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The Benefits and Obstacles of Regenerative Agriculture in Germany

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Abstract in English

This study aimed to investigate the benefits and obstacles of regenerative agriculture in Germany. Due to the urgency of climate change and the climate protection potential of regenerative agriculture, as well as the fact that regenerative agriculture is hardly widespread in Germany, this study seemed relevant. Firstly, a foundation was laid by reviewing the existing literature. Secondly, qualitative research was conducted through four semi-structured interviews with four experts on regenerative agriculture in Germany. Thirdly, the results extracted from the interviews were analysed through thematic analysis and compared with the existing literature. It was found that regenerative agriculture offers multiple benefits for the environment, but also to society overall and especially also to the farmers. Nevertheless, there are still various obstacles, such as policy and institutional barriers, farmers' doubts, a lack of knowledge and information, and an overall reluctance. Due to these obstacles, shifting to regenerative agriculture on a large scale in Germany seems rather difficult under the current framework conditions. Therefore, collaboration between the different stakeholders is crucial to enable this transformation process towards regenerative agriculture.

Abstract in German

Ziel dieser Studie war es, die Vorteile und Hindernisse der regenerativen Landwirtschaft in Deutschland zu untersuchen. Aufgrund der Dringlichkeit des Klimawandels und des Klimaschutzpotentials der regenerativen Landwirtschaft, sowie der Tatsache, dass die regenerative Landwirtschaft in Deutschland kaum verbreitet ist, erschien diese Studie relevant. Zum einen wurde eine Grundlage durch die Sichtung der vorhandenen Literatur geschaffen. Zweitens wurde eine qualitative Untersuchung durch vier halbstrukturierte Interviews mit vier Experten für regenerative Landwirtschaft in Deutschland durchgeführt. Drittens wurden die aus den Interviews gewonnenen Ergebnisse durch eine thematische Analyse ausgewertet und mit der vorhandenen Literatur verglichen. Es wurde festgestellt, dass die regenerative Landwirtschaft vielfältige Vorteile für die Umwelt, aber auch für die Gesellschaft insgesamt und insbesondere auch für die Landwirte bietet. Dennoch gibt es immer noch zahlreiche Hindernisse wie politische und

institutionelle Barrieren, Zweifel der Landwirte, mangelndes Wissen und fehlende Informationen sowie eine allgemeine Abneigung. Aufgrund dieser Hindernisse scheint eine großflächige Umstellung auf regenerative Landwirtschaft in Deutschland unter den derzeitigen Rahmenbedingungen eher schwierig. Daher ist die Zusammenarbeit zwischen den verschiedenen Akteuren von entscheidender Bedeutung, um diesen Transformationsprozess hin zu einer regenerativen Landwirtschaft zu ermöglichen.

Abstract in Spanish

El objetivo de este estudio era investigar las ventajas y los obstáculos de la agricultura regenerativa en Alemania. Debido a la urgencia del cambio climático y al potencial de protección del clima de la agricultura regenerativa, así como al hecho de que la agricultura regenerativa apenas está extendida en Alemania, este estudio pareció pertinente. En primer lugar, se sentaron las bases revisando la bibliografía existente. En segundo lugar, se llevó a cabo una investigación cualitativa mediante cuatro entrevistas semiestructuradas con cuatro expertos en agricultura regenerativa en Alemania. En tercer lugar, los resultados extraídos de las entrevistas se analizaron mediante análisis temático y se compararon con la bibliografía existente. Se constató que la agricultura regenerativa ofrece múltiples beneficios para el medio ambiente, pero también para la sociedad en general y, especialmente, para los agricultores. Sin embargo, sigue habiendo múltiples obstáculos, como las barreras políticas e institucionales, las dudas de los agricultores, la falta de conocimientos e información y una reticencia general. Debido a estos obstáculos, el cambio a la agricultura regenerativa a gran escala en Alemania parece bastante difícil en las condiciones marco actuales. Por lo tanto, la colaboración entre las diferentes partes interesadas es crucial para permitir este proceso de transformación hacia la agricultura regenerativa.

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List of Abbreviations

GHG Greenhouse Gas

CO2 Carbon Dioxide

pH Potential Hydrogen

BCG Boston Consulting Group

NABU Naturschutzbund Deutschland

CAP Common Agricultural Policy

1. Introduction

Climate change is one of the biggest challenges of the 21st century that needs to be addressed. Scientists predict that it will lead to mass extinctions, an increasing number of droughts and floods, rising sea levels, loss of biodiversity, and a spread of hunger (United Nations, 2022). The leading cause of climate change is the increase of human-caused greenhouse gases in the atmosphere. The global greenhouse gas emissions have reportedly risen again in 2022 (World Meteorological Association, 2022). The main GHG released into the atmosphere is carbon dioxide, which has entered the atmosphere in vast quantities as a result of the burning of fossil fuels and the destruction of CO2 "carbon sinks" that act as storage for CO2, such as grasslands, forests, and especially the organic matter in our soils, also known as "Soil Carbon Matter". The CO2 released is then absorbed by two other carbon sinks: the atmosphere and the oceans. However, since these two carbon sinks have reached their capacity limit, the carbon in the atmosphere is leading to an increase in temperatures and the acidification of oceans. The destruction of the grasslands and forests was mainly caused by the need for space for agricultural practices and its industrialisation over the past 250 years (Tickell, 2017). Today, agriculture contributes in Germany up to 12.5% of all GHG emissions (Kurth et al., 2023). Agricultural practices summarised under the expression "regenerative agriculture", developed in the US, would not only allow reducing the carbon emissions of agriculture but, by building up soil, rather than depleting it, to actually sequester carbon back into the soil. Furthermore, it increases biodiversity and thereby helps to restore ecosystems and rebuild watersheds (Tickell, 2017). As one of the world's largest agricultural producers, Germany is the world's third-largest exporter of agricultural products, experiencing severe weather events like in 2018, posing a threat to agricultural yields (Eckstein et al., 2020). It is estimated that only around 50,000 hectares (0.003 %) of Germany's agriculture are being farmed regeneratively (Zinke, 2020). Although Germany, as one of the largest carbon emitters in the world and the largest in Europe, has a target to reduce its carbon emissions for the agricultural sector by 31-34% compared to 1990 emissions, no concrete measures were presented on how this will be achieved (Jantke et al., 2020).

This study aims to answer what the benefits and obstacles of regenerative agriculture in Germany are and why so few farmers in the country are applying regenerative agricultural practices to their land, a topic that has been given little attention in the existing literature. Particularly, due to the novelty of regenerative agriculture and the difficulty in defining it because of the many sub-aspects of the holistic approach to agriculture, little research has been done in this field (Merfield, 2019). Research has been done explaining how regenerative agriculture works (Khangura et al., 2023; Rhodes, 2017) and how to mitigate climate change through it (Poore & Nemecek, 2019). Furthermore, studies have been conducted into the policy and technological constraints to implementing GHG emissions mitigations in agriculture (Smith et al., 2007), as well as the willingness of German farmers to reduce GHG emissions in agriculture, with overall positive results (Jantke et al., 2020). Furthermore, non-peer-reviewed scientific research has been done on how an adoption process of regenerative agriculture could look like in Germany. Several benefits and obstacles are mentioned in this paper (Kurth et al., 2023). This study aims to fill an existing gap in the literature that addresses the question of what benefits the concrete method of regenerative agriculture can bring to Germany and what obstacles exist to implementing regenerative practices in German agriculture. Since German agricultural law is largely shaped by the agricultural policy of the European Union, the findings made in this study for Germany will arguably also be applicable in part to other EU states.

The research question that drives this thesis is: What are the benefits and obstacles of regenerative agriculture in Germany?

A qualitative research approach is chosen for this study. Due to the limited time frame and the topic being very case-related, semi-structured interviews are preferred over quantitative research. Even though interviews are case-related, shared benefits and obstacles can provide a deeper understanding of why so few farmers are adopting regenerative agricultural practices to their land in Germany. Judgement sampling is the chosen sampling method for this paper due to the very few regenerative farmers in Germany. Four experts in the field of regenerative agriculture in Germany are interviewed for this study. The interviews are transcribed and then inductively coded to identify patterns and trends.

This paper aims to give a deeper understanding of the benefits of regenerative agriculture in Germany and the obstacles to applying regenerative agricultural practices in the country. This paper will be helpful to all German farmers, potential agriculture investors, and German and EU agricultural policymakers to see if all the necessary steps for a transition to regenerative agriculture in Germany have already been taken.

This thesis consists of six sections. The following section, number two, reviews the existing literature and provides the theoretical background to the topic, mainly focusing on the description of regenerative agriculture and thus already outlining some potential benefits and obstacles of regenerative agriculture in Germany. Section three describes the methodology, clearly presenting the techniques performed in the qualitative research. The fourth section provides a coded analysis of the interviews. Section five will discuss the research results. Finally, the sixth section will conclude the work based on the research question.

2. Literature Review

The following chapter will present the existing literature on the benefits and obstacles of regenerative agriculture in Germany, clearly identifying the research gap. Furthermore, essential background knowledge and an understanding of regenerative agriculture will be provided. Finally, the literature review will be concluded.

2.1 Definition of Regenerative Agriculture

Due to the novelty of regenerative agriculture and its many complexities, defining the topic is challenging. The term "regenerative" was first described by (Rodale, 1983) as an agricultural production system that goes beyond merely sustainable farming. Regenerative agriculture is also known as organic, holistic, and ecological agriculture or natural farming, humus/carbon farming and natural intelligence (Masters, 2019). (Soloviev & Landua, 2016) even believes that regenerative agriculture cannot be defined.

Regenerative agriculture is mainly defined through an outcome-based approach. It is also seen as more than just a collection of farming practices but also as a social movement, value system and philosophy (Merfield, 2019). Furthermore, it is essential to understand that regenerative agriculture is still evolving, and its current form is only about 15-25 years old. That is also why regenerative agriculture lacks a formal definition (Elevitch et al., 2018; Merfield, 2019).

This paper will define regenerative agriculture based on five pillars and the significance of soil. These five pillars are:

- Avoiding measures that harm the soil life and biodiversity
- Optimising photosynthesis on the land throughout the year
- Promoting a closed nutrient cycle
- Incorporating biodiversity and water retention on the field
- Integration of animals on the land

The common denominator of regenerative agriculture is that it always starts with soil improvement. The goal of regenerative agriculture is to build living soils, therefore, soil fertility and, as a result, regenerate below-ground/above-ground biodiversity and the local water cycle (Merfield, 2019; Schreefel et al., 2020).

Living soil is closely related to the level of soil organic matter. Soil organic matter refers to the wide range of organic matter in the soil composed of plant and animal residues at various stages of decomposition, humus is one part of soil organic matter. Regenerative organic agriculture aims to consistently promote the soil life, known as the microbiome, consisting of bacteria, fungi, as well as small and tiny organisms such as worms or insects (Harris, 2009) and thus to increase the humus content, therefore, organic matter continuously (LaSalle et al., 2008). Promoting soil life occurs through the symbiosis of plants and soil life. Photosynthesis is crucial to this symbiosis because it is the process by which plants convert CO2 and water into glucose, a type of sugar, using light as an energy source. The plant releases 40 to 50% of the glucose through its roots to the soil life, a process called exudation, and, in return, the plant receives essential nutrients and water (Kuzyakov & Domanski, 2000). Regenerative farmers aim to continuously optimise this symbiosis, the so-called soil carbon cycle. A higher humus content in the soil results in higher nutrient density in the cultivated crops, ultimately leading to high-quality food. (Institute, 2014). Also, it leads to a higher water storage capacity, significantly improved water infiltration rates, which is the amount of water that can infiltrate into the soil on a square meter in a fixed time, and higher temperature of the soil during cold periods, which protects plants against frost and more binding of carbon in the long term (Gerke, 2022).

The first pillar is that regenerative agriculture is built on the principles of organic farming and avoids measures that harm soil life and biodiversity. That is achieved by not using chemical-synthetic pesticides and fertilisers, minimising soil compaction and mechanical interventions like tilling.

The second pillar is that regenerative agriculture enhances photosynthesis on the land throughout the year by acting according to the following principles. First, the soil is always covered and contains living roots throughout the year, e.g., through cover crops

and intercrops. Additionally, having a high diversity of plants, seeds, and hence different root lengths, regenerative agriculture builds humus consistently in different soil layers.

The third pillar promotes a closed nutrient cycle, composting, and avoiding waste, thereby allowing the farmers to not depend on external inputs like fertilisers.

The fourth pillar is to significantly increase the diversity of plants and manage water retention in the field. To increase diversity, farmers use a variety of practices, for example, crop rotation, mixed crops, highly diversified cover crop mixes, cultivation of hedges, and agroforestry. To improve rainwater retention, farmers build ponds and lakes, protect wetlands and moors, protect the embankment of rivers from grazing animals, and renature the flow of rivers, wetlands, and moors.

The last and fifth pillar is the integration of animals on the land. Regenerative farmers reintegrate animals into agriculture to optimise the symbiosis between soil, plants and herbivores. The animals live in their natural habitat instead of stables as long as the weather permits. Examples of regenerative breeding and grazing methods are "mob grazing", which is a holistic approach to grazing cattle on pastures and cover crops, are mobile stables for laying hens or broilers, is symbiotic agriculture, where chicken, geese, cattle and pigs are together on the same pasture and the growing of pigs in forest pasture systems (Brown, 2018; Khangura et al., 2023).

2.2 Differentiation of Regenerative Agriculture

To fully understand regenerative agriculture, it is essential to understand the differentiation between regenerative agriculture to conventional and organic agriculture.

2.2.1 Organic Agriculture

Given that regenerative farmers avoid using pesticides, fungicides, or antibiotics and provide their animals with space and grass to eat, one may assume that regenerative agriculture is equivalent to organic farming. However, there is a distinction since

regenerative farmers emphasise soil health and structure to improve the soil's capacity to absorb carbon and retain water (Malik, 2014). Furthermore, organic agriculture is highly regulated by various organisations, e.g., by The International Federation of Organic Agricultural Movements (IFOAM), the European Union or the United States Dept. of Agriculture. These regulations define certain principles and rules for performing organic agriculture, which need certification, another critical difference to regenerative agriculture. While organic agriculture performs under an input restriction approach by defining which inputs are permissible and which are not, e.g., no use of pesticides, regenerative agriculture performs under an output-focused approach. Even though regenerative agriculture has semi-defined farming practices, e.g., no tilling, it focuses much more on the outcomes, e.g., building soil organic matter (Merfield, 2019).

Furthermore, regenerative agriculture is much more than just a way of farming. It is also a social movement encompassing a new way of thinking and aligning with nature. While organic agriculture is a set of principles following the rule of “not harming the environment”, regenerative agriculture goes a step further by regenerating soil life and biodiversity to fully align with the principles of nature. (Soloviev & Landua, 2016).

2.2.2 Conventional Agriculture

Conventional agriculture, also called industrial and modern agriculture, is a set of farming practices emphasising high-yield production, monocultures, and using synthetic fertilisers, pesticides, and herbicides. Using these is not only causing soil deterioration, but these synthetic inputs are all based on fossil fuels (Azarbad, 2022). Conventional agriculture's advent was the industrial revolution and, therefore, the mechanisation of agriculture, also called the second agricultural revolution. Irrigation, tilling, and other agricultural practices became far more mechanised than before, increasing productivity and causing many farm workers to move into manufacturing. The foundation of the third agricultural revolution, also called the green revolution, was the invention of synthetic fertilisers and pesticides. Pesticides and synthetic fertilisers were invented, and agriculture evolved from small-scale systems to larger industrialised systems, always trying to maximise output (Trautmann et al., 1985). It was Fritz Haber and Carl Bosch, two German scientists who invented the process of ammonia synthesis at the beginning

of the 20th century, ammonia being a core raw material to produce synthetic nitrogen fertilisers. Haber was later also involved in the early development of pesticides. However, ammonia was also a core raw material to produce explosives for WWI and WWII. After WWII, significant idle capacities to produce ammonia fostered the green revolution (Tickell, 2017). The use of the new inventions significantly increased agricultural yields and outputs. Today, some historians think that the invention of fertilisers led to the entire multibillion-person increase in human population over the last century (Meers, 2016). However, the overuse of these pesticides has also had detrimental effects on the environment, e.g., soil erosions, water pollution, and on society, with severe health risks for farmers and consumers (Rhodes, 2017).

