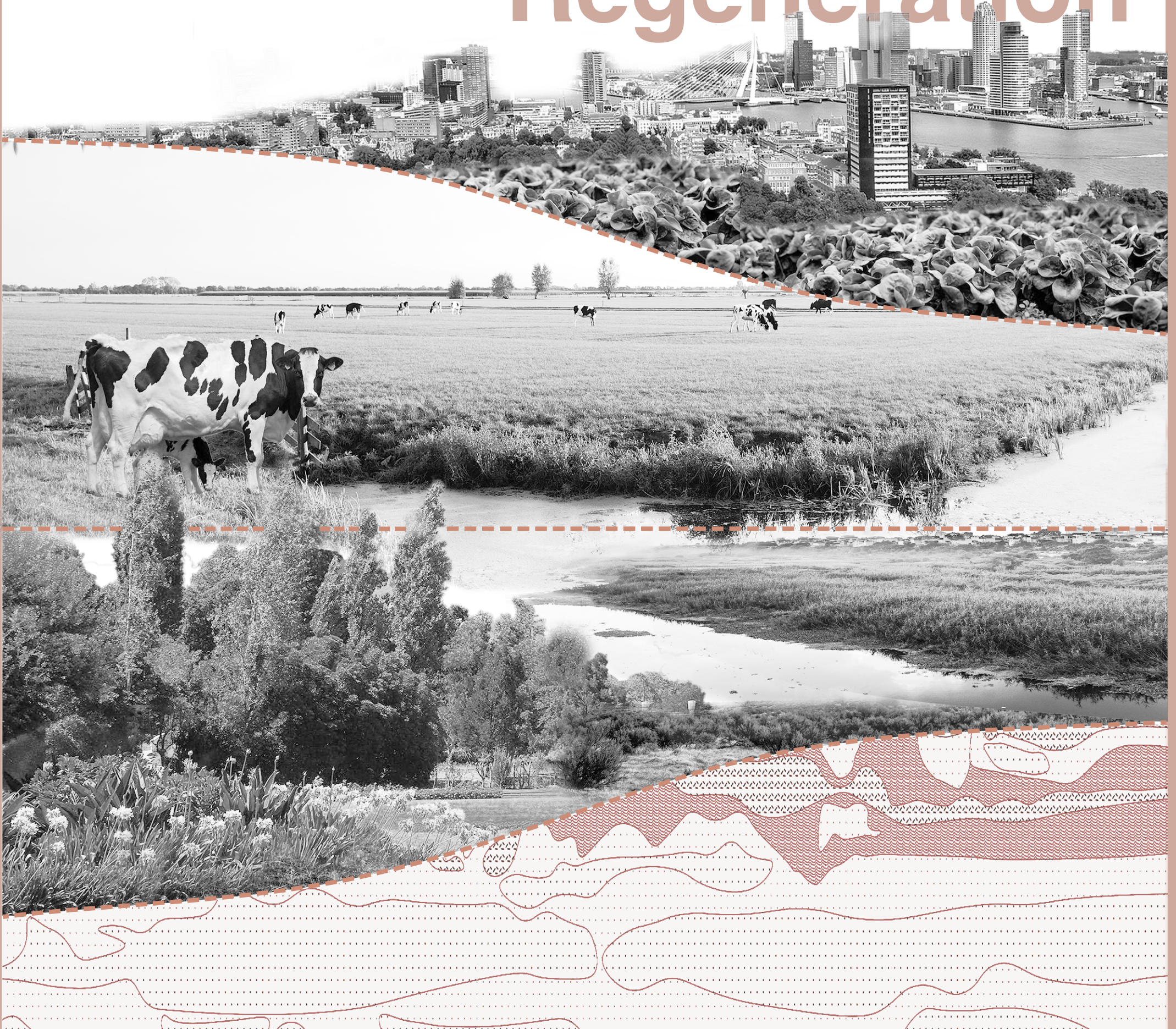


Rooting for Regeneration

Towards a sustainable food system



ROOTING FOR REGENERATION

Towards a sustainable food system

Delft University of Technology
Faculty of Architecture and the Built Environment

MSc3: Architecture, Urbanism and Building Sciences
Urbanism Track 2022/2023 Q3
R and D Studio: Spatial Strategies for the Global Metropolis (AR2U086)
Research and Design Methodology for Urbanism (AR2U088)

Tutors

Caroline Newton
Lukas Höller

Marcin Dabrowski
Roberto Rocco

Students

Bram Terwogt	4674790
Hannah Norman	5395844
Oleg Khoroshev	5895456
Paula von Zeska de Toledo	5716217
Xinyu Lin	5787513

12th of April, 2023

All images, diagrams, graphics are by the authors unless stated otherwise.
Sources for additional data are mentioned within the page and on the reference list.
All icons are adapted from The Noun Project, see reference list for specific source.

