progress? 31

6. Economics, Profitability, and Incentives

**Primary Questions:**

- Many primary producers suffer from low profitability, what needs to change to improve it?
- How do regenerative or alternative methods affect the economy of a farm or business (e.g., investment needs)?
- What financial incentives currently exist, and which ones are missing?

**Secondary Questions:**

- Who should bear the financial risk of testing new agricultural methods?
- How do raw material quality and variation affect your operational costs?

    - Is there a willingness among consumers to pay a premium for these products?

7. Knowledge, Innovation, and Communication

**Primary Questions:**

- Where do you source knowledge and inspiration for your work?
- What determines whether you trust new information or methods?
- How can sustainability values be communicated to customers?

**Secondary Questions:**

    - Is there sufficient data and evidence (e.g., carbon sequestration data) to support a widespread shift to regenerative methods?
    - What knowledge gaps do you currently see in the industry?

8. Policy, Regulation, and Preparedness

**Primary Questions:**

- How do current policies (e.g., EU's CAP) and administrative burdens affect your work?
- Has the increased focus on "food preparedness" (Swedish: livsmedelsberedskap) changed how you prioritize?

**Secondary Questions:**

    - Do you see a role for your organization in strengthening national or regional food security?
    - Are there specific regulations (e.g., food safety, import rules) that make change difficult?

9. Future and Scaling

**Primary Questions:**

- What role do you believe regenerative systems will play in the future of Swedish agriculture?
- What is required to "scale up" these methods and make them more common?

**Secondary Questions:**

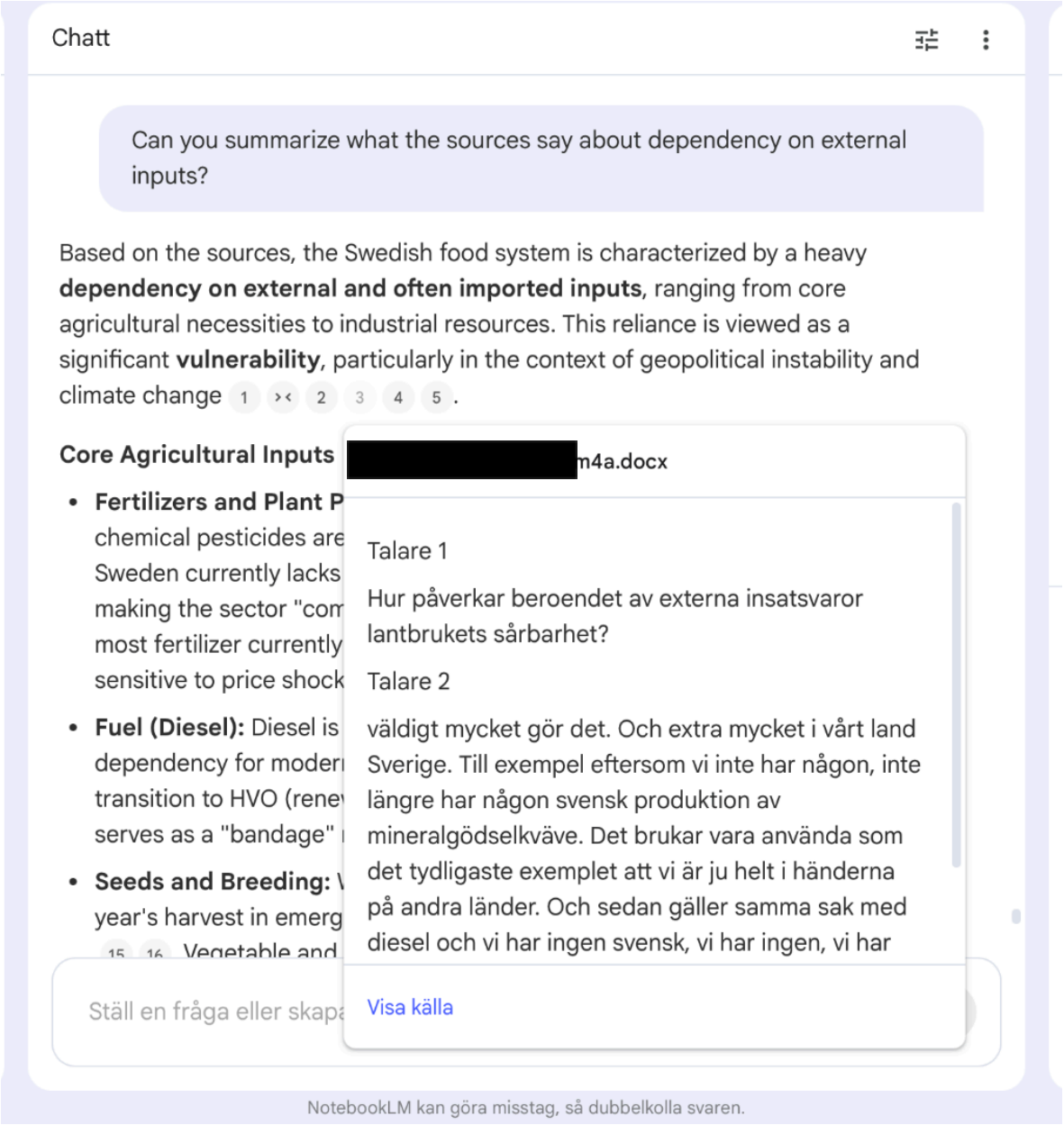
    - Are there any major risks or opportunities you foresee in the coming years?
    - *(For Finance):* What role will carbon credits play in the future of agricultural financing?

10. Closing

**Final Remarks:**

- Is there anything important I have missed or that you would like to add?

**Appendix 3: Visual description of how NotebookLM was used during the data analysis**



**Appendix 4: SDG and its associated targets related to the food system**

| | | |
|---|---|---|
| SDG 2 | Zero Hunger | End hunger, all forms of malnutrition, double the agricultural productivity and incomes of small-scale food producers, ensure sustainable food production systems and resilient agricultural practices, help maintain ecosystems, adaptation to climate change, improve land and soil quality, maintain the genetic diversity of seeds |
| SDG 6 | Clean water and sanitation | Improve water quality by minimizing release of hazardous chemicals, increase recycling, increase water-use efficiency, protect and restore water-related ecosystems |
| SDG 9 | Industry, innovation and infrastructure | Develop reliable, sustainable and resilient infrastructure, sustainable industrialization, enhance scientific research |
| SDG 11 | Sustainable cities and communities | Strengthen efforts to protect and safeguard the world's cultural and natural heritage, support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning |
| SDG 12 | Responsible consumption and production | Achieve the sustainable management and efficient use of natural resources, halve per capita global food waste at the retail and consumer levels, and production and supply chain, including post-harvest losses, significantly reduce the release of chemicals to air, water and soil to minimize their adverse impacts on human health and the environment, reduce waste generation, encourage companies to adopt sustainable practices |
| SDG 13 | Climate action | Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters |
| SDG 15 | Life on land | Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, restore degraded land and soil, halt the loss of biodiversity, protect and prevent extinction of threatened species, integrate ecosystem and biodiversity values into national and local planning |

(United Nations, n.d)