Furthermore, the green revolution allowed the decoupling of livestock and crop production. Before, each farm had livestock as the manure provided nitrogen; today, farm animals are primarily concentrated in large feedlots and in Germany in housing sheds. Cows, pigs and chickens are fed grain to increase milk and meat production. Cows are herbivores and naturally feed on grass. The federal ministry of Food and Agriculture reported in 2020 that 60% of agriculturally used land in Germany is assigned to grow grain to feed livestock animals (Federal Ministry of Food and Agriculture, 2020). Moreover, the reason livestock is causing so much greenhouse gas emissions is not the animal itself but the way it is held and the fact that it cannot digest the grain it is being fed (Sarkwa et al., 2016). Overall, conventional agriculture can be seen as a reaction to the rise in food demand and the desire to maximise productivity and efficiency. However, the environment's and society's disadvantageous effects show the need to transition to more resilient and sustainable agricultural methods to tackle these issues (Aune, 2012).

2.3 Benefits of Regenerative Agriculture

The next part of the literature review will discuss the different benefits of regenerative agriculture in more detail. The benefits of regenerative agriculture can be divided into environmental and socio-ecological benefits. Moreover, each individual regenerative practice provides different environmental benefits.

2.3.1 Environmental Benefits

The following section will outline the environmental benefits regenerative agriculture could have in Germany, including improved soil health, increased biodiversity, improved water quality and climate change mitigation.

2.3.1.1 Improved Soil Health

Regenerative agriculture, as mentioned before, always starts with the soil (Schreefel et al., 2020). Soil health has been defined "as the capacity of a living soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health" (Doran, 2002, p.1). The aim of improving soil health is to increase biodiversity below ground. The increase in soil biodiversity represents its ability to sequester carbon and provides many other benefits to a farm (Hungate et al., 2017). Soil health has three properties. Firstly, the physical property, which comprises texture and water-holding capacity. Secondly, the chemical property includes pH and soil organic matter. Lastly, the biological property comprises microbial diversity, nitrogen mineralisation, and soil respiration (Khangura et al., 2023).

Furthermore, the soil is highly capable of storing carbon in organic matter through soil organic carbon. The main reason soils are so deteriorated today is the loss of soil organic carbon through conventional agricultural practices. Therefore, restoring the soil's organic carbon improves the soil structure, water infiltration, water retention, nutrient cycling, and aeration and could sequester the CO2 from the atmosphere. Indeed, soil can sequester three times more carbon than the atmosphere (Robertson et al., 2015). There are various opinions regarding scientific research on the CO2 sequestration potential. The Rodale Institute suggests that if regenerative agriculture would be achieved globally, we could sequester 100% of our annual greenhouse gas emissions in soil (Moyer et al., 2020). The "4 per 1000" initiative from the French government stated during the COP21 that if an annual increase of 0.4% in the topsoil, i.e., the first 30-40 cm of soil, would be achieved, up to 6 gigatons of CO2 could be sequestered in the soil, compared to 4.3 gigatons emitted by humanity every year. The "4 per 1000" has faced criticism, argued primarily through

the obstacles of regenerative agriculture, which this paper will further address (Poulton et al., 2018).

There is much uncertainty about regenerative agriculture's real carbon sequestration potential. Some research suggests that the possibility of rereleasing carbon into the atmosphere, even if unintentionally, is high (Frelih-Larsen et al., 2022). That is why bringing the carbon from the topsoil to the subsoil, i.e., 1-2m of soil, is seen as essential in locking up carbon in the soil but also requires a more time-consuming process (Moyer et al., 2020). The Boston Consulting Group recently released a non-peer-reviewed report on regenerative agriculture in Germany in collaboration with the Naturschutzbund Deutschland, which sees the potential to reduce carbon emissions twofold—first, the carbon sequestration in soil and, secondly, the reduced carbon emissions through a reduced nitrogen fertiliser use. In 2021 the German agricultural sector was responsible for 75% of all nitrous oxide emissions, which is a greenhouse gas and, and due to its potency, has the potential to warm the atmosphere 300 times more than CO2 (Del Grosso et al., 2008). Due to the high share of nitrous oxide in the German agricultural sector and the fact that nitrogen fertilisers are not utilised in regenerative agriculture, BCG sees regenerative agriculture as an effective way to reduce these emissions.

Additionally, they multiply the reduced carbon emissions with the expected carbon external climate costs of €223 per ton of CO2 in 2035. Hence, for carbon sequestration in soil, they observe the impact at €6.8 billion annually and, therefore, at 30.6 million tons of CO2 per year. For reduced carbon emission through reduced nitrogen fertiliser use, they see the impact at €1.1 billion annually and hence at 4.9 million tons of CO2 per year. This would mean an annual 35.5 million tons of CO2 in 2035, compared to 674.8 million tons of CO2 emissions in Germany in 2021 (Kurth et al., 2023). With only 5.26% annual reduced carbon emissions in Germany, compared to the Rodale Institute with 100 % globally, we have proof of the divergence in research.

2.3.1.2 Increased Biodiversity

Biodiversity is multidimensional; there is below-the-ground and above-the-ground biodiversity, which regenerative agriculture can improve. According to research, agriculture contributes 25 % to biodiversity loss (Torsten Kurth et al., 2020). Below-ground biodiversity highly correlates with soil health, as mentioned before. Various living organisms can be found in healthy soil, hence biodiversity. The complex interactions of soil microbes play an important role in biodiversity below ground. Research has found that 60% more biomass from soil microorganisms can be traced from organic agriculture compared to conventional agriculture, and 80% of the soil in organic agriculture is more active than conventional agriculture (Lori et al., 2017). The soil microbes are responsible for processing plant matter into soil carbon; therefore, they are the most vital factor in the ability of soil to sequester carbon. The emphasis of regenerative agriculture to have living roots in the soil all year long is crucial because roots are the feeding machine of the soil microbes.

Furthermore, having a wide variety of roots in the soil is essential for long-term carbon storage in the soil. That is why regenerative agriculture tries to plant diverse polycultures instead of monocultures (Kravchenko et al., 2019). Also, the soil's many nutrients are essential for the plants to grow. The nutrient cycle depends on the soil microbes' quick carbon matter turnover (Lavallee et al., 2020).

Biodiversity above the ground again correlates with soil health. Having bare soil has various negative impacts, like encouraging erosions and disabling photosynthesis, ultimately leading to a decline in agricultural productivity. Having polycultures is essential not only due to the variety of roots but also because monocultures are highly dependent on pesticides and herbicides, which destroy soil life and lead to soil carbon loss. Research has shown that organic farming leads to the abundance and richness of species and 34 % more biodiversity (O. M. Smith et al., 2020).

2.3.1.3 Improved Water Quality

Improving water quality is another important environmental factor of regenerative agriculture in Germany. The water quality is improved through regenerative agriculture in 3 ways. First, by increasing the soil's water-holding capacity, also called moisture retention and its ability to let the water sink into the groundwater, referred to as soil infiltration rate. Secondly, by avoiding nitrate pollution and lastly, by regenerating the small water cycles (Kurth et al., 2023).

In 2016 80 % of the irrigation water came from groundwater and spring water sources (J. Arle et al., 2018). Over the next 12 years, research expects irrigation to quadruple due to increased droughts (Rosa et al., 2020). Building up soil organic matter by applying regenerative agricultural methods improves water infiltration and retention rates. They are, therefore, essential in mitigating future droughts by reducing irrigation and replenishing groundwater (Lankford & Orr, 2022). The estimated reduction of water in need for irrigation through regenerative agriculture is 20 million cubic meters, corresponding to an annual water consumption of 430,000 Germans (Kurth et al., 2023).

Regenerative agriculture can decrease the number of nitrogen fertilisers and therefore reduce the nitrate unloaded into water. This positively affects the groundwater and soil and can benefit Germany financially. €600 million have to be spent annually on the filtering process of nitrates from drinking water, and €300 million have to be paid on EU penalties for failing in nitrate thresholds in groundwater (Torsten Kurth et al., 2020).

The ability of regenerative agriculture to regenerate small water cycles is crucial in saving the climate. 40 % of our rainwater comes from the small water cycle from inland, while the other 60 % comes from the sea. The small water cycle was disrupted by the increase of bare soil, which is one reason for the desertification of land (Tickell, 2017). Most transpiration happens through the evaporation of water through trees and plants, which is a part of the photosynthesis process and can have a cool-down effect on the land. Moreover, the condensation nuclei process, which is bacteria from leaves rising in the atmosphere and connecting with the transpiration nuclei, also referred to as water vapour,

leads to the creation of clouds. Clouds lead to more rain and, by reflecting sunlight, have a cool-down effect (Noreika et al., 2022).

2.3.2 Practice-Specific Benefits of Regenerative Agriculture

Certain practices and their particular benefits are outlined in the following section to achieve the overall benefits of regenerative agriculture. To understand regenerative agriculture practices, it is crucial to emphasise that it is multi-layered and ever-evolving. There is not a one-solution method that works for all settings. Regenerative agriculture must be adapted to the particular agricultural and environmental conditions to align with the natural habitat. Before adopting the regenerative agricultural system, it is necessary to consider and analyse variables, including precipitation, temperature, soil type, farm business mix, markets, and individual preferences (Khangura et al., 2023). All regenerative practices are again based on the beforementioned five pillars, which are avoiding measures that harm the soil, life, and biodiversity, optimising photosynthesis on the land throughout the year, promoting a closed nutrient cycle, incorporating biodiversity and water retention on the field and lastly the integration of animals on the land. Due to many different practices, this paper will discuss the most important examples: cover crops, no-tilling farming, soil amendments, agroforestry systems, including the cultivation of hedges, regenerative grazing, and active water management. (Lal, 2015).

2.3.2.1 No-Till Farming

No-till farming, also called direct planting or zero tillage, is a conservation tillage technique that disturbs the soil as little as possible during planting and crop maintenance. To achieve that, no-till farming farmers use specialised equipment to plant seeds directly into undisturbed soil. Tilling or ploughing the land, on the other hand, may weaken the soil's structure, deplete its organic content, as the carbon oxidises when turned up, and worsen soil erosions. Scientific evidence argues that no-till farming, as opposed to traditional tillage, may prevent soil erosion by up to 90% (Lal, 2015). Furthermore, by increasing soil organic matter, no-till farming may enhance soil structure, nutrient availability, and water-holding capacity (Martínez et al., 2013). Also, no-till farming can increase soil organic matter by up to 30%, resulting in better soil health and higher crop

yields (Derpsch et al., 2010). In Germany, only about 1% of all the arable land is under no-till farming (Zikeli & Gruber, 2017).

2.3.2.2 Cover Crops

Maintaining soil cover and live roots in the soil throughout the year is part of the pillar of regenerative agriculture. The integration of cover crops in the agricultural system is one strategy, as cover crops are commonly cultivated between primary crops to cover the soil and maintain live plants during non-cash cropping seasons. Thereby, regenerative farmers ensure that the soil is covered year-round and that living plants are in the soil for as long as possible (Brown, 2018). There are two standard methods in planting cover crops; one is right after harvest, and the other one is by under-seeding cash crops like annual grains with legumes and grasses. Once the cash crop is harvested, the perennial cover crops will have an increase in sunlight and start growing fast and sustain soil cover until the following cash crop is seeded.

Moreover, one can plant single species or a mixture of many species as cover crops. Research indicates that a combination of species provides all the advantages of each species in the mix (Finney et al., 2017). Various plant species can be used as cover crops in different cropping systems. These species include legumes, grasses, brassicas, and annual or perennial crops. To function correctly, cover crops must provide various ecological services to the soil and cropping system. The main job cover crops have to fulfil is to stop soil erosion caused by wind and water. Cover crops can strengthen the soil's structure, water-holding capacity, and nutrient absorption by penetrating the soil deeply. The biomass produced by cover crops can also serve as weed control, act as a source of organic fertiliser and provide a variety of habitats for bacteria and fungi in the soil. Cover crops serve as a barrier between the soil and the crop, which can help manage pests and diseases by reducing the prevalence of soil-borne pathogens and pest infestations (Beillouin et al., 2021). Various studies have been conducted on cover crops, which show their efficiency in improving soil health and crop yield. For example, there is evidence that using cover crops improves soil structure, water retention, and soil organic matter content (Kaye & Quemada, 2017). A recent study has shown that cover cropping area could be tripled in Germany and cover crops are an excellent tool for

climate change mitigation, and the total carbon input of soil could be increased to 12% (Seitz et al., 2022).

2.3.2.3 Soil Amendments

Soil amendments are another essential method of conservation agriculture. It is part of the third pillar of the definition of regenerative agriculture, namely promoting a closed nutrient cycle. These soil amendments can be in the form of residue management or composting. In residue management, previous crop residue, including stalks, leaves, and other plant materials, is left on the soil's surface to prevent erosion while protecting it from extreme weather conditions. It provides aid with moisture retention, moderates soil temperatures, inhibits weed growth, reduces soil water evaporation, and provides organic matter cycled by earthworms (Blanco-Canqui, 2013; Sapkota et al., 2015). Compost is made of the residue of plants and can improve soil structure, disease suppression and nutrient cycling. It is highly effective in producing soil carbon because it directly feeds the soil microbes (Fronning et al., 2008; Gattinger et al., 2012).

2.3.2.4 Agroforestry, Incl. Cultivation of Hedges

India as the first country to develop an agroforestry strategy, defines in the national agroforestry policy, agroforestry, as “a land use system which integrates trees and shrubs on farmlands and rural landscapes to enhance productivity, profitability, diversity, and ecosystem sustainability. It is a dynamic, ecologically based, natural resource management system that, through the integration of woody perennials on farms and in the agricultural landscape, diversifies and sustains production and builds social institutions” (Government of India, 2014, p.1). The way agroforestry is practised can take many different forms. The most common types of agroforestry are silvoarable and silvopasture systems. Integrating woody perennials with agricultural or horticultural crops is called silvoarable agroforestry or tree intercropping. These trees are grown in wide alleys to allow the crops to grow. Both trees and crops are grown simultaneously; while the trees mature, the crops provide an annual income (Alliance, 2018).

Another part of silvoarable agroforestry is the cultivation of hedges. Farmlands can be protected by planting hedges around the plots or by creating and maintaining a long windbreak of live trees and plants. Hedges also decrease the field size, and research in Germany has shown that a decrease in field size lead to an increase in biodiversity (Tscharntke et al., 2021a). Silvopasture is the discipline of harmoniously combining trees with animal grazing. Since grass is mostly a perennial crop, there is no tillage, bare soil, and broader biodiversity than in ordinary grassland (Burgess et al., 2019). One of agroforestry's fundamental principles and objectives is soil health and biodiversity. The symbiosis of trees, crops, and animals can indeed achieve more biodiversity and healthier soil (Tscharntke et al., 2021b). Also, carbon sequestration is a positive benefit of agroforestry; in Germany, research has shown that especially agroforestry in the combination of croplands could have a considerable sequestration potential (Golicz et al., 2021).

Another essential factor of agroforestry is that it can improve the natural water cycle. It cools down the microclimate through evapotranspiration and shading on the surface. Furthermore, soil erosions can be prevented by planting trees and shrubs and stabilising the soil (Frelih-Larsen et al., 2022). Combining these critical objectives of agroforestry, biodiversity, healthy soil, and a functioning water cycle will ultimately lead to a more resilient ecosystem with less extreme weather conditions (Castle et al., 2022).