ABSTRACT

A transition is needed within the current agricultural sector. The intensive food production emits a significant amount of greenhouse gases and generates a nitrogen surplus. As a consequence, biodiversity levels and soil quality decrease. One way of achieving a more sustainable food system is through regenerative agriculture which is a nature based practice where ecosystem services and soil health are central. This research aims to understand how the decentralisation of farming practices can lead to regenerative agriculture in a socially just way. Through research by design, the concepts of decentralisation, regenerative agriculture and social justice were studied separately and layered on the project areas of North West Europe and Biesbosch National Park. The objective of this research is to develop a vision and strategy for these areas to achieve a socially just transition to regenerative agricultural practices. Based on the guidebook by Soil Heroes Foundation, we propose a set of regenerative agriculture typologies for North West Europe and show how we can transition to these using methods of spatial and systemic (administrative, fiscal, economic) decentralisation. Each transition is qualitatively assessed by its implications for social justice in local communities and its potential to improve soil quality of the region. For the Biesbosch area, a strategy is proposed that is based on our vision for North West Europe. Through eight strategy interventions, the decentralised food chain generates food security and provides opportunities for less intensive agricultural practices.

Key words: regenerative agriculture, decentralisation, social justice, food security, climate change mitigation

INTRODUCTION

01

ROOTING FOR REGENERATION	2
ABSTRACT	3
INTRODUCTION	10
PROBLEM STATEMENT	13
RESEARCH QUESTION	14
VISION STATEMENT	16
VALUES AND GOALS	18
SDG AND EUROPEAN GREEN DEAL	19

METHODOLOGY

02

THEORETICAL FRAMEWORK	22
CONCEPTUAL FRAMEWORK	26
METHODOLOGY FRAMEWORK	28

ANALYSIS

04

AGRICULTURAL LAND USE	32
SOIL IS THE BASE	34
AGRICULTURAL DEVELOPMENT	36
NITROGEN CYCLE	38
NITROGEN HOTSPOT	40
EUROPE'S LIVESTOCK BARN	42
NITROGEN EMISSIONS IN NL	44
THE LAST SPECS OF NATURE	46
FROM FIELD TO FORK	48
RECENT POLICIES	50
SOCIO-TECHNICAL LOCK-IN	52
PUBLIC DISCOURSE	54

VISON

05

A COLLECTIVE ANSWER	58
REGENERATIVE AGRICULTURE	60
LAND COVER TRANSITIONS	62
LAND COVER TRANSITIONS	64
DETERMINING FUTURE LAND USE	66
VISION FOR NW EUROPE	69
DECENTRALISATION	70
A DECENTRALISED FOOD CHAIN	73
SOCIAL JUST TRANSITION	74
A SHIFT IN STAKEHOLDER RELATIONS	77
VISION FOR SOUTH HOLLAND	78

STRATEGY

06

BIESBOSCH	82
CONFLICTS MAP	87
HOEKSCHÉ WAARD -MUNICIPALITY	88
MOLENLANDEN-MUNICIPALITY	96
BIESBOSCH	104
FLOWS BETWEEN THREE AREAS	106

CONCLUSION AND DISCUSSIONS

07

CONCLUSION	110
DISCUSSION	113

REFLECTIONS

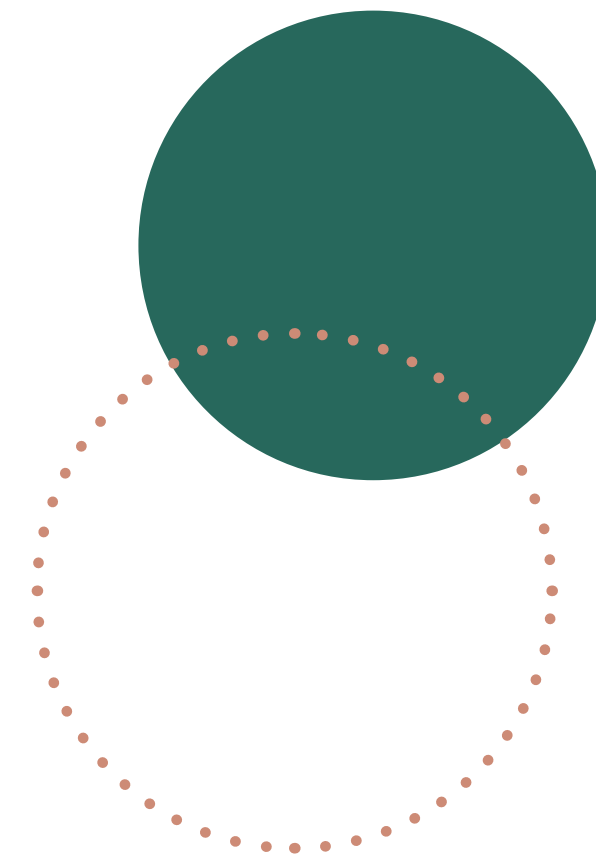
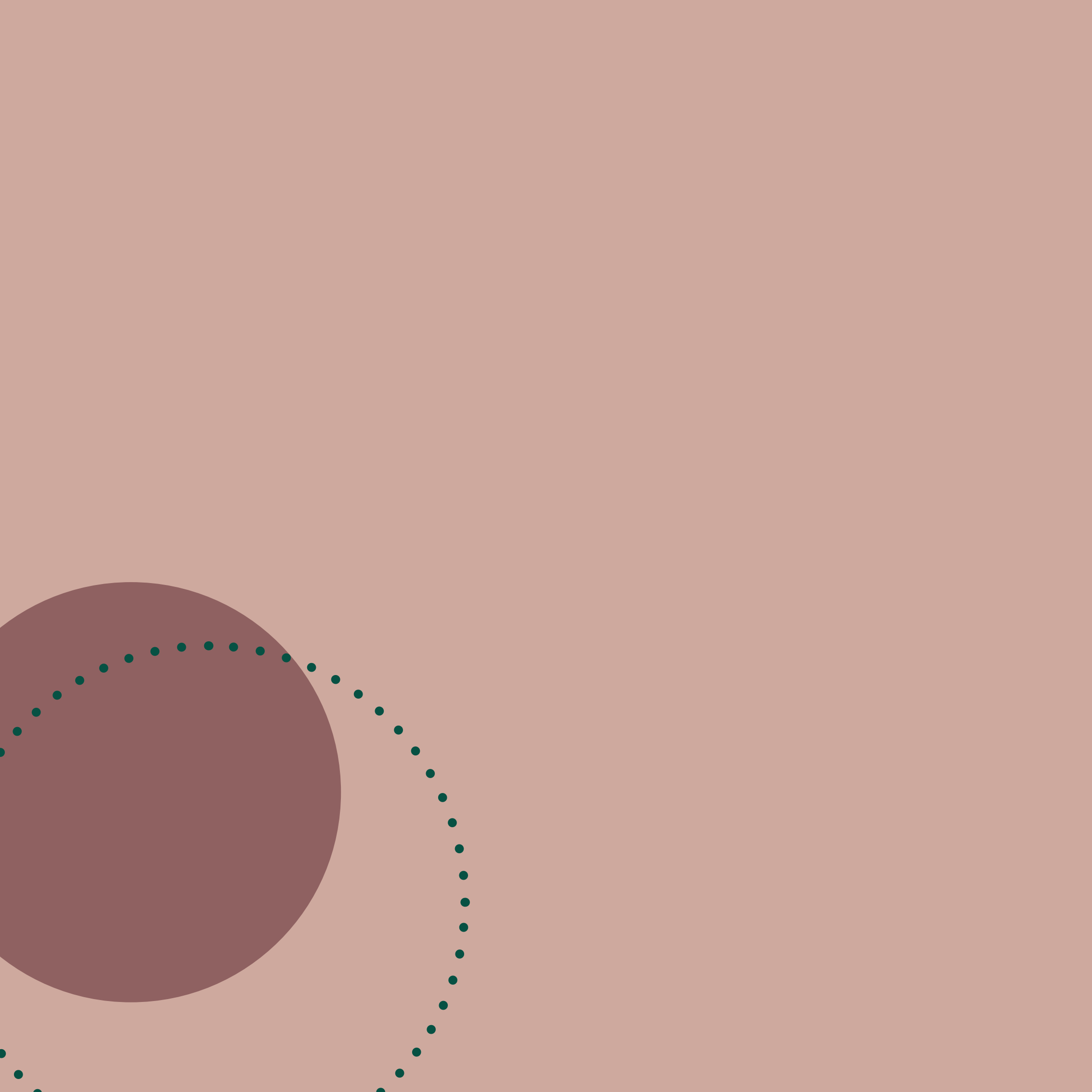
08