2.3.2.5 Regenerative Grazing

Regenerative grazing enhances perennial grasslands and forests' natural sink capacity significantly through highly managed grazing systems. (Hungate et al., 2017). Cows would not cause 7-18% of global greenhouse gas emissions if they would be raised differently. Most of the grassland they inhabit, especially in North and South America, is used to produce grain as forage for livestock. However, cows cannot digest these grains, producing high methane emissions (Stanley et al., 2018). Today more than 65 % of methane emissions in Germany come from agriculture and, hence livestock (Kurth et al., 2023). Regenerative grazing uses cows to resemble the grazing habits of the vast herds of ruminants that may be seen in nature, including wildebeest, buffalo, and bison. Extensive grasslands and savannahs, which have the planet's finest humus soils, are where these

animals roam. These massive herds of ruminants cause significant environmental disruption as they pass over these grasslands by eating, trampling, and excreting on the grass. They only stay in one place for a short time; however, after a herd has passed through a region, it may be months before another herd returns. After the herd has passed, the grass is in a condition of shock, intensifying its development by feeding soil life and growing roots deeper into the earth via photosynthesis, which raises soil carbon levels. Rotational grazing is a summary term for different forms of managed grazing, including holistic, multi-paddock, and mob grazing. They have differences, but the underlying idea is the same. This paper will be limited to the explanation of mob grazing. The central concept of mob grazing is what is known as disturbance and rest. The process of the cows being moved daily from one section of the pasture, which is referred to as paddocks, is known as mob grazing or rotational grazing. The affected paddock will not see a cow for 6 to 8 weeks, which allows it to recover and renew more quickly because of the strengthened growth and the fact that the cows do not consume the regrowing grass as they normally would if they remained on the pasture longer. (Machado Filho et al., 2021). Animal welfare is dramatically improved with rotational grazing and essential ecosystem services, which boost soil carbon sequestration, enhance soil health, improve water retention, preserve water quality, and promote biodiversity. Since 70 % of global agricultural land accounts for grazing land, research suggests regenerative grazing may provide the most significant global sequestration potential (Moyer et al., 2020).

2.3.2.6 Active Water Management

For effective water management, the retention of rainwater is vital (Lankford & Orr, 2022). This can be achieved by creating lakes, ponds and water runoff areas. Furthermore, the restoration of wetlands is essential to restore aquatic habitats. Humanity has dramatically decreased aquatic habitats through dam building, river management, and agricultural drainage schemes, and those that remain are somewhat disjointed and compartmentalised (Tockner & Stanford, 2002). By harvesting rainwater in ponds and lakes and integrating them into arable land, this water can irrigate the soil. As scientific studies have shown, it can positively affect practices like mob grazing. Ponds and lakes have a positive effect on the behaviour of cattle and their steer performance (Bica et al., 2021). The restoration of wetlands, such as peatlands, is another critical component. Since peatlands are the largest terrestrial carbon store, their drainage has led to the release of

enormous amounts of greenhouse gas emissions, especially in Germany, where 98% of all peatlands have been drained. With a 7.5% contribution of all greenhouse gas emissions in Germany, Germany is the largest peatland emitter worldwide (Joosten et al., 2015). Once these peatlands are rewetted, they can sequester again. Research suggests that restoring peatlands in Germany can be an economically feasible method to reduce greenhouse gas emissions (Roe et al., 2021).

2.3.3 Socio-Ecological Benefits

The socio-ecological benefits of regenerative agriculture in Germany are twofold, including the farmers and Germany as a whole. As previously discussed, these benefits include regenerative agriculture's climate change mitigation potential. Secondly, regenerative agriculture can provide more nutrient-rich food directly linked to human health, and lastly, regenerative agriculture supports local food production, food security and economic benefits.

Regenerative agriculture claims to produce more nutrient-dense food. Nevertheless, no study has been conducted on the direct impact of regenerative agriculture on food (Khangura et al., 2023). Still, research suggests that nutrient food crops depend on healthy soil and, therefore, on the soil microbes. The depletion of soil has led to a significant decline in food nutrients (Marler & Wallin, 2006). Also, there is a direct link between healthy soil and nutrient-rich food to human health. Research has found that the gut microbiome, which is essentially bacteria in humans, is responsible for the digestion of food and the intake of nutrients, and functions in a similar way to the soil microbes. A vast richness of gut microbiomes is directly linked to healthy food and its nutrients. Research has shown that a dysfunction of the gut microbiomes can lead to several diseases like inflammatory or immune-mediated diseases, gastrointestinal diseases, atopic diseases, diabetes, obesity, or chronic kidney diseases (Lozupone et al., 2012). That is why chemical inputs in agriculture not only directly affect the soil health but also the health of humans (Hirt, 2020).

The literature considers the economic benefits of regenerative agriculture in Germany for different stakeholders. First, the research suggests that regenerative agriculture can increase farmers' profits and revenues. The Boston Consulting Group calculated the profit increase for regenerative agriculture farms in Germany. They excluded subsidies, labour costs and water costs. In selling carbon credits for sequestering soil and mitigating soil through regenerative agriculture, they see another source of income for regenerative farmers. Also, they divided the adoption process of regenerative practices for the financial analysis into two stages. Overall, they see a potential profit increase of 60 or more % for all farmers after 6 to ten years (Kurth et al., 2023).

The economic benefits for Germany are seen at €8.5 billion for regenerative agriculture in Germany in 2035. This calculation includes the withdrawal of carbon from the atmosphere paid through carbon credits and water quality improvements. Furthermore, the corporation of multiple stakeholder groups is necessary to allow a transition to regenerative agriculture in Germany. These stakeholders include suppliers of inputs and machinery, farmers, crop processors and food producers, food wholesalers and consumers. Primarily the food wholesalers and retailers are essential because without them purchasing the harvest of regenerative farms, the transition will be challenging. As sustainability pressures increase for all these stakeholders, collaboration can benefit them, especially in the long run. If successful, this could lead to a more secure food supply grown locally and less dependent on food and energy sources from other countries. It could also lead to better price stability, reducing pressure on consumers in times of high inflation. In addition, the food could eventually be exported to other countries, securing their food supply as well (Kurth et al., 2023).

2.4 Obstacles of Regenerative Agriculture

As described above, regenerative agriculture could provide multiple benefits to Germany. Despite the advantages, regenerative agriculture also has disadvantages, which under the current framework of agriculture are seen as obstacles by many farmers in implementing regenerative agriculture in Germany. These obstacles include a lack of knowledge and information on farmers' and consumers' sides, inadequate scientific research, and policy and institutional barriers. One of the critical reasons for the persistence of all these

obstacles are highly influential lobby groups who see saving the climate as a threat rather than an opportunity. The NABU conducted a study in 2019 finding a highly interconnected network of politics, associations such as the farmers' federation (Deutscher Bauernverband), the agriculture and food industry, the agrochemicals, the finance industry, authorities and foundations (Nischwitz & Chojnowski, 2019). Nevertheless, research has also found that most of the German population would favour a shift to a different way of agriculture (C. Chemnitz & C. Rehmer, 2019).

2.4.1 General Disadvantages of Regenerative Agriculture

The general disadvantage of regenerative agriculture is that yields can potentially be lower. Research has shown that yields in organic farming can be eight to 25 % lower than in conventional agriculture (Hermani, 2020). In addition, reduced or no tillage can lead to undesirable plant growth, which some farmers compensate for by using more herbicides. In addition, many farmers do not have sufficient knowledge about regenerative agriculture and therefore need to acquire this knowledge first. Furthermore, the conversion to regenerative agriculture is associated with a high financial risk, as it usually takes at least five years before regenerative agriculture is profitable (Bosma et al., 2022). The fact that regenerative agriculture can be more labour-intensive, primarily through practices such as agroforestry, is not only an additional cost factor for German farmers, but many farmers have difficulties finding employees in the first place (Pearson, 2007). Nevertheless, research suggests that digitalisation and the associated loss of industrial jobs could potentially make farming a more attractive place to work again (Merlo, 2021).

2.4.2 Lack of Knowledge and Information

Even though regenerative agriculture is gaining more popularity in Germany, there is still a lack of information and knowledge. Research suggests that through more knowledge and information, enrolment increases the benefits of regenerative agriculture (Sweikert & Gigliotti, 2019). Nowadays, most content taught in German agricultural universities and apprenticeships comprises conventional farming. Therefore it is suggested that universities, apprenticeship training, local chambers, private agronomic advisory bodies and media should devote more attention to regenerative agriculture. Further hurdles are

that farmers have deeply held beliefs and are not open towards new approaches to agriculture. Also, some have not experienced yield reduction through climate change and therefore do not see the urgency of change. (Kurth et al., 2023).

2.4.3 Inadequate Research Design

For knowledge and information, science is vital. Some research suggests that science through a comprehensive approach is essential for a successful transformation process. This approach is called “transformative research” and emphasises the need for science to be more comprehensive. The current research design for agriculture is built on achieving maximum yield under perfect conditions. However, nature is not always in perfect condition, and it is a complex ecosystem of many different components and interconnectedness. Science usually focuses only on conducting research on a single component but not on how this component reacts to other components of a complex ecosystem. That is why research suggests that for transformation, the way research is being conducted must fundamentally change (Chemnitz et al., 2021).

2.4.4 Policy and Institutional Barriers

Agricultural policies in Germany are developed by the European Union, which apply to all member states, nevertheless providing them with some flexibility. The CAP is the central agricultural policy of the EU; it regulates European agriculture and provides subsidies for financial support to farmers and rural areas. The program is implemented in several ways. First, there is a direct payment, which accounts for 90 % of the CAP, and then there are funds for developing rural development programs. Direct payments are paid based on the cultivated areas of the individual farms. The CAP is criticised by research in many ways, especially for regenerative agriculture. Research suggests direct payments should be based on socio-ecological benefits and outcome-based rewards. Furthermore, it should be more ambitious on the climate and incentivise a shift to regenerative agriculture (C. Chemnitz & C. Rehmer, 2019; Kurth et al., 2023). Adopting regenerative agricultural practices is timely and costly; therefore, farmers will need financial support (Gish, 2022). Other research suggests that the way to incentivise the shift to regenerative agriculture is to start accounting for the negative externalities on the environment and

society of agriculture and therefore receiving the actual price for a product. This approach is called true costing and would make conventional agriculture products more expensive than regenerative agriculture products (Aspenson, 2020).

2.5 Conclusion of the Literature Review

The literature above has defined regenerative agriculture and how it differentiates from conventional and organic agriculture. Furthermore, the different potential benefits and obstacles of regenerative agriculture in Germany were described. Especially for the local benefits and obstacles of regenerative agriculture in Germany, a lack of research was found.

3. Methodology

The following section will explain how the empirical research for this study was conducted. This chapter will outline which research methods for the data collection were chosen and how the research was conducted and later analysed. Furthermore, which ethical considerations were upheld throughout the study will be elaborated.

3.1 Research Design

For the research design, either a qualitative or quantitative approach can be chosen. Quantitative research is based on numbers and a deductive research design. It requires a hypothesis, which after a test is rejected or confirmed. Qualitative research, on the other hand, is based on words and an inductive research design. It does not require a hypothesis and tries to generate an opinion by providing descriptive data. Hence qualitative research is used for exploratory research, whereas quantitative research is used for confirmatory research (Leavy, 2022). Since the topic of this paper is relatively new, without much research conducted, a qualitative research approach is the most suited study design (Merriam, 2008).

3.2 Data Collection

For the data collection of research, there is a distinction between primary and secondary data. Primary data is data that does not yet exist and is collected by the researcher for the specific purpose of the study topic. Secondary data, on the other hand, is data already obtained from past published research but for a different investigation purpose. The data source chosen for the research depends on the nature and objectives of the study. For a qualitative research design, the data can be obtained through direct observations or directly questioning people. Direct observations are the most suitable method for reviewing people's behaviour and reactions. Interviews are the most suitable method when the research aims to gain a deeper understanding of individuals' attitudes and beliefs (Rabianski, 2003).

Since the study was centred on a present and future-focused subject, it was necessary to gather additional information from various sources to go further into the research issue.

Therefore, the researcher collected the primary and secondary data using qualitative research approaches. Four experts were interviewed to obtain the primary data. The existing literature was reviewed to obtain the secondary data.

3.3 Semi-Structured Interviews

For qualitative interviews, there is a distinction between three different designs. There are structured, semi-structured and non-structured interviews. Structured interviews use pre-formulated questions in a specific order to ensure consistency in the interviews conducted. Semi-structured interviews only use some preformulated questions with no prefixed order. Furthermore, a certain level of improvisation is allowed here, and new questions can emerge. Non-structured interviews use very few preformulated questions and are the most flexible and improvised form of interviews. In-depth interviews usually take the form of semi-structured or non-structured interviews. In-depth interviews aim to get a more comprehensive answer than "yes" or "no" and to gather unique knowledge from each participant (Leavy, 2022).

Since regenerative agriculture is a relatively new topic in Germany and requires a certain amount of flexibility, semi-structured interviews were chosen for this study.

3.4 Sampling

The sampling process is the selection of the target group for the research conducted. The sampling for quantitative research is typically done through probability samples, while nonprobability samples are used for qualitative research. Due to the generalisation objective of quantitative research, big sample sizes are usually used, while small sample sizes are more appropriate for qualitative research. Accordingly, the researcher of this study chose to target a small sample size, between three and five people.

There are three different theoretical approaches for qualitative nonprobability sampling. These include judgement, snowball, and theoretical sampling. Judgement sampling is a non-random sampling technique where the researcher selects the most suitable participants to answer the research questions. Snowball or chain-referral sampling identifies a few participants based on the research criteria. These participants are later

used to identify new participants. Theoretical sampling involves selecting participants based on the topics of the emerging data. It is usually used when the researcher tries to build a theory (Marshall, 1996). For this paper, the judgement sampling theory was chosen, and four experts in the field of regenerative agriculture in Germany were interviewed.

Expert interviews are considered an efficient means of obtaining high-quality data on a topic that corresponds to the person's expertise (Bogner et al., 2009). Since the subject of this thesis is detailed and much local expertise is required to answer the interview questions reliably, experts are the most appropriate target group.

3.5 Empirical Procedure

The empirical procedure began with the search and contacting of the interview participants, followed by the creation of a semi-structured interview guide and, finally, the conducting of the interviews.

3.5.1 Sample Recruitment

The search of the participants was the starting point of the sample recruitment and was carried out during the literature review. All participants of the study were approached through connections or acquaintances. Every participant was contacted via email, summarising the study's purpose and the interview objective. The following table provides information on each participant, legitimising their expertise in regenerative agriculture in Germany.

Participant	Information
Participant 1: Gender: male Age: 38	Regenerative farmer and owner of a farm of one thousand hectares in East Germany, where he is testing and reporting on different regenerative farming practices. Also, an author and public promoter of regenerative farming in Germany.
Participant 2: Gender: male Age: 63	Regenerative farmer and owner of a farm below 100 hectares in the South of Germany. Engaged in promoting regenerative farming in Germany through several associations. One of the first people to farm regeneratively in Germany.
Participant 3: Gender: male Age: 51	Physical geographer and permaculture designer in Germany. Advisor of the UNEP in global environmental issues. Helps and advises a regenerative farm in the South of Germany. Also, an author and public promoter of regenerative farming in Germany.
Participant 4: Gender: male Age: 49	Demeter and soil expert. Converted a farm to regenerative in Poland and advised several large-scale farms in Germany on how to become regenerative. Currently converting a farm in England.

Table 1: Interview Participants Overview

3.5.2 Interview Guideline

The interview guideline was constructed according to the research question and the literature. Therefore, the questions of the interview guideline focused mainly on the benefits and obstacles of regenerative agriculture in Germany. The interview was introduced with questions about the participants' background knowledge and concluded

by asking if the participant had any concluding remarks about the interview. The questions allowed each participant to answer comprehensively and to make full use of their extensive knowledge. The general structure of the interviews always remained the same. Nevertheless, some questions were used for some participants and some not. Dependent on what the respondent answered in previous questions, occasionally, new questions emerged during the interview process. The interview guideline can be found in the appendix.

3.5.3 Recording, Transcription and Data Storage

Depending on the preferences of the participants and the geographical distance, the location, the means of communication for the interview and the language were determined. Only Participant One opted for English, while all other participants chose German as the interview language. Two of the four interviews were conducted via Zoom, one in person and one via phone. All interviews were recorded using the computer's recording programme. A backup recording was made with a phone for the interviews on Zoom and in person. Only the interview via phone had no backup recording. Later all recordings were transcribed with the online tool (*Trint*, 2022) and, if necessary, translated with (*DeepL Translator*, 2023). All transcriptions were double-checked for accuracy. The data was stored on the researcher's computer's local hard disk and cloud.