PERSONAL REFLECTIONS	114
----------------------	-----

REFERENCES

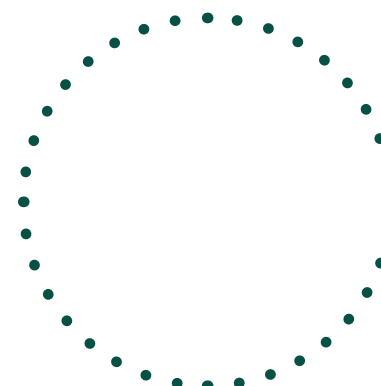
09

REFERENCES	120
LITERATURE	121
COLLAGE & ICONS SOURCES	126



1. INTRODUCTION

Introduction
Problem statement
Research question
Vision statement
Values and goals
SDG and European Green Deal



INTRODUCTION

A transition is needed within the agricultural sector as it is currently one of the main causes of pressure on natural resources and the environment (Kay et al., 2019; van Zanten et al., 2018). The excess phosphorus and nitrogen that is caused by the use of chemical fertilisers, specifically nitrogen oxides and ammonia (van Halm, 2022), which is produced by agriculture may result in eutrophication of water bodies and loss in biodiversity (Bol et al., 2018). Furthermore, nitrogen concentrations that are too high impede the regenerative capacity of the soil and affect surrounding water bodies above and underground (IPCC, 2022). Moreover, current agricultural practices result in soil erosion and highlight our dependency on fossil fuels (Rhodes, 2017).

To counteract the environmental degradation that is caused by intensive agricultural practices, the European Union has introduced several policies over the years. One of which is the European Green Deal. One of the priorities of the European Green Deal is to ensure a “just transition for all” (von der Leyen, 2019, p. 6). The meaning of principles and criteria for such a just transition is an under-studied area within scientific research (Tribaldos & Kortemäki, 2022). Besides the European Green Deal, in June 2021, the European Union also reached an agreement on the future of the Common Agricultural Policy. The latter focuses, among other things, on improving long-term soil health and crop diversification (European Commission, 2022).

The Netherlands has also introduced several policies to reduce the environmental externalities caused by agriculture as 45% of the country’s total nitrogen emissions are emitted by agriculture. However, as stated by Bavel et al. (2004), the Dutch government has historically not complied sufficiently to European regulations such as the Nitrates Directive. This lack of action eventually led to the current so-called nitrogen crisis where drastic changes need to be made to current agricultural practices to preserve natural areas in the Netherlands and surrounding countries (van Halm,

2022). For this, the Dutch government has set intentions to halve nitrogen emissions by 2030 while also aiming for a combined approach for nature, water, and climate (Rijksoverheid, 2022a). In the Startnotitie Nationaal Programma Landelijk Gebied the need for a transition towards sustainable (circular) agriculture is highlighted (ibid.). While Dutch governmental bodies have made several plans to reduce nitrogen emissions, a large societal divide has been created between the urban and non-urban, and farmers and environmental organisations.

When rethinking the current agricultural system, the current food chain should also be taken into account. Currently, the Netherlands is the second largest exporter of agricultural products in monetary value globally (FAO, 2020). The biggest products are animal based (e.g. milk, eggs, meat) and are produced on 53.6% of the total land cover of the Netherlands (World Bank, 2020). Almost 75% of the products produced are exported to other countries, Germany being the biggest importer of Dutch agricultural products. Even though almost three quarters of the agricultural products are exported, it becomes clear that Dutch farmers in the current system do not experience financial sustainability nor have a strong negotiation position in the food chain. Therefore, it becomes evident that to create a more sustainable food system, more sufficient revenue models for farmers in the Netherlands must be created (Rijksoverheid, 2022b). Environmental sustainability plays an important role in the creation of such sufficient revenue models in the long term. Hence, new and more sustainable forms of agriculture should be considered. Rhodes (2017) argues that all sustainable solutions are unsustainable over the longer term if they are not also regenerative. Accordingly, to achieve such regenerative agriculture, a context-specific system of polyculture and crop rotation should be introduced to protect the soil.

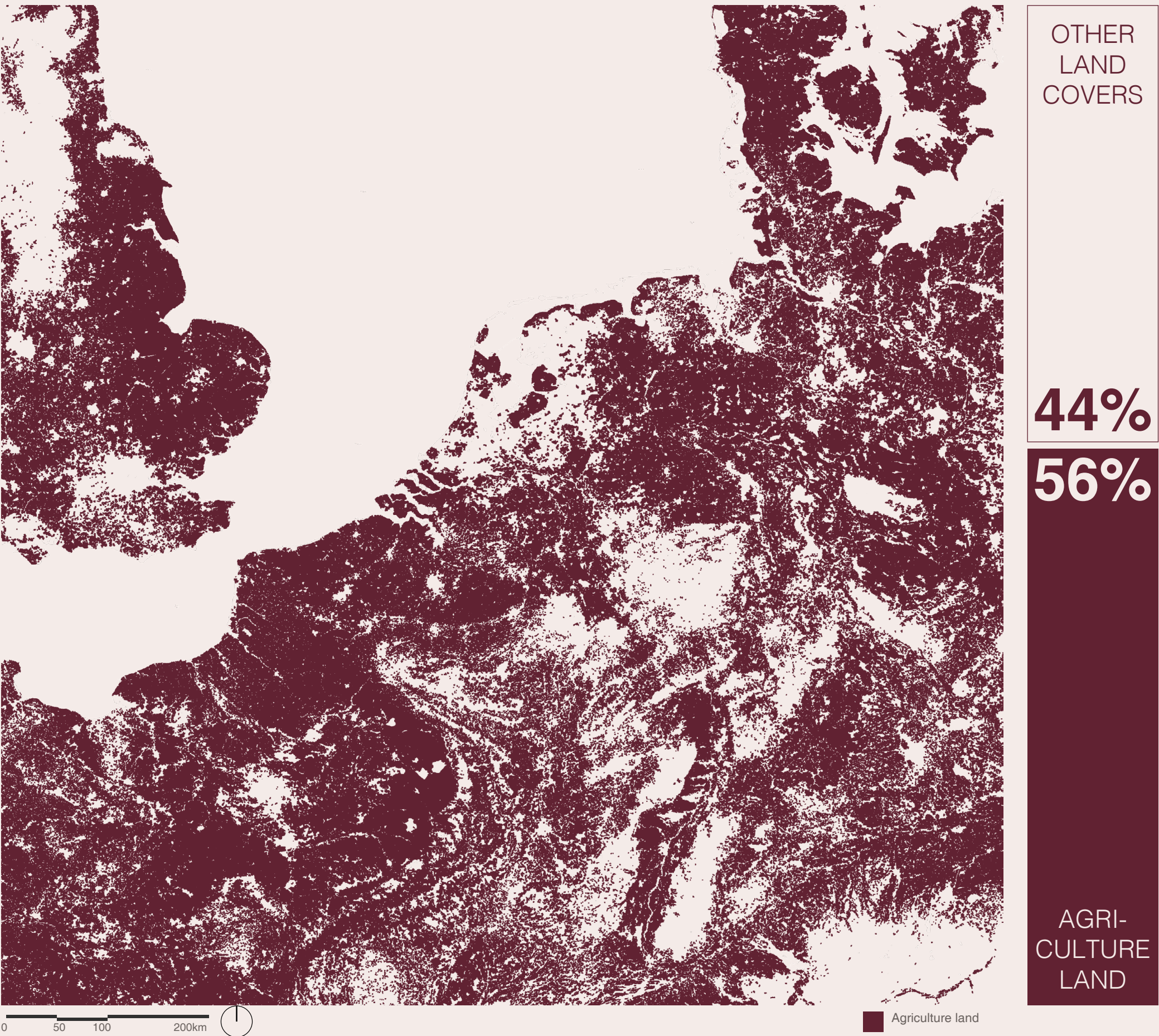


Figure 1: NWE Agricultural land. Source: Based on Corine Land Cover

PROBLEM STATEMENT



Moving towards a sustainable future is no easy process. By imposing restrictions on farmers to reduce environmental impacts caused by agriculture, such as reducing nitrogen emissions, we are causing more and more pressure on the crucial stakeholders that ensure our food security, dividing society and perpetuating social inequality. If, however, we are less stringent with limitations on nitrogen emissions, we risk being left with depleted soil and without the last oases of natural reserves (Fraters et al., 2015). So how do we go on with this dilemma?