3.6 Ethical Considerations

Ethical considerations are an underlying principle of empirical research. In order to ensure the ethical protection of the participants and researcher, both signed a consent form. This consent form included ethical considerations like the participant's anonymity, transparency on the objective and procedure of the interview, and the recording and later transcription. Each participant gave their consent. Ethical considerations were always taken into account throughout the study.

3.7 Data Analysis

After conducting, recording, and transcribing the interviews, they were analysed using the coding program (*ATLAS.Ti Scientific Software Development GmbH*, 2023). The researcher applied the thematic analysis theory according to Attride-Sterling (2001). Thematic analysis has the advantage of providing a high degree of flexibility which can be applied to the different needs of studies. Moreover, it provides the researcher with rich and complex data. After coding each interview and identifying themes, Attride-Sterling suggests clustering these themes into different levels, always trying to establish patterns and similarities. The first and most basic level are the Basic Themes, followed by the Organising Themes and concluded with the Global Themes. Since the codes applied to the transcripts during the data analysis process are connected to the basic themes and, therefore, the two other levels of themes, a network of codes is established (Nowell et al., 2017).

The coding of the transcripts can be conducted using inductive or deductive coding. Deductive coding is meant when coding according to a theory found in prior research. Inductive coding is meant when establishing new themes and a new coding framework from raw data. This study chose inductive coding, creating a new coding network. Nevertheless, due to the research question and interview guideline, the global themes of the coding framework are aligned with the interview guideline and literature.

4. Results

The following chapter will present the empirical results of this study. The reader will get an overview of what the four experts in regenerative agriculture think about the topic in question.

4.1 Background of the Data

This study aimed to understand the benefits and obstacles of regenerative agriculture in Germany. Therefore, four experts in the field of regenerative agriculture in Germany were interviewed.

4.2 Extracting the Data

This part of the study will explain how the coding network out of the transcripts was constructed and how the themes were set. After conducting the interviews, all transcripts were coded, and 149 individual codes were established. After rereading the text segments of the codes, these were summarised into 39 basic themes. The 39 basic themes were then further summarised by rereading them again into nine organising themes. These nine organising themes comprise the three global themes: differentiation of regenerative agriculture and the benefits and obstacles of regenerative agriculture in Germany. The researcher established that each basic theme needed a minimum appearance of over five times to be included in the results. Furthermore, the researcher found that several basic themes could not be clearly assigned to the respective organisational theme due to their ambiguity. Here, the researcher had to decide through his background knowledge which organisational theme was most suitable for the basic theme. The following table provides an overview of the basic, organising, and global themes. A more detailed description of the basic themes and codes can be found in the appendix.

Global Themes	Organising Themes	Basic Themes
Differentiation of regenerative agriculture	Definition of regenerative agriculture	Nature instead of chemistry; RA difficult to define; Start from the soil; Start thinking like nature
	Conventional/Organic agriculture	Organic agriculture; Conventional agriculture
Benefits of regenerative agriculture in Germany	Environmental benefits	Biodiversity benefits; Carbon sequestration benefits; Climate change benefits; Livestock benefits; Resilient ecosystem benefits; Soil benefits; Water benefits
	Social benefits	Food system benefits; Germany as a leading example; Society health benefits
	Farmers' benefits	Growing interest and demand; Independence; Personal farmers satisfaction; RA can be profitable
Obstacles of regenerative agriculture in Germany	Policy and institutional barriers	Lobby power; Misconduct of the term regenerative agriculture; Problematic policies; Problematic subsidy/incentive system; True costs are not considered
	Farmers' doubts	Economic concern; High financial risk for German farmers; Not sufficient support for farmers; Regenerative agriculture is complex and difficult; Land ownership
	Lack of knowledge and information	Agricultural education system; Inadequate and lack of scientific research; Lack of consumer knowledge; Local examples needed; False information; Problematic way of farming
	Reluctance	Farmer's reluctance; Current mindset not in line with RA; Problematic consumer behaviour

Table 2: Thematic Network

4.3 Differentiation of Regenerative Agriculture

The global theme differentiation of regenerative agriculture, divided into the definition of regenerative agriculture and conventional/organic agriculture, provides information on the four interviewees on how they define regenerative agriculture and where they see the difference between regenerative agriculture compared to conventional and organic agriculture.

4.3.1 Definition of Regenerative Agriculture

All four interviewees could not give a precise one-sentence definition of regenerative agriculture. Participant One even stated that the definitions would not help. When explaining what regenerative agriculture means to them, each participant emphasised that it actually means thinking like nature and understanding that nature is circular and not linear. All the respondents also stressed that regenerative agriculture always starts from the soil and, thus, that maintaining healthy soil is crucial. Although they all talked about the well-known practices of regenerative agriculture, they also stressed that even though these practices are valuable tools, they do not necessarily have to be applied. Instead, they believe that farmers should always respond to the local needs of nature and especially to the ones of the soil and that if farmers start thinking like nature again, they will also find the right means to preserve it.

Example 1: *Well, I think it is a difficult question to answer because there is in the reality of ecology and the reality of farming, there is no is no use for definitions. Right. You farm somewhere, and you have a certain soil, and you have a certain system, and that may be better or worse. It does not really matter what it is called. You can do ecological agriculture badly. You can do conventional agriculture badly. Regenerative agriculture has no agreed definition.* (Participant 1, RA difficult to define)

Example 2: It i**s** *simply that we get involved as fellow creatures in a highly intelligent system again. It has to become clear that humans are not the intelligence of everything but that we are simply a part of nature.* (Participant 2, Start thinking like nature)

Example 3: *So, I would say regenerative agriculture; for me, regenerative agriculture has to do with having an awareness about soil life or the interaction of it. In other words, the symbiotic relationship between plants and soil life which depend on each other. And when I understand that, I automatically find that I have to take other measures or methods in a different way.* (Participant 3, Start from the soil)

4.3.2 Conventional/Organic Agriculture

The organisational theme of conventional/organic farming aims to explain how the participants see these two forms of farming compared to regenerative farming. Participant Two explained that organic agriculture used to be very similar to regenerative agriculture but has been diluted over the years. Moreover, all participants believe that the main difference between organic and regenerative agriculture is that organic agriculture imposes prohibitions on farmers, restricting them. They believe that this is due to the very strict legal definition. As explained above, the respondents believe that agriculture should constantly adapt to the local needs of nature, and therefore they think this prohibitive definition of organic farming is wrong. In conventional agriculture, all participants see a problem in the fact that conventional farming is linear due to the mindset introduced after the Second World War, stating that farming has to produce maximum quantities at a minimum price. Furthermore, they all stressed that cows are only a problem for the environment because they are fed and kept incorrectly. Lastly, they all stressed that the chemical inputs of conventional agriculture are not only bad for soil health but also for human health.

Example 4: I will *say that when it comes to organic, it is simply clear that this and that must not be used, and then you can call yourself organic.* (Participant 3, Organic agriculture)

Example 5: *You know, we have created an agricultural production system in the last 40 to 50 years which focussed on producing as much as we possibly can for the cheapest possible price.* (Participant 1, Problematic way of farming)

Example 6: *And the next thing is, of course, the restructuring of animal husbandry. That must be managed. So away from the fact that we feed them heaps of grain which is complete nonsense***.** (Participant 2, Problematic way of farming)

4.4 Benefits of Regenerative Agriculture

The second global theme is the benefits of regenerative agriculture in Germany. The corresponding organisational themes are environmental, social, and farmer's benefits. For each organisational theme, corresponding examples of the interviews will be provided.

4.4.1 Environmental Benefits

Environmental benefits are all benefits that are directly related to and therefore have an impact on the environment. Soil benefits, water benefits and livestock benefits were frequently mentioned in the interviews. All participants highlighted how vital soil is in solving environmental problems and how regenerative agriculture can build soil organic matter, thus restoring the soil. Also, the importance of the small water cycle and the opportunity through regenerative agriculture to restore this cycle was pointed out by all participants. They also saw livestock integration in agriculture as one of the critical ways to completely take advantage of the environmental benefits. Even though all interviewees agreed on the carbon sequestration benefits, disagreement was detected on the amount of carbon that can be sequestered through regenerative agriculture in soil. Finally, the ability of regenerative agriculture to create resilient ecosystems was highlighted by all respondents.

Example 7: *So this regenerative agriculture is agriculture that renews itself. So, if you do the right things, I will say you can rebuild this fertility of the soil quite quickly.* (Participant 3, Soil benefits)

Example 8: *Also, the whole water issue, not just drinking water, but the whole water cycle. In other words, the water cycle that we can stabilise again with regenerative agriculture.* (Participant 2, Water benefits)

Example 9: *We have integrated cows that are grazing on the arable land using our cover crops and nurse crops, as well as during the summer times perennial grass that we also include into the agricultural land. So, we use these cows to build the soil carbon and biodiversity.* (Participant 1, Livestock benefits)

Example 10: *We have also managed to build up more than 3% humus over the last 25 years, and if I calculate the CO2 that is too much in the atmosphere and extrapolate that, I arrive at 1.5% humus build-up on our global fields, that would be enough to get all the CO2 out of the atmosphere.* (Participant 2, Carbon sequestration benefits)

Example 11: *So more than we emit, so in Poland, in the 2000 hectares, we have 6000 tons a year of CO2 binding and in Gato, we have 2000 tons. And in England, I do not know, and I have not calculated it yet, but I am very cautious. These are all theoretical values. As long as the carbon is not used up, it is gone again very quickly.* (Participant 4, Carbon sequestration benefits)

Example 12*: I would say that the advantage for farmers is that they can develop resilient systems. In other words, in times of climate change and increasing drought, it is more and more important that our system is resilient as a whole*. (Participant 3, Resilient ecosystem benefits)

4.4.2 Social Benefits

The social benefits are the benefits that regenerative agriculture could provide to German society as a whole. Especially society's health benefits were often mentioned among the participants. Indeed, there was substantial agreement on the fact that our current agricultural system does not provide nutrient-rich food, which is a cause of the many health problems people face today. Interviewees see regenerative agriculture as a solution to provide nutrient-rich food again and thus restore not only the environment but also human health. Furthermore, the respondents see benefits for the German food system, mainly through the support of the local food supply. Participant Four also highlighted how regenerative agriculture is more energy efficient overall.

Example 13: *So, in Poland, we feed 365 cows only with hay and grass. So, we sell Demeter hay milk, and even people who have allergies can drink this milk.* (Participant 4, Society health benefits)

Example 14: *For us as a community or for us as a society. Increased resilience, more contact with locals or producers, and presumably, this will ultimately lead to a different awareness of nutrition.* (Participant 3, Food system benefits)

4.4.3 Farmers' Benefits

The benefits for farmers are all the advantages that German farmers could potentially achieve by introducing regenerative farming methods on their farms. In general, there was strong agreement among the participants on the importance of Farmers' benefits. The independence of several factors, such as chemical inputs and the personal farmer's satisfaction, was often mentioned. All interviewees pointed out that regenerative agriculture gives farmers much greater personal satisfaction because they work with nature, not against it. Also, participants agreed that the independence of external factors brings economic advantages and more personal satisfaction. The respondents also see the growing interest and demand for regenerative agriculture as an advantage for farmers, mainly due to the increasing demand for organic products and the urgency to act because of climate change.

Example 15: *And if you apply regenerative methodologies, and you might even start as like a soft value, it might even start to fall back in love with what you are doing because it reminds you of maybe, you know, what your father's or grandfather's mother's or even yourself used to do, and used to have a fascination about understanding ecosystems and working with those and not just sort of controlling them.* (Participant 1, Personal farmer's satisfaction)

Example 16: *Yes, for farmers. I enjoy it much more because you are not as dependent on the world, on industry and suppliers, and on seeds.* (Participant 4, Independence)

Example 17: *Well, I mean, I think there is a growing interest of people looking for those kinds of products and wanting to be regional and, you know, products that make sense and in a logical and social context.* (Participant 1, Growing interest and demand)

4.4.4 Combination of Environmental Benefits with Social and Farmers' Benefits

As mentioned above, the mapping of several basic themes to organisational themes was not always easy, as the organisational themes are strongly interlinked. In particular, the environmental benefits positively affect not only the environment but also society and farmers since having a healthy environment is crucial for society overall. The following table gives a clear picture of the interlinkages.

Environmental benefits	Biodiversity benefits; Carbon sequestration benefits; Climate change benefits; Livestock benefits; Resilient ecosystem benefits; Soil benefits; Water benefits	Social benefits	Food system benefits; Germany as a leading example; Society health benefits
		Farmers' benefits	Growing interest and demand; Independence; Personal farmers satisfaction; RA can be profitable

Table 3: Interrelationship of Social/Farmers' Benefits with Environmental Benefits

All the interview participants mentioned that the environmental benefits also affect society and farmers.

Example 18: *So for society, I simply see the fundamental advantage of reduced soil erosion, increased water infiltration and thus increased input into groundwater increase.* (Participant 3, Soil benefits)

4.5 Obstacles of Regenerative Agriculture

The second global theme are the obstacles of regenerative agriculture in Germany. These are divided into four organisational themes, policy and institutional barriers, farmers' doubts, lack of knowledge and information and reluctance. Throughout the interviews,

the obstacles were mentioned more than the benefits, and overall, the interviews offered additional insights concerning obstacles already mentioned in the literature.

4.5.1 Policy and Institutional Barriers

Policy and institutional barriers are laws, regulations and government programs which hinder the introduction of regenerative agriculture in Germany. Overall, all interviewees saw these barriers as a fundamental problem, making the adoption of regenerative agriculture on a larger scale currently almost impossible. The barriers mostly mentioned were: lobby power, the fact that true costs are not considered, and the misconduct of the term regenerative. By lobby power, is meant the influence of the food industry in Germany, primarily through food retailers, but also the influence of agrochemical companies on farmers particularly. All participants see a massive problem in big food retailers and their power over the customers. Three of them even stated that there is far too much emphasis in the discussion in Germany on the consumer and farmer, while there must be more discussion on the farmer and the food industry. Without the cooperation of the oligopolistic food retailers, the participants currently see no chance of selling regenerative products on a large scale in Germany. The influence of the agrochemical companies on farmers is seen negatively by the interviewees in two different ways. Firstly, they make farmers dependent on their products by making them believe they cannot farm without their chemical input. Secondly, through their donations to the agricultural education system in Germany, they influence what is taught and what is not. In the fact that true costs are not considered, the participants see one of the significant obstacles of regenerative agriculture, but on the other hand, also one of the solutions to overcome these obstacles. In their eyes, considering the external costs for the environment and society would make regenerative agriculture products more competitive compared to conventional products since they would then be more expensive than regenerative agriculture products. Moreover, according to them, it could have the potential to make agriculture independent of subsidies because they are paid adequately for the quality of their product. The participants see the misconduct of the term “regenerative” as a danger as big corporations currently use it for “greenwashing”. This is mainly due to the lack of a legal definition of regenerative agriculture. Nevertheless, all participants agreed that a definition similar to the one of organic agriculture, which only prohibits, would not help because regenerative farmers need to be able to adapt their practices to the local needs of

their land. Participant Three suggested that a label is needed for regenerative agricultural products.

Moreover, all participants see a problem in the current subsidy system, which in their eyes, is not incentivising enough for the implementation of regenerative agricultural practices in Germany. Participants Three and Four also mentioned that they consider CO2 certificates unhelpful because they enable people to emit CO2 and will further increase the "greenwashing" problem.

Example 19: *You know, the sort of the supermarkets and the trade companies and the whole, you know, the food industry has such a great way of making sure that, you know, people are being force-fed. And so they do not understand, really. And so there is this great mismatch hidden in people who would like to have more of the good product. And some farmers would like to do more for the environment, but somehow they do not seem to meet right, and you never quite know what it is. And I mean, on one side, it is, of course, because of political subsidies, but it is also the power of the trade companies, the food companies and the supermarkets.* (Participant 1, Lobby power, Problematic policies; Problematic subsidy/incentive system)

Example 20: *True Costing is exactly a path that you can definitely take. Just by making clear what the real environmental damage is. Of course, this will also create a political framework by quantifying the real costs.* (Participant 2, True costs are not considered)

Example 21: *I see it rather the other way around - this is also a discussion I am having with some people because all the chemical companies are now talking about regenerative agriculture, which is, of course, complete nonsense. Because, in the end, it is not regenerative agriculture at all. I have neighbours in England who do no-till and spray everything dead in the end. That is why I am very careful with this term because regenerative agriculture is more of a fashionable term for me.* (Participant 4, Misconduct of the term regenerative agriculture)

4.5.2 Farmers' Doubts

Farmers' doubts are all concerns and uncertainties farmers have about adopting regenerative agricultural practices in Germany. All participants raised these points frequently, especially the high financial risk for German farmers, the economic concern, and the fact that there is not sufficient support for farmers. Even though the two basic themes, "economic concern" and "high financial risk for German farmers", highly correlate, the researcher found it essential to distinguish between them. The economic concerns refer to the fact that many farmers find it extremely difficult to see the economic viability of regenerative agriculture under the current framework conditions. The respondents gave different reasons for this. One difficulty they all saw was that regenerative agriculture takes time to be profitable. Participant One, in particular, emphasised that due to the novelty of regenerative agriculture in Germany, there are currently no economic models to inform farmers considering conversion. Furthermore, all participants agreed that economic viability is crucial for farmers to take the plunge. The high financial risk for German farmers relates more to the respondents' information that many farmers in Germany are in debt and have difficulties paying their current bills. In addition, they all mentioned that the increase in extreme weather in Germany poses a risk to the harvest of German farmers and, thus, an immediate financial risk. Additionally, related to the financial difficulties of German farmers, they all stressed that a transition to regenerative agriculture needs financial support. The point that there is insufficient support for farmers refers to the interviewees' arguments that there are insufficient advisors and networks which help German farmers transition to regenerative agriculture. However, it is also generally hard to get out of the conventional farming system. Three participants mentioned the problem that regenerative agriculture is complex and difficult. Participant Four also raised the issue of land ownership. He explained that people who would like to practise regenerative agriculture usually do not own land or cannot afford to buy it either.

Example 22: *If it is not more economically viable, then there is no space for it. It has to be economically more viable. Farmers need to be able to earn a better profit with applying principles of regenerative farming.* (Participant 1, Economic concern)

Example 23: *And you cannot leave that to the farmers alone because the risk that there is simply too much financial risk is simply too great.* (Participant 2, High financial risk for German farmers)

Example 24: *And you know, many farms have specialised and are often highly indebted, and you know, they need to pay the annuities to the bank, and they cannot just change the whole operation. It is a system that they are stuck in. And so that is also a big obstacle.* (Participant 1, High financial risk for German farmers)

Example 25: *We all learn from mistakes, but the motivation must be there to keep making these mistakes. So do not repeat it now; learn from it and take the next step. And that is not possible if everyone does it for themselves. It is far too exhausting. So this network is needed for innovative people*. (Participant 3, Not sufficient support for farmers)

4.5.3 Lack of Knowledge and Information

The lack of knowledge and information is twofold. Respondents see this lack on the part of farmers but also on the part of consumers. The lack of economic models, as well as points from the organisational theme "not sufficient support for farmers", are overall also a lack of knowledge and information but were classified by the researcher based on its specific understanding as other organisational themes. The most frequently mentioned points by the participants were the current agricultural education system, the inadequate and lack of scientific research and the lack of consumer knowledge. Regarding the agricultural education system, all respondents see a problem in what is taught at agricultural universities and during apprenticeships. They pointed out that ecological, holistic principles are hardly taught and that most content still revolves around conventional agriculture. They see the reason for this in the fact that agricultural teachers are often stubborn, but also in the problem mentioned above that the industry is the biggest funder of agricultural universities. Concerning the inadequate and lack of scientific research, the interviewees mentioned that there has not been enough scientific research on many areas of regenerative agriculture and that this research is needed for the shift in agriculture. Furthermore, the respondents believe that science needs to be done more comprehensively, as nature is interconnected, and the current scientific system does not take this interconnectedness into account. Regarding the lack of consumer knowledge,

they pointed out that consumers do not know what agriculture actually is and how important a healthy diet and nutrient-rich food is. They all stressed that this knowledge should be taught more in German schools.

Example 26: *For example, with my water landscapes, everyone said that I would be completely crazy, that we were building dikes in a dry landscape, and what is that all about? But they could not get a picture of it, and then they saw the lakes. They then said wow, that looks cool and also works. People are simply so educated that they can no longer formulate the right questions. So most agricultural universities are financed by the industry or the pharmaceutical industry too. The pharmaceutical industry also often finances university hospitals, so the industry knows how to do it. It does. It needs really good and independent education, and of course, it also needs incredibly good science that proves it.* (Participant 4, Agricultural education system)

Example 27: *So those who say we build up humus in quantities where scientists say that it is not possible, simply because the science is not covered. And the complexity of the methods because, for example, when I start to integrate animals into the field, I have completely different options for building up humus because this ultimately draws on 400 million years of evolution.* (Participant 3, Inadequate and lack of scientific research)

Example 28: *And then to have scientists who then know agriculture from the inside. And that is also a huge problem. I am actually always talking about contexts. Always emphasising the connections because today, everything is calculated apart.* (Participant 4, Inadequate and lack of scientific research)

Example 29: *And I believe that there is simply a need for something like education for consumers. Well, we do not even know how agriculture works anymore. We do not even know how our grains or potatoes or our animals are grown anymore.* (Participant 3, Lack of consumer knowledge)

Example 30: *What is fatal, of course, is simply the whole nutrition education. So, that we really learn from an early age onwards in schools and kindergartens. I could, for example, imagine that with a syntropic garden, that we bring the children into contact with such topics right from the start. And then it is no longer the question of whether*

people eat healthily or not. It is a lot of educational work. (Participant 1, Lack of consumer knowledge)

4.5.4 Reluctance

Reluctance in the case of obstacles to regenerative agriculture in Germany refers to the general resistance and hesitation of various stakeholders to implement regenerative agriculture in Germany. Three basic themes emerged in the interviews, all of which were mentioned by the participants. Firstly, they believe that the current mentality is not in line with regenerative agriculture. They particularly addressed the reluctance of farmers and see a problematic consumer behaviour, which is undoubtedly partly due to the lack of knowledge and information mentioned above. Regarding the current mentality not being in line with regenerative agriculture, the participants frequently mentioned that people first think too much that technology is the solution while forgetting that nature offers the best solutions. They also see the idea of society being able to control nature as critical for regenerative agriculture. Regarding the farmers' reluctance, they pointed out that farmers tend to be very stubborn, resulting in them despising other farmers in their local communities who shift to regenerative agriculture. Regarding the problematic consumer behaviour, the participants stressed two points, firstly that there is significant food waste and, secondly, a general lack of health awareness in German society.

Example 31: … but also *take care and account of the ecological, social and values of those systems and then also obviously develop software and technology, but with the understanding of the ecosystem, not just with the idea that technology is going to fix the problem and so on.* (Participant 1, Current mindset not in line with RA)

Example 32: *And so I think that is really the biggest thing. It is the mind and, and sort of the philosophy that it is, so difficult to adopt and to be willing to do. Because changing your way always means giving in to something, always means acknowledging that the prior maybe was not right or maybe is not what is wanted anymore. And farmers are too proud.* (Participant 1, Farmers’ reluctance)

Example 33: *When you, as a farmer, do something differently than everyone around you, you will be sorted out there. There is research from England from a few years ago where they said that is the biggest obstacle.* (Participant 3, Farmers' reluctance)

Example 34: *And the next thing is that the people in the Western world eat too many calories. If you would give them to the ones who starve, then there is no hunger anymore. The second is that if we throw away 50% of the food, which is really a crime. If we would not do that, there is no longer any hunger and the questions of yields.* (Participant 2, Problematic consumer behaviour)

The thematic network analysis has extracted the most relevant information from the four expert interviews. The overall results suggest that there are clear benefits of regenerative agriculture but also that there are still many obstacles for farmers to adopt regenerative agricultural practices in Germany. Especially regarding the obstacles, the research in this study provided new, valuable information in addition to the literature. Furthermore, the research provides ideas on how to solve these obstacles.

5. Discussion

The following chapter critically discusses the research findings of this thesis and compares them with the existing literature described previously. The research question was: “What are the benefits and obstacles of regenerative agriculture in Germany?”. The existing literature provides a good deal of information on the benefits of regenerative agriculture, even if these are mostly not applied to Germany itself, while obstacles are hardly discussed. Especially regarding obstacles, the data research conducted in this study provides new information that complements the existing literature.

5.1 Understanding Regenerative Agriculture

The existing literature explains how defining regenerative agriculture is difficult. Nevertheless, some basic principles, such as the “integration of animals on the land”, are provided. Furthermore, it emphasises how it always starts with soil life (Khangura et al., 2023). The data research of this study gives a similar understanding of regenerative agriculture. However, it emphasises more that understanding nature's local needs is how regenerative agriculture must be seen. The prohibition concept of organic agriculture is seen by both the literature and the data extracted from the interviews as crucial. Nevertheless, the interviews showed how the non-protection of the term "regenerative" can lead to its misuse. Therefore, the difficulty of defining regenerative agriculture is a critical issue that must be solved in the future.

5.2 Regenerative Agriculture Has Benefits

The result for the environmental benefits of regenerative agriculture outlined in the literature and data research are very similar. Both emphasise how regenerative agriculture can help mitigate climate change by improving soil health, water quality and biodiversity. Furthermore, both point out the importance of integrating farm animals in the countryside and indicate that the cow is, in principle, not a problem but rather an asset (Stanley et al., 2018). Regarding carbon sequestration in soil, both the literature and the interviews showed no consensus on its real potential (Frelih-Larsen et al., 2022; Moyer et al., 2020). Therefore, further research on this topic will be necessary. Nevertheless, both the

literature and the interviews agree that peatlands are extremely helpful in sequestering carbon (Roe et al., 2021).

The Socio-ecological benefits in the literature are twofold, divided between societies' benefits and farmers' benefits. This division was confirmed by the interviews conducted. Both literature and data research show how there are health benefits for society through more nutrient-rich food (Lozupone et al., 2012). Moreover, although there is no evidence for the direct effects on nutrient density in food through regenerative agriculture, there is proof regarding the effects of healthy soil, which is the crucial component of regenerative practices (Marler & Wallin, 2006). The literature and the data research also see a general benefit for the food system by supporting local structures (Kurth et al., 2023). The energy efficiency benefit of a regenerative agriculture food system mentioned by participant four of the interviews has not yet been regarded in the literature and is a potential topic for further investigation.

The benefits for farmers are primarily considered in the literature from an economic point of view. The potential increase in profits and revenues is justified by the financial compensation for water quality and carbon sequestration through CO2 certificates. Profitability is seen through this model already in year one (Kurth et al., 2023). The data research, on the other hand, suggests that regenerative agriculture takes more time to be profitable. Therefore, the economic viability can be more complicated than the BCG study suggests. Nevertheless, the respondents do not include compensation models such as CO2 certificates in their calculations. Even though the respondents support compensation for ecological services, CO2 certificates are seen critically, as, in their opinion, they still allow people to emit CO2. The interviews also revealed additional farmers' benefits, which are not mentioned in the literature. Namely, the increased farmer satisfaction, as well as the growing interest and demand, are essential advantages to be considered among the benefits of regenerative agriculture.

5.3 Regenerative Agriculture Has Obstacles

The obstacles of regenerative agriculture are mainly discussed in the literature as a lack of knowledge and information, an inadequate research design, and policy and institutional barriers. All these obstacles were confirmed by the interviews in this study. However, the

interviews revealed two additional themes, namely a fundamental reluctance among the population, and farmers' doubts, which are mainly financial and economic in nature.

Most of the literature's lack of knowledge and information is derived from the agricultural education system still teaching conventional agriculture (Kurth et al., 2023). The data research of this study revealed that this system is mainly financed by the agrochemical industry, which has an interest in the continuation of conventional agriculture. However, this reference should be further researched and investigated to create more transparency. The interviews also further revealed that consumers need to be educated about farming but also about nutrition. It is suggested that this should start at an early age through schools. Moreover, the literature highlights the inadequate research design that prevents a comprehensive understanding of ecological interrelationships (Chemnitz et al., 2021). The interviews support this argument. They also stress that much more research is needed in the field of regenerative agriculture, as this is essential for the conversion of agriculture.

The policy and institutional barriers are explained in the literature through a wrong subsidy system and incentive system (C. Chemnitz & C. Rehmer, 2019; Kurth et al., 2023). Also, the literature supports the true costing approach in which external costs for the environment and society are accounted for (Aspenson, 2020). In addition, there has been research on the significant influence of the German industry lobby on agriculture (Nischwitz & Chojnowski, 2019). The data research of this study supports all these arguments. In particular, the lobby power of the industry was seen by respondents as extremely damaging. Furthermore, it was suggested that accounting for external costs could be extremely helpful for a transition to regenerative agriculture because it could have the potential to liberate farmers from subsidies, and they would finally be paid adequately for the quality of their products. Therefore, the researcher of this study suggests that these two topics should be further investigated. Especially the true cost approach could be an interesting one, as it may have the potential to change agriculture on a large scale towards regenerative agriculture and could allow regenerative farmers to continue farming in the future without a prohibitive definition but by adapting to the local needs of nature. Therefore, further research should be conducted on true costs in the context of regenerative agriculture.

The farmers' doubts are a topic not adequately discussed in the literature. It has been mentioned that yields can be lower, and a transition to regenerative agriculture takes time (Bosma et al., 2022). However, especially the lack of economic models and the high financial risk for German farmers is barely discussed. Farmers need to have exemplary local economic models to be able to understand the economic viability of regenerative agriculture. Furthermore, the fact that farms are in debt and financing costs are high has to be considered since regenerative agriculture within the current framework takes time to be profitable. Especially policymakers should take these concerns into consideration and think about solutions. Incentivising and financing a transition could be a potential solution, as suggested by the interviewees.

The overall reluctance that the interviewees pointed out is also barely considered in the literature. The fact that society has a linear way of thinking, which is the opposite of the holistic thinking of regenerative agriculture, as well as the farmers' stubbornness and problematic consumer behaviour, implies that social change has to be promoted. The interviewees suggest that this can only happen through education.

6. Conclusion and Limitations

The aim of this study was to conduct research on the benefits and obstacles of regenerative agriculture in Germany. Due to the urgency of climate change and the potential of regenerative agriculture to be a climate change mitigation tool, but also because regenerative agriculture is only practised to a small extent in Germany, this topic seemed relevant to the researcher of this paper.

First, a base for the study has been laid by reviewing the literature on related research. The literature presented in chapter two first defined regenerative agriculture and distinguished it from conventional and organic agriculture. Furthermore, the benefits, divided through soil health, biodiversity, and water quality, were explained. In addition, the main regenerative practices and their specific benefits were explained, as well as the socio-ecological benefits. Moreover, the obstacles of regenerative agriculture in Germany were described. The lack of knowledge and information, the inadequate research design and the policy and institutional barriers were explained with the help of the literature.

Secondly, a qualitative study was conducted through four semi-structured interviews. All four participants interviewed are experts in the field of regenerative agriculture in Germany. Overall, the interviewer stuck to the same interview guideline in all four interviews. Nevertheless, depending on the interview process, questions were modified or added. The transcripts of the interviews were then coded inductively, and a coding framework with global, organisational, and basic themes was established.

Finally, in the discussion part of this paper, the results of the interviews were compared with the existing literature. It was found that all participants confirmed the literature, yet new benefits and obstacles emerged.

Overall, regenerative agriculture in Germany clearly offers potential benefits, not only to the environment but also to society overall and, in particular, also to the farmers. Nevertheless, there are still multiple obstacles, such as policy and institutional barriers, farmers' doubts, a lack of knowledge and information, and an overall reluctance. Therefore, introducing regenerative agriculture on a large scale in Germany seems rather difficult under the current framework conditions. Hence, different stakeholders, such as

farmers, policymakers and the food industry, should discuss how to enable a large-scale transition to regenerative agriculture. In addition, more research needs to be done to legitimise regenerative agriculture.

However, this study has certain limitations which have to be considered. Firstly, many of the environmental benefits outlined in the literature review are examples from different countries, such as the US. Although these general environmental benefits probably also apply to Germany, the impact on nature is local; therefore, local scientific research on the effects of regenerative agriculture is needed. A further limitation is the novelty of the topic. Although regenerative agriculture is based on ecological principles, it is a relatively new concept, so there is not yet much information on the long-term impact of this new approach to agriculture. Furthermore, this study has only a limited stakeholder perspective. Only experts in regenerative agriculture were interviewed. The reason for this was the limited time frame, but also the fact that conventional farmers are usually not well informed about regenerative agriculture. Nevertheless, it could be valuable information to hear their opinions as well as those of policymakers.

Moreover, a proposal for further research could be, as previously indicated, the potential impacts of true costing on regenerative agriculture in either Germany or Europe. In addition, more scientific research in the field would be valuable, for example, on the carbon sequestration potential of regenerative agriculture or its impact on the nutritional content of food. More information is also needed on the economic viability of regenerative agriculture. There should also be more research and investigations on the influence of lobby makers within the whole food system in Germany in order to create more transparency.

7. References

Aspenson, A. (2020). True Costs for Food System Reform: An Overview of True Cost Accounting Literature and Initiatives. *John Hopkins Center for a Livable Future*.

ATLAS.ti Scientific Software Development GmbH (ATLAS.ti 22 Mac). (2023).

Aune, J. B. (2012). Conventional, organic and conservation agriculture: production and environmental impact. *Agroecology and Strategies for Climate Change*, 149–165.

Azarbad, H. (2022). Conventional vs. Organic Agriculture–Which One Promotes Better Yields and Microbial Resilience in Rapidly Changing Climates? *Frontiers in Microbiology*, *13*.

Beillouin, D., Ben-Ari, T., Malézieux, E., Seufert, V., & Makowski, D. (2021). Positive but variable effects of crop diversification on biodiversity and ecosystem services. *Global Change Biology*, *27*(19), 4697–4710.

Bica, G. S., Pinheiro Machado Filho, L. C., & Teixeira, D. L. (2021). Beef cattle on pasture have better performance when supplied with water through Than Pond. *Frontiers in Veterinary Science*, *8*, 616904.

Blanco-Canqui, H. (2013). Crop residue removal for bioenergy reduces soil carbon pools: how can we offset carbon losses? *BioEnergy Research*, *6*, 358–371.

Bogner, A., Littig, B., & Menz, W. (2009). Introduction: Expert interviews—An introduction to a new methodological debate. *Interviewing Experts*, 1–13.

Bosma, D., Hendriks, M., & Appel, M. (2022). *Financing regenerative agriculture*.

Brown, G. (2018). *Dirt to Soil: One Family's Journey Into Regenerative Agriculture*.

Burgess, P. J., Harris, J., Graves, A. R., & Deeks, L. K. (2019). Regenerative Agriculture: Identifying the impact; enabling the potential. *Report for SYSTEMIQ*, *17*.

C. Chemnitz, & C. Rehmer. (2019). *AGRAR-ATLAS Daten und Fakten zur EU-Landwirtschaft*.

Castle, S. E., Miller, D. C., Merten, N., Ordonez, P. J., & Baylis, K. (2022). Evidence for the impacts of agroforestry on ecosystem services and human well-being in high-income countries: a systematic map. *Environmental Evidence*, *11*(1), 1–27.

Chemnitz, C., Weigelt, J., Enders, C., Häring, A. M., Isermeyer, F., Kunisch, M., Müller, A., Neubert, S., Rieken, H., Sommer, R., Taube, F., Tuider, J., & Wiggering, H. (2021). *Reserch for change: Towards a transformative research strategy for climate-resilient agriculture in Germany*.

DeepL Translator (Deepl Mac). (2023). https://www.DeepL.com/translator

Del Grosso, S. J., Wirth, T., Ogle, S. M., & Parton, W. J. (2008). Estimating agricultural nitrous oxide emissions. *EOS, Transactions American Geophysical Union*, *89*(51), 529.

Derpsch, R., Friedrich, T., Kassam, A., & Li, H. (2010). Current status of adoption of no-till farming in the world and some of its main benefits. *International Journal of Agricultural and Biological Engineering*, *3*(1), 1–25.

Doran, J. W. (2002). Soil health and global sustainability: translating science into practice. *Agriculture, Ecosystems & Environment*, *88*(2), 119–127.

Eckstein, D., Hutfils, M.-L., & Winges, M. (2020). Global climate risk index 2020: Who suffers most from extreme weather events. *Weather-Related Loss Events In*.

Elevitch, C. R., Mazaroli, D. N., & Ragone, D. (2018). Agroforestry standards for regenerative agriculture. *Sustainability*, *10*(9), 3337.

Federal Ministry of Food and Agriculture. (2020). *Understanding Farming Facts and figures about German farming*.

Finney, D. M., Murrell, E. G., White, C. M., Baraibar, B., Barbercheck, M. E., Bradley, B. A., Cornelisse, S., Hunter, M. C., Kaye, J. P., & Mortensen, D. A. (2017). Ecosystem services and disservices are bundled in simple and diverse cover cropping systems. *Agricultural & Environmental Letters*, *2*(1), 170033.

Frelih-Larsen, A., Riedel, A., Hobeika, M., Scheid, A., Gattinger, A., Niether, W., & Siemons, A. (2022). *Role of soils in climate change mitigation*.

Fronning, B. E., Thelen, K. D., & Min, D. (2008). Use of manure, compost, and cover crops to supplant crop residue carbon in corn stover removed cropping systems. *Agronomy Journal*, *100*(6), 1703–1710.

Gattinger, A., Muller, A., Haeni, M., Skinner, C., Fliessbach, A., Buchmann, N., Mäder, P., Stolze, M., Smith, P., & Scialabba, N. E.-H. (2012). Enhanced top soil carbon stocks under organic farming. *Proceedings of the National Academy of Sciences*, *109*(44), 18226–18231.

Gerke, J. (2022). The central role of soil organic matter in soil fertility and carbon storage. *Soil Systems*, *6*(2), 33.

Gish, S. (2022). *Drivers and Barriers of the Transition To Regenerative Agriculture Within the EU's Common Agricultural Policy Reform: Comparative Analysis with the US Farm Bill*.

Golicz, K., Ghazaryan, G., Niether, W., Wartenberg, A. C., Breuer, L., Gattinger, A., Jacobs, S. R., Kleinebecker, T., Weckenbrock, P., & Große-Stoltenberg, A. (2021). The role of small woody landscape features and agroforestry systems for national carbon budgeting in Germany. *Land*, *10*(10), 1028.

Government of India. (2014). *NATIONAL AGROFORESTRY POLICY*.

Harris, J. (2009). Soil microbial communities and restoration ecology: facilitators or followers? *Science*, *325*(5940), 573–574.

Hermani, C. (2020). *Regenerative Agriculture and the Quest for Sustainability-Inquiry of an Emerging Concept (Master Thesis). ResearchGate*.

Hungate, B. A., Barbier, E. B., Ando, A. W., Marks, S. P., Reich, P. B., Van Gestel, N., Tilman, D., Knops, J. M. H., Hooper, D. U., & Butterfield, B. J. (2017). The economic value of grassland species for carbon storage. *Science Advances*, *3*(4), e1601880.

Institute, R. (2014). *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming*. Rodale Institute Kutztown, PA.

Jantke, K., Hartmann, M. J., Rasche, L., Blanz, B., & Schneider, U. A. (2020). Agricultural greenhouse gas emissions: Knowledge and positions of German farmers. *Land*, *9*(5), 130.

Joosten, H., Brust, K., Couwenberg, J., Gerner, A., Holsten, B., Permien, T., Schäfer, A., Tanneberger, F., Trepel, M., & Wahren, A. (2015). *MoorFutures®: integration of additional ecosystem services (including biodiversity) into carbon credits-standard, methodology and transferability to other regions*. Deutschland/Bundesamt für Naturschutz.

Khangura, R., Ferris, D., Wagg, C., & Bowyer, J. (2023). Regenerative Agriculture—A Literature Review on the Practices and Mechanisms Used to Improve Soil Health. *Sustainability*, *15*(3), 2338.

Kravchenko, A. N., Guber, A. K., Razavi, B. S., Koestel, J., Quigley, M. Y., Robertson, G. P., & Kuzyakov, Y. (2019). Microbial spatial footprint as a driver of soil carbon stabilization. *Nature Communications*, *10*(1), 3121.

Kurth, Subei, Bünger, Plötner, Krämer, & Havermeier. (2023). *The Case for Regenerative Agriculture in Germany— and Beyond*.

Kuzyakov, Y., & Domanski, G. (2000). Carbon input by plants into the soil. Review. *Journal of Plant Nutrition and Soil Science*, *163*(4), 421–431.

Lal, R. (2015). A system approach to conservation agriculture. *Journal of Soil and Water Conservation*, *70*(4), 82A-88A.

Lankford, B., & Orr, S. (2022). Exploring the critical role of water in regenerative agriculture; building promises and avoiding pitfalls. *Frontiers in Sustainable Food Systems*, 217.

LaSalle, T., Hepperly, P., & Scholar, F. (2008). *Regenerative Organic Farming: A Solution to Global Warming*.

Lavallee, J. M., Soong, J. L., & Cotrufo, M. F. (2020). Conceptualizing soil organic matter into particulate and mineral-associated forms to address global change in the 21st century. *Global Change Biology*, *26*(1), 261–273.

Leavy, P. (2022). *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches*. Guilford Publications.

Lori, M., Symnaczik, S., Mäder, P., De Deyn, G., & Gattinger, A. (2017). Organic farming enhances soil microbial abundance and activity—A meta-analysis and meta-regression. *PloS One*, *12*(7), e0180442.

Machado Filho, P., Luiz, C., Seó, H. L. S., Daros, R. R., Enriquez-Hidalgo, D., Wendling, A. V, & Pinheiro Machado, L. C. (2021). Voisin rational grazing as a sustainable alternative for livestock production. *Animals*, *11*(12), 3494.

Malik, P. (2014). "Organic farming- an overview". *International Journal of Research in Engineering and Applied Sciences*, *4*, 27–42.

Marler, J. B., & Wallin, J. R. (2006). Human health, the nutritional quality of harvested food and sustainable farming systems. *Nutrition Security Institute*.

Marshall, M. N. (1996). Sampling for qualitative research. *Family Practice*, *13*(6), 522–526.

Martínez, E., Fuentes, J.-P., Pino, V., Silva, P., & Acevedo, E. (2013). Chemical and biological properties as affected by no-tillage and conventional tillage systems in an irrigated Haploxeroll of Central Chile. *Soil and Tillage Research*, *126*, 238–245.

Masters. (2019). *For the Love of Soil: Strategies to Regenerate Our Food Production Systems*.

Meers, E. (2016). *EIP-AGRI Focus Group: How to improve the agronomic use of recycled nutrients (N and P) from livestock manure and other organic sources?: starting paper*.

Merfield, C. N. (2019). An analysis and overview of regenerative agriculture. *The BHU Future Farming Centre. p*, *20*.

Merlo, V. (2021). *Freiwillige Mitarbeit in der Landwirtschaft*.

Merriam, S. B. (2008). *Qualitative Research in Practice*.

Moyer, J., Smith, A., Rui, Y., & Hayden, J. (2020). Regenerative organic agriculture and the soil carbon solution. *Kutztown, PA, USA: Rodale Institute*.

Nischwitz, G., & Chojnowski, P. (2019). Verflechtungen und Interessen des Deutschen Bauernverbandes (DBV). *NABU, IAW, Berlin/Bremen*.

Noreika, N., Li, T., Winterova, J., Krasa, J., & Dostal, T. (2022). The Effects of Agricultural Conservation Practices on the Small Water Cycle: From the Farm-to the Management-Scale. *Land*, *11*(5), 683.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, *16*(1), 1609406917733847.

Pearson, C. J. (2007). Regenerative, semiclosed systems: a priority for twenty-first-century agriculture. *Bioscience*, *57*(5), 409–418.

Poore, J., & Nemecek, T. (2019). Reducing food's environmental impacts through producers and consumers (vol 363, eaaw9908, 2019). *Science*, *363*(6430), 939.

Poulton, P., Johnston, J., Macdonald, A., White, R., & Powlson, D. (2018). Major limitations to achieving "4 per 1000" increases in soil organic carbon stock in temperate regions: Evidence from long-term experiments at Rothamsted Research, United Kingdom. *Global Change Biology*, *24*(6), 2563–2584.

Rabianski, J. S. (2003). Primary and secondary data: Concepts, concerns, errors, and issues. *The Appraisal Journal*, *71*(1), 43.

Rhodes, C. J. (2017). The imperative for regenerative agriculture. *Science Progress*, *100*(1), 80–129.

Robertson, F., Armstrong, R., Partington, D., Perris, R., Oliver, I., Aumann, C., Crawford, D., & Rees, D. (2015). Effect of cropping practices on soil organic carbon: evidence from long-term field experiments in Victoria, Australia. *Soil Research*, *53*(6), 636–646.

Rodale, R. (1983). Breaking new ground: The search for a sustainable agriculture. *Futurist*, *17*(1), 15–20.

Roe, S., Streck, C., Beach, R., Busch, J., Chapman, M., Daioglou, V., Deppermann, A., Doelman, J., Emmet-Booth, J., Engelmann, J., Fricko, O., Frischmann, C., Funk, J., Grassi, G., Griscom, B., Havlik, P., Hanssen, S., Humpenöder, F., Landholm, D., … Lawrence, D. (2021). Land-based measures to mitigate climate change: Potential and feasibility by country. *Global Change Biology*, *27*(23), 6025–6058.

Sapkota, T. B., Jat, M. L., Aryal, J. P., Jat, R. K., & Khatri-Chhetri, A. (2015). Climate change adaptation, greenhouse gas mitigation and economic profitability of conservation agriculture: Some examples from cereal systems of Indo-Gangetic Plains. *Journal of Integrative Agriculture*, *14*(8), 1524–1533.

Sarkwa, F. O., Timpong-Jones, E. C., Assuming-Bediako, N., Aikins, S., & Adogla-Bessa, T. (2016). The contribution of livestock production to climate change: a review. *Livestock Research for Rural Development*, *28*(3).

Schreefel, L., Schulte, R. P. O., de Boer, I. J. M., Schrijver, A. P., & van Zanten, H. H. E. (2020). Regenerative agriculture – the soil is the base. *Global Food Security*, *26*, 100404.

Seitz, D., Fischer, L. M., Dechow, R., Wiesmeier, M., & Don, A. (2022). The potential of cover crops to increase soil organic carbon storage in german croplands. *Plant and Soil*, 1–17.

Smith, O. M., Cohen, A. L., Reganold, J. P., Jones, M. S., Orpet, R. J., Taylor, J. M., Thurman, J. H., Cornell, K. A., Olsson, R. L., & Ge, Y. (2020). Landscape context affects the sustainability of organic farming systems. *Proceedings of the National Academy of Sciences*, *117*(6), 2870–2878.

Smith, P., Martino, D., Cai, Z., Gwary, D., Janzen, H., Kumar, P., McCarl, B., Ogle, S., O'Mara, F., & Rice, C. (2007). Policy and technological constraints to implementation of greenhouse gas mitigation options in agriculture. *Agriculture, Ecosystems & Environment*, *118*(1–4), 6–28.

Soloviev, E. R., & Landua, G. (2016). Levels of regenerative agriculture. *Driggs, ID: Terra Genesis International*.

Stanley, P. L., Rowntree, J. E., Beede, D. K., DeLonge, M. S., & Hamm, M. W. (2018). Impacts of soil carbon sequestration on life cycle greenhouse gas emissions in Midwestern USA beef finishing systems. *Agricultural Systems*, *162*, 249–258.

Sweikert, L. A., & Gigliotti, L. M. (2019). Evaluating the role of Farm Bill conservation program participation in conserving America's grasslands. *Land Use Policy*, *81*, 392–399.

Tickell. (2017). *Kiss the Ground*. Simon and Schuster.

Tockner, K., & Stanford, J. A. (2002). Riverine flood plains: present state and future trends. *Environmental Conservation*, *29*(3), 308–330.

Torsten Kurth, Gerd Wübbels, Alexander Meyer zum Felde, Sophie Zielcke, Mario Vaupel, Mayra Buschle, Jörg-Andreas Krüger, Konstantin Kreiser, & Magdalene Trapp. (2020). *The Biodiversity Imperative for Business*.

Trautmann, N. M., Porter, K. S., & Wagenet, R. J. (1985). *Modern agriculture: Its effects on the environment*.

Trint. (2022). https://trint.com

Tscharntke, T., Grass, I., Wanger, T. C., Westphal, C., & Batáry, P. (2021a). Beyond organic farming–harnessing biodiversity-friendly landscapes. *Trends in Ecology & Evolution*, *36*(10), 919–930.

Tscharntke, T., Grass, I., Wanger, T. C., Westphal, C., & Batáry, P. (2021b). Beyond organic farming–harnessing biodiversity-friendly landscapes. *Trends in Ecology & Evolution*, *36*(10), 919–930.

United Nations. (2022). *UN climate report: It's 'now or never' to limit global warming to 1.5 degrees*. United Nations. https://news.un.org/en/story/2022/04/1115452

World Meteorological Association. (2022). *State of the Global Climate 2022*. https://public.wmo.int/en/our-mandate/climate/wmo-statement-state-of-global-climate

Zikeli, S., & Gruber, S. (2017). Reduced tillage and no-till in organic farming systems, Germany—Status quo, potentials and challenges. *Agriculture*, *7*(4), 35.

Zinke. (2020). *Regenerative Landwirtschaft – das bessere Bio oder Humbug?* Agrarheute. https://www.agrarheute.com/management/betriebsfuehrung/regenerative-landwirtschaft-bessere-bio-humbug-575587

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APPENDIX

Thesis submitted in partial fulfilment of the
requirements for the degree of Bachelor of Science
(B.Sc.)

The Benefits and Obstacles of Regenerative Agriculture in Germany

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8. Appendix 1: Codes and Basic Themes

Basic Themes	Codes
Start thinking like nature	Aligning with nature; Aligning with social requirements; Have a cycle thinking; Holistic thinking; Interaction of nature; Understanding nature
Nature instead of chemistry	High diversity of animals; Natural tools substitute synthetic tools; No use of chemical inputs
RA difficult to define	Definitions don't help; No clear definition
Start from the soil	Awareness of soil life; Minimal soil movement; Permanent roots
Organic agriculture	Organic is the basis of regenerative agriculture; Organic prohibits, reg. no limits
Problematic way of farming	Farms are too specialised; Linear system of agriculture; Makes you sick; Max quantity and cheapest price; Monoculture; One harvest per year; Synthetically blown up yields; Wrong food for cows; Wrong way of keeping cows
Biodiversity benefits	Above-the-ground biodiversity; High humus content is biodiversity; Protection of biodiversity; Stabilized biodiversity;
Carbon sequestration benefits	Carbon sequestration; Peatlands huge carbon sequestration potential
Climate change benefits	Climate change adaption; Improved nitrate pollution; Positive impact on climate
Livestock benefits	Benefits of regenerative grazing; Combining forests and animals; Cows as help; Cows help in profitability; More animal welfare
Resilient ecosystem benefits	Building resilient systems; More resilience and profit in bad weather years than in conventional; Value to ecosystem
Soil benefits	Building humus cools down the atmosphere; Closed Nutrient Cycle; Compost can quickly help; Healthy soil; More organic content in the soil; Promoting soil life; Reduced soil erosions; Soil health is like human health
Water benefits	Improved groundwater; Regeneration of the water cycle; Water retention

Food system benefits	More energy efficiency; New culture and food system; Supports local food supply
Germany as a leading example	Be a worldwide example; Become agricultural leaders
Society health benefits	Feed more people; Human health; Nutrient-rich food
Growing interest and demand	Increased demand for local and organic food; Increased food awareness; People want a change; Urgency to act; Young people interested in RA
Independence	Farmer's independence; Independence because local; Independence of chemical inputs
Personal farmers satisfaction	Better farmer image; Hope for future generations of farmers; More beautiful landscape; More satisfaction; More values
RA can be profitable	Agroforestry can be profitable after some time; Can be more profitable
Lobby power	Agrochemicals have too much influence; Big corporations taking foundations of live away; Food industry worse than conventional farming; More transparency; Power of food industry; Power of food retailers; Power of trade companies; Too much talk about consumer and farmer
Misconduct of the term regenerative agriculture	No definition of RA leads to green washing and misuse of the word; Regenerative agriculture term is not protected; Regenerative farming label needed; Risk of green washing
Problematic policies	Composting not allowed; Law for contamination needed
Problematic subsidy/incentive system	Best would be no subsidies, but unrealistic CO2 certificates not useful; Direct payments are wrong; Subsidy system does not allow transformation; Not enough incentives
True costs are not considered	External Cost on society and ecosystem; Payments for ecosystem and society services needed; True cost accounting as a solution
Economic concern	Cover crops are expensive due to seed prices; Due to climate change nature more unpredictable and can be bad for harvest; Farmers not enough money to pay bills; Farms in debt; Financial support needed for transition, but

	limited; Regenerative agriculture is more expensive; Takes time to be profitable
High financial risk for German farmers	Due to climate change nature more unpredictable and can be bad for harvest; Farmers not enough money to pay bills; Farms in debt; Financial risk is high; Financial support needed for transition, but limited; Financing costs too high
Not sufficient support for farmers	Hard to get out of system; No access to knowledge; Not sufficient advisors; Not sufficient networks
Regenerative agriculture is complex and difficult	Agroforestry takes time and work; Composting is complex; Difficult to get carbon into subsoil; More demanding and complex
Land ownership	Land prices too high; Regenerative farmers cannot afford land; With lease farmers are often not allowed to work regenerative
Agricultural education system	Agricultural teachers are stubborn; Farmers not sufficient knowledge; Way of agricultural education wrong; Wrong university educational system
Inadequate and lack of scientific research	Carbon sequestration potential no scientific evidence; More scientific emphasis; Not enough research done; Wrong scientific system
Lack of consumer knowledge	Consumers are not educated about farming; Wrong school educational system
Local examples needed	Finding the regenerative agriculture practices best for your land; More successful examples needed
False information	Feed the world myth; Thinking compost bad for groundwater
Conventional agriculture	Farms are too specialised; Linear system of agriculture; Makes you sick; Max quantity and cheapest price; Monoculture; One harvest per year; Synthetically blown up yields; Wrong food for cows; Wrong way of keeping cows
Farmer's reluctance	Farmers are stubborn; Farmers frustrated; Farmers not part of discussion; Farming very emotional; Other farmers despise you
Current mindset not in line with RA	Linear thinking; Technology no more than a tool; Thinking income is everything; Thought we can control nature; Worlds are clashing

Problematic consumer behaviour	Germans spend no money on food; Lack of health awareness; Significant food waste; No demand for RA products

9. Appendix 2: Interview Guideline

Introduction

- Introduction of myself and the purpose of the interview.

Background Information

- What is your overall agricultural background and what agricultural practices do you use on your land?
- What is your overall experience with regenerative agriculture, and why did you decide to choose it?
- How do you think regenerative agriculture distinguishes itself from conventional agriculture?

Benefits

- What benefits can regenerative agriculture bring to farmers and their communities, especially in Germany?
- What influence can regenerative agriculture have on environmental problems such as climate change and soil degradation in Germany?
- Can regenerative agriculture be as productive as conventional agriculture?

Obstacles

- What obstacles have you encountered or are you still encountering in the introduction of regenerative farming methods here in Germany?
- Are there any policies or regulations that are currently hindering the adoption of regenerative agriculture?
- Do you think there is sufficient demand for regenerative agriculture products in Germany? (Yes/No)
    - If not, how could this demand be established?

Adoption of Regenerative Agriculture

- What experiences have you had with the adoption of regenerative farming methods in Germany?
- Are there specific regenerative farming methods that are more difficult to adopt than others? If so, why?

- What is your experience with the financial viability of regenerative agriculture in Germany? Have you noticed any differences in profitability compared to conventional farming practices?
- What resources or support do you think farmers need to successfully convert to regenerative agriculture?
- What are the most significant changes you have noticed on your farm, but also maybe community since shifting to regenerative agriculture?

Conclusion

- Are there any final remarks you would like to make?
- Thank participant.

10. Appendix 3: Interview Exemplar

Author: First of all, thank you very much for doing this interview with me on my thesis topic, the obstacles and the benefits and obstacles of regenerative agriculture in Germany. So, first of all, I want to understand more about your farming background in general. So what is your farming background, and what farming practices do you use on your land?

Participant 1: So basically, we run an operation on roughly 3000 hectares, which is something around 1000 hectares of arable land. The farm is defined by its very sandy soils and low, low soil quality, as well as incredibly low precipitation, with roughly 400 millimetres per year. So, it is a very sort of tough environment, and we are already facing what it is to be in in the full effect of climate change. So this is why we started looking into different methods of ecological agriculture, to, you know, heal the soil and the ecosystems and build organic content in the soil and close nutrient cycles and increase biodiversity and become more independent also. And more specifically, these methods that we are applying is composting in different composting methodologies and different agroforestry types and more sort of classical large-scale agroforestry to syntropic agroforestry where we are looking into different nuts, berry and fruit varieties. We have integrated cows that are grazing on the arable land using our cover crops and nurse crops, as well as during the summer times perennial grass that we also include into the agricultural land. So, we use these cows to build the soil carbon and biodiversity. Then we have started a tree nursery because we've experienced that, you know, if you want to grow something that is supposed to last for a while, in a setting like ours, you know, you have to, there are no shortcuts. And then we also look into different ways of transforming monoculture forests, which we have a lot of here in East Brandenburg. And all of this basically we do now scientifically, let's say analysed, and we've found a foundation that is basically trying to gather all the data and, and all the processes and all the stuff in order to be able to scale those kind of ecological regenerative method methodologies. And we think what we need is not only to prove that these are economically viable business models but also to take care and account of the ecological, social and values of those systems and then also obviously develop software and technology, but with the understanding of the ecosystem, not just with the idea that technology is going to fix the problem and so on.

Author: Okay, great. So, for you, how do you think regenerative agriculture differs from conventional agriculture? Where do you see the main difference also, maybe in philosophy, but also maybe the general philosophy of the two systems?

Participant 1: Well, I think it's a difficult question to answer because there is in the reality of ecology and the reality of farming, there's no is no use definitions. Right. You farm somewhere, and you have a certain soil, and you have a certain system, and that may be better or worse. It doesn't really matter what it's called. You can do ecological agriculture badly. You can do conventional agriculture badly. Regenerative agriculture has no agreed-upon definition. So, all of those words and definitions, they don't really matter. In my eyes, conventional farming with regenerative agricultural practices would also be classified regenerative conventional farming just to make it more precise. And if that is the case, you know, it is merely as far as the regenerative ideas are concerned and the attempt to understand the ecosystems, but well enough to substitute expensive syntactic tools with, let's say, natural tools with the aim of increasing your profitability. That would be it for me if I compare conventional with regenerative conventional. But then, of course, there's a whole different way, world of ecological, regenerative and all the other things. But of course, I'm not a big fan of the different definitions.

Author: Okay, great. Then we're already switching to the benefits. So what benefits do you think regenerative agriculture can bring to farmers and their communities, especially also here in Germany?

Participant 1: I mean, you know, regenerative agriculture or regenerative organic agriculture doesn't really matter. If it's not more economically viable, then there's no space for it. It has to be more economically viable. Farmers need to be able to earn a better profit with applying principles of regenerative farming. If that is the case, then some of the benefits, of course, is that you can pay, you know the people that work on your farm, but that potentially, if you choose to and are able to treat the animals better that you potentially can afford to care more about, let's say, other sort of values surrounding the farm as far as you know, connected to the rural neighbourhood is concerned. And if you apply regenerative principles, you might find yourself in a position where you become less dependent on external synthetic inputs. And if you apply regenerative methodologies you might even start as like a soft value, you might even start to fall back in love with

what you're doing because it reminds you of maybe, you know, what your father's or grandfather's or mother's or even yourself used to do, and used to have a fascination about understanding ecosystems and working with those and not just sort of controlling them. So, I think the positive potentials are really, you know, very much all around the place just because the problems are so big also. I mean, just can't get much worse than it.

Author: Oh, of course. Okay. So, your next question is also, how much do you really think regenerative agriculture can have an impact on environmental challenges such as climate change and soil degradation here in Germany? How big do you think the impact could be?

Participant 1: I mean, just sort of hypothetically, the impact could be big. You know, we have created an agricultural production system in the last 40 to 50 years which focussed on producing as much as we possibly can for the cheapest possible price. And so considering that our financial system, our subsidy system, our political system, our scientific system, the way we've developed technology and education, all of these are sort of built around the fact that we wanted to produce mass production at the cheapest price. So, considering that if we turn our attention and our focus with regards to sort of the technological skills that we have and the scientific excellence that we might apply towards topics that are in line with, let's say, ecological requirements and social requirements, i.e. biodiversity, soil health and carbon storage, climate, climate adaptation, nutritional side effects of well-produced food. You know, we would have a huge impact on the way that we can actually design our culture and food systems. You know, this would be, I mean, if we would actually do it, I mean, you know, we could still become better world leaders in agricultural systems that are more or less independent of any other shit that you have to buy and then bring in to that. The potential is huge probably not comparable on a country-to-country basis with other countries that are much, much bigger or whatever. But like, as far as, the knowledge, the technology, the understanding, the, you know, the making it scalable is concerned, you know, Germany is at the absolute forefront or could potentially be at the forefront of it.

Author: Okay, great. So also, do you think regenerative agriculture can be as productive as conventional agriculture, even maybe even more productive?

Participant 1: Well, I mean, this also kind of draws back into what I was saying earlier, that if you give us 30 to 50 years of development into that new understanding, that new philosophy of land use, you know, no one knows what the result will be. Especially if you take account of the external costs of ecosystems and society. Right. That makes changes everything, of course. But on top of that, you know, like, you know, our land use system is that we have come up with as the king of creation is horizontal monoculture, one harvest per year. Yeah. I mean, that just makes no sense. Like we need to combine agroforestry or some agriculture forestry and animals into working in ecological systems that make sense. And if we would do that, you know, we would probably be able to move quite fast. I mean, even on our farm, where you can actually feed many more people on the same spot as compared with hyper synthetically blown-up yields that have no additional value because you would actually have more and more products on the same field in the same year and with lower external costs. So you can only extend benefits. Who knows? So yes, a 100% we can. Yes, we can. And then also, I mean, obviously, we have to include in that discussion, you always have to mention the fact that we don't eat 40% of the food that is being produced now. And also, I think 80% of the world's population of people have less than two acres of farmland. Right. So, I mean, talk about big industrial agriculture like those arguments being brought forward by the sort of industrial farming system. When you're talking about feed for animals, they don't want to eat that shit. Yeah, that's another element.

Author: Okay. So, yeah, now we're coming to the adopt adoption part of regenerative agriculture. So specifically, to your farm. So, what is your experience of adopting regenerative agriculture in Germany? So implementing regenerative farming practices on your land, what is your general experience, and what obstacles are you facing?

Participant 1 Um, I mean, I guess obstacles. I mean, this is why I did all of this, is why we do what we're doing is there's hardly any, let's say, independent and self-experienced knowledge, and data and technology and machines and people that can actually do it or that have done it or that can, that you can use in order to calculate if it's a viable investment or not. And so, you know, and this is basically what we do on the farm, trying to develop all that data and gather all that data so we can actually say, you know, doing this regenerative method or doing that regenerative method, you know, is a viable economic model that makes sense to invest in. So none of those are at this point available for people

to actually do or use. And so, for me, it's really the knowledge and as far as the data is concerned, the knowledge as far as the people is concerned. I mean, certainly, the sort of financial aspect is part of it, I guess. But it's not as big as a problem if you know that you're doing something that makes sense, or if you have a viable economic business, then you get some money like that's not the problem. But it is, I think, for many, still an obstacle. And yeah, the overall well, knowledge. And then I mean, you know, you assume coming to other potential problems as far as the logistics are concerned, you know, the complexity of the system incorporating different products at different times, you know, the kind of trade power of some few that have an influence. And I also think the idea of, you know, value creation on the farm, whereas, you know, you know, just producing something, but you actually are able to make a nut pesto or whatever. So there are certainly obstacles and then obviously also the risk factor. And like, you know, many farms have specialised and are often highly indebted, and you know, they need to pay the annuities to the bank, and they can't just change the whole operation. It's a system that they're stuck in. And so that is also a big obstacle. Yeah. Did I answer the question?

Author: Yeah. Also, maybe. Do you have any obstacles in terms of nature or I don't know, if you adopt these farming practices not using any pesticides anymore do you face any obstacles in terms of nature?

Participant 1: Well, I mean, so we were an organic beforehand, and now we're like a regenerative organic farm, right? If you're a conventional farm and you become a regenerative farm, you are still a conventional farm So that. That all doesn't necessarily have a bigger burden and effect. But, I mean, you know, for us, I guess the thing is the obstacles, you know, the brutality of nature.

Author: Okay. And I mean, you're doing agroforestry, you're doing mob grazing, you're doing syntropic farming. Are any farming practices from the ones you use more difficult to adopt than others are?

Participant 1: Sure, syntropic agriculture is certainly more demanding than, let's say, some classical agroforestry. Composting also can be quite you know; it can be quite complex. But I think it's not really about the methodology the key fact is that it is about finding which of the many things that you can do is the most viable for your ecological

and the business context, really. And that, I think this is tough. And all the other stuff is it's just doing it, observing and learning from it and hoping to get better, but to know which one is the most important one for you or the one that makes more sense for you and that is more difficult.

Author: Okay. Also, quickly back to the obstacles in terms of policies and regulations. The ones you got here in Germany are currently, do you think, hindering the adoption process of regenerative agriculture, or are there any policies which are barriers for you in adopting to regenerative agriculture?

Participant 1: Sure. Oh, so there's yeah, there's a great deal of policies that don't help for sure. And but I mean, I just, I just ignore them, really. So I can't say much about that stuff. Okay. But, it is definitely, that our political and subsidy system is not made for, you know, transforming agriculture as it needs to be.

Author: Also. Do you think there is actually sufficient demand for regenerative agricultural products here in Germany? So, is there a market? And if there is insufficient demand, what do you think we would need to change to have that demand?

Participant 1: Um, that it's a good question. Um, I think. Well, I mean, I think there's a growing interest of people looking for those kinds of products and wanting to be regional and, you know, products that make sense in a logical and social context. Right. And I just think that, you know, we, especially in the cities, but we, you know, we have so much. You know, the sort of supermarkets and the trade companies and the whole, you know, food industry has such and such a great way of making sure that, you know, people are being force-fed. And so they don't understand, really. And so there's this great mismatch hidden in people who would like to have more of the good product. And some farmers would like to do more for the environment, but somehow they don't seem to meet right, and you never quite know why that is. And I mean, on one side, it is, of course, because of political subsidies, but it is also the power of the trade companies, the food companies and the supermarkets. Right. So that is certainly a big topic and something that, um, you know, needs to be solved in a better, in a more transparent way. But I mean, yeah, but I think there is a tendency that people want to understand more about the food and appreciate it. But it's still difficult. And the reality is that people don't buy a high-value

product, and most go buy it, and then there's the market for it, and then it'll be difficult, of course.

Author: Do you think if we would implement systems like true costing, for example, we could actually create more demand for these products because products from conventional farming actually get a lot more expensive?

Participant 1: Yeah, I mean, sure. I think, you know, true cost accounting is one of the major tools that we could use because that would still apply to the same kind of market principles, you know, we could still use the same system that we have in place and would work out. But apart from that is also, you know, as far as sort of in Germany, we call it “richtig rechnen”. And so the other side of true costing is to also to look at, you know, the values that you do that you are actually creating on a farm. So there is a whole great deal of financial accountability of farm laws and how we actually go about trying to value sort of ecosystem functions and so on. So yeah, for sure. I mean, for me, there is no way around it. I think that is one of the big tools and instruments that we have. However, there is a certain danger that also I think needs to be always mentioned when we do this because what we are doing is we're giving value to having ecological, social systems. Right? And although I agree, that needs to be part of the solution. But what can happen from this is that we start thinking about it as a product that you can buy and sell and own and trade, and that becomes difficult and dangerous. If you look at, you know, big corporations or big countries buying rivers and lakes and, you know, and I mean, that is very exciting, and that is a huge, huge topic and problem that we also need to be aware of.

Author: Okay, great. So so, what resources we already spoke of about financial models, but what other resources do you think a farmer needs in Germany to successfully transition to regenerative agriculture?

Participant 1: Well, I mean, it's, of course, it is a difficult question because there is no one answer that can be applied across all farmers. I guess that is. If there's one thing everyone shares, it is the pay needs to be big enough. If you realise that you do not, you are not who you think you are or where you think you were. And if you realise that, you know, the industry has you under complete control and, you know, taking decisions, you just acting it out. And yeah, I think that is, that is a point where people will be like, look,

I don't want to do this anymore. And I think that we are getting there more and more. I think it's a very, very difficult process because, you know, especially farming is so emotional, and people have been doing this for 30 or 40 years. They've always done their best. They've always, you know, appreciated their own work and self-worth through the work. And now you've got people coming left and right and telling them they're not good enough anymore. They know what they're doing. You know we did a huge mistake by not bringing in the farmers and not making them part of the discussion in a sense. Right? So, um, yeah, we are, we are at this very interesting point in time. I think many are realising that something needs to change and everyone is looking for new ways and, you know. But the frustration on the side of the farmers is also huge, and I think that is really something that can't be underestimated. That might be the reason not to change because they're like, you know what? But you know that that's really, I think, from an idea the reality and the average age is 50 or 55. You know, look, I mean, I'm only 38, but even when I was 20, and someone told me, you're not doing the right thing, I was going to be pissed off. Imagine what you think someone who is 50 would do. And I think that that doesn't work. And so I think that is really the biggest thing. It's the mind, and sort of the philosophy that it's so, so difficult to adopt and to be willing to do. Because changing your way always means giving into something, always means acknowledging that the prior where maybe wasn't right or maybe is not what is wanted anymore. And farmers are too proud. They've invested too much time, too much love, too much sweat and tears, to just do that. If there's no other way. So I think that for me is number one.

Author: Okay. Then one more question on the on the financial viability. Are you already more profitable applying regenerative agriculture methods on your land than you were before with conventional farming? And if not, when do you think you will become more profitable?

Participant 1: Well, the answer is no, we're not more profitable. But I also, in a sense that to put that in perspective, because we chose to do research, and so we are doing that sort of design for being profitably viable in the design that they are, the design that they are to, you know, look at different types of and, and what you say is are the types of fruits. So and so we have something around 2000 different types of varieties of nuts, berries and fruits. No one can tell in a syntropic setting in East Brandenburg which are the four plums you know, that work really well and that are okay with the drought and that are okay with

the late frost and so forth. So that is sort of why where we as a company as such applying those methods are not only looking at the sort of the profitability. If you want me sort of to, to break it down a bit, I think what, what brings you to profitability the fastest, is the cows really okay? Because not only do you have a use of course in order to look after the soil which are cover crops and nurse crops, that they can actually use in the winter and also bring back the nutrients. You also have increased the dependency of bringing in nutrients from the outside. So you have the soil-building strength, and you have the usage of costs that you use in order to protect the soil. And then you also have sort of the independence through another product on the same field. And obviously, depending on the size of the farm and depending on the nutritional requirements, well, nutrient and the nutrient requirements of your farm, you would have to start, or you would have to wait until you get up to the sort of the setting that you have enough cows to actually be able to do to sort of demand-supply all the sort of all these values. And whereas I started 2019 with 21 cows, we have 150 cows now. We will have around 70 calves this season. We can slaughter around 30 this year, 60 next year and a hundred after that. So that would be 2019, 2021, 22, 23, 24, 25. So it takes us seven years to get up to our production number that we need. And if I, if I am good and I slaughter 100 cows and sell them at a very good price, I would probably make a profit of, well, it's a good business model basically. Okay, let's put it that way. And so the cows, but I said this is very specific. But the cows, if you sell them well, you can get into profitability fast. As far as agroforestry is concerned, we have one product, one subtopic, agroforestry fields, where we focus on the profitability and where we work with apples, pears and plums. We planted around 500 of those trees, and this is a field that has three hectares, and we expect them to grow into profits by year 15. But it takes time for them to grow and then to produce the yield. However, and this is quite interesting on those three hectares, which is comparatively small, you can calculate the potential sales of that and doing the process that we would have done with grains, which would be you harvest around three tonnes of rye, one ton of rye is worth maybe €300. So that's €2,700 sales on three hectares, plus, let's say €500 per hectare, the subsidy. Okay. So that is your revenue potential, and we're talking about 5000, €6,000. That's it. Okay. If in 15 years the trees are producing as they're supposed to produce, we will have a yearly revenue of €180,000. Is it independent of the economic viability. But that also means I have to sell them at a high price. I find the people that harvest them. Well, mechanically, then the sales price would go down, though, because then it's a different product. I have to get the logistics right.

Author: And these 15, these 15 years, you are still including the subsidies, right?

Participant 1: Throughout the 15 years I would still get the subsidies. Of course, then composting is difficult to quantify and such because the effect is very much dependent on your agricultural use system. Right. So when I took over, we were doing sort of industrial ecological agriculture. So that means we ploughed every field, maybe even two times per year, keeping it brown at all times during the summer to decrease the wheat pressure. Now we've changed the setting agriculturally that we don't plough any more or reduce ploughing to a very minimum. We keep everything covered with cover crops and nurse crops, we don't have a monoculture, but we have different things. We include the cows in the system we use composting. So but that is, that is really a bit of a tough process. Okay. A long way, and actually, it's getting more expensive. The seeds, especially the nurse crops and the cover crops are incredibly expensive, and the weed pressure has gone up, you can tell. So that is also yield effective and then comes the fact that if you have a bad year such as last year where we had 3 to 2 months of 30 to 35 degrees and with a soil temperature of 75, you know, that has burned away all life on 20 centimetres depth. So all the work that we've been doing for three years, that would have moved us more into soil health and economically more stable resilience, has been burned away. Okay, so that is a difficult one.

Author: How are you actually planning on selling your products? Do you want to sell it for example don't through a super biological regenerative supermarket chain? Or do you want to sell it on your farm or I don't know, in a small shop in Berlin yourself?

Participant 1: I mean. Well, I mean, that is a whole world. And it's only, you know, that I have been quite. Not necessarily naive, but, you know, I always kind of push that thought away from me because I said, you know, I need to find viable and viable or economically viable production methods before I think about selling. Are we moving slowly into an area where the cows are becoming, you know, a large enough group to actually think about, you know, marketing and selling logistics as such. And, you know, we're in the middle of it like we have an online shop that goes, okay, I guess we have connections to the restaurants in Berlin that that are quite interested. And we are speaking to, you know, big ecological supermarkets like bio company or whatever. But it's a process, and it's

tough. You know, it is really people don't, if you tell them ecological, they're like, oh that's the best quality you. And if you tell it's also holistically managed grazing, and they don't eat Kraftfutter. But then you tell them, Well, I shoot them myself on the pasture. They never put a foot on anything they don't know. And then they say I have to shrimps, please. If that's information to take in and see. But yeah, I mean, that is something. Going back to your question earlier, I think, you know, that is that's really a key thing. How do we get people to understand the value of worth and how can we get them to be interested in it also, and to spend time and invest time in wanting to know and, you know, wanting to enjoy also I guess?

Author: So and then also, I mean, I know you employed a lot of people on your farm, so so what are the main changes you have noticed in your farm and, and also, communities since adopting to regenerative agriculture?

Participant 1: I mean thought, and I know also that, you know, this is very specific. You know, this is, you know, there's no general thing that you could apply and say doing that. We are a farm in an area that has been defined by centuries of, you know, industrial, agricultural, um, you know, let's take down every tree that we can see and have the biggest possible fields whatsoever. You know, the longer I can drive straight, the better it is. So, you know, we have people in our team that are exactly like that, and they don’t want trees in their way. So and then we have other people coming in, and they think that's the worst of the worst, the worst. And they want to plant trees everywhere. And they want to, you know, they hear the aura of the trees and bushes screaming or whatever. So, you know, there's obviously a huge clash of values and backgrounds and nationalities and, you know, and that's never easy. You know, it's the same as in our societies. And people always regard someone that is different more and more, well, I guess more critical. They may be also afraid, you know. And then, at the end of the day, every single person is emotional and has fear and worries and wants to be loved and wants to be seen. And that is also challenging. And I mean, I understand that, of course. And the question is, how can you manage it in a way that you know, that diversity is the reason for getting better. That is how it works. You know, that's the nature of society. Diversity is what makes things strong. But it's a challenge for sure. Like, you know, there are worlds clashing.

Author: Okay. That was actually the last big question. Is there any final thought, anything you would like to add to our discussion or anything?

Participant 1: There is one thing that is very strong on my mind or what I think a lot of is sort of, you know, we tend to throw those topics all in one goal and we talk about the farmers and the consumers. And those topics are just in the bulk of farmers and consumers. But what we have to talk about and make sure that we differentiate is the industry and the farmers. So the industrial, agricultural conventional system, that is a huge problem. An offshoot problem because it's profit maximisation shareholder value, it is always going to be to the cost of the environment or the society. It is just at this point, there is no other way of doing it right. But as far as the farmer is concerned, conventional agriculture is not necessarily bad. You know the biggest star Gate Brown is a conventional farmer. But he uses that once every three years because he needs to, and then it's fine. Yeah, but that differentiation between the industry that is bad and the problem and the farmer that actually needs more freedom and more power, more education, more help, whatever. I think that is also very important to mention.

Participant 1: Okay. Interesting. Thank you so much for the interview.

10. Appendix 4: Sworn Declaration

Sworn Declaration

Being aware that making a false declaration is an offence punishable by law and being aware of the legal consequences of this for the examination process, which go as far as exclusion from it in the event of cheating or the attempt to cheat in accordance with the Examination Rules of ESCP Europe Wirtschaftshochschule Berlin e.V. ("ESCP Business School"), I hereby undertake the following sworn declaration to ESCP Business School:

I have written the thesis entitled

The Benefits and Obstacles of Regenerative Agriculture in Germany

entirely by myself and independently and have used no other than the sources and resources named. Further, all the quotations and citations – including tables, maps and figures – are clearly marked as such. This declaration includes the data accessed on the internet. The thesis has not been presented to any other examining body; nor has it been published in whole or in part.

Furthermore, I grant ESCP Business School the right, under the provisions of §31 of German copyright law (Urheberrechtsgesetz), to use the thesis for the purpose of marking and assessing it as well as examining it from the point of view of plagiarism. This right to use the thesis includes the right of ESCP Business School to commission a third party to undertake the plagiarism check on behalf of ESCP Business School. The third party is subject to the same legal requirements on data protection and confidentiality as ESCP Business School.

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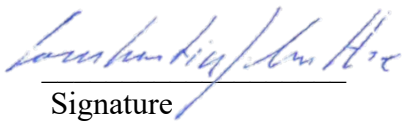

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10. Appendix 5: Additional Affirmation

Additional Affirmation

Hereby I confirm that I will not give or sell this thesis for publication to any institution. Furthermore I will not publish this thesis in the Internet.

In the case that I plan to publish this thesis I can only do so with written consent of my supervisor.

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