To answer this, we must first understand the status quo and how the inherent design of intensive farming and a highly globalised economy has put us on an unsustainable path. For instance, livestock currently takes up approximately two-thirds of all agricultural land globally (FAO, 2020). The expansion of areas for livestock production has resulted in forests and native grasslands to be turned into agricultural land which has caused biodiversity loss and increasing carbon emissions (van Zanten et al., 2018). The Netherlands has 53.6% of its land covered in farmland (World Bank, 2020). The rest are urbanised regions, water, and scarce natural areas. Such dense fabric has its roots in the development path the country has been on in the last centuries – a world trade leader. The Netherlands is the second biggest agricultural exporter globally in monetary value (CBS, 2022). With its rather small territory, the country has a disproportionate impact on its environment as it produces more agricultural exports than large countries like Brazil and Germany (FAO, 2020; CBS, 2022). Intensive farming is characterised by higher levels of fertiliser use (Tollefson, 2010), which is a prerequisite of such abundant harvests from such small plots of land. This, in combination with intensive livestock, results in 86% of the country's ammonia emissions (CBS, 2021a). In the natural cycle, nitrogen levels are elevated in the soil which leads to faster and richer plant

growth. The flip side of the coin is, however, that an imbalance in the natural nitrogen cycle impedes the regenerative capacity of the soil and affects surrounding water bodies above and underground (IPCC, 2022). Excessive nitrogen and phosphorus concentrations are often deposited in surrounding water bodies. Nitrogen molecules, such as nitrate ions or ammonium nitrate, cause eutrophication of rivers and canals. This is a process which causes harmful algal blooms, anoxic conditions and water acidification (Ngatia et al., 2019).

Livestock poses another ecological issue: apart from greenhouse emissions and the release of ammonia gas, cattle tramples the soil reducing its ability to store water and nutrients (Chaichi et al., 2005). Both crop farming and livestock are currently spatially centralised into clusters, intensifying their effects on the surrounding environment and reducing the regenerative capacity of the soil (IPCC, 2018). It becomes clear that an alternative way to farming is necessary in order to ensure our food and water security in the future, protect and regenerate the environment and cater to the needs of human and non-human stakeholders. There are different approaches to redesigning farming practices on the path to sustainability. This research analyses the potential of decentralisation of farming and food production to ensure a socially just transition towards regenerative agriculture and aims to find an optimal spatial strategy for such practices in the Netherlands and Northwestern Europe. To achieve this, the study looks through the lens of the global food chain to better understand the effect that a more decentralised and local supply chain would have on the country and its nature. Furthermore, the potential of more mixed and community-led agricultural practices in the spatial, societal, ecosystemic and economic context of the Netherlands, and South Holland in particular, will be analysed.

RESEARCH QUESTION

The organisational decentralisation implies a more local and cooperative food chain where decentralisation technologies play a supportive role. The aim of spatial decentralisation is to smartly distribute out the externalities, however reduced, over the territory of NW Europe. (Martin & Smits, 2022)

“How can decentralisation of agriculture aid in a socially just transition towards regenerative farming practices in North West Europe?”

A socially just transition increasingly features in policy and political discourse (e.g. European Green Deal) and appeals to the need to ensure that efforts to steer society towards decarbonisation and a more sustainable food system are underpinned by attention to issues of equity and justice. In a socially just transition social progress, environmental protection and economic needs are brought together. (Sabato & Fronteddu, 2020; Newell & Mulvaney, 2013; Blattner, 2020).

Regenerative agriculture is the concept of agricultural practice where soil is the base. The approach uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting ecosystem services, with the aspiration that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production. (Groot Goerkamp et al., 2021; Schreefel et al., 2020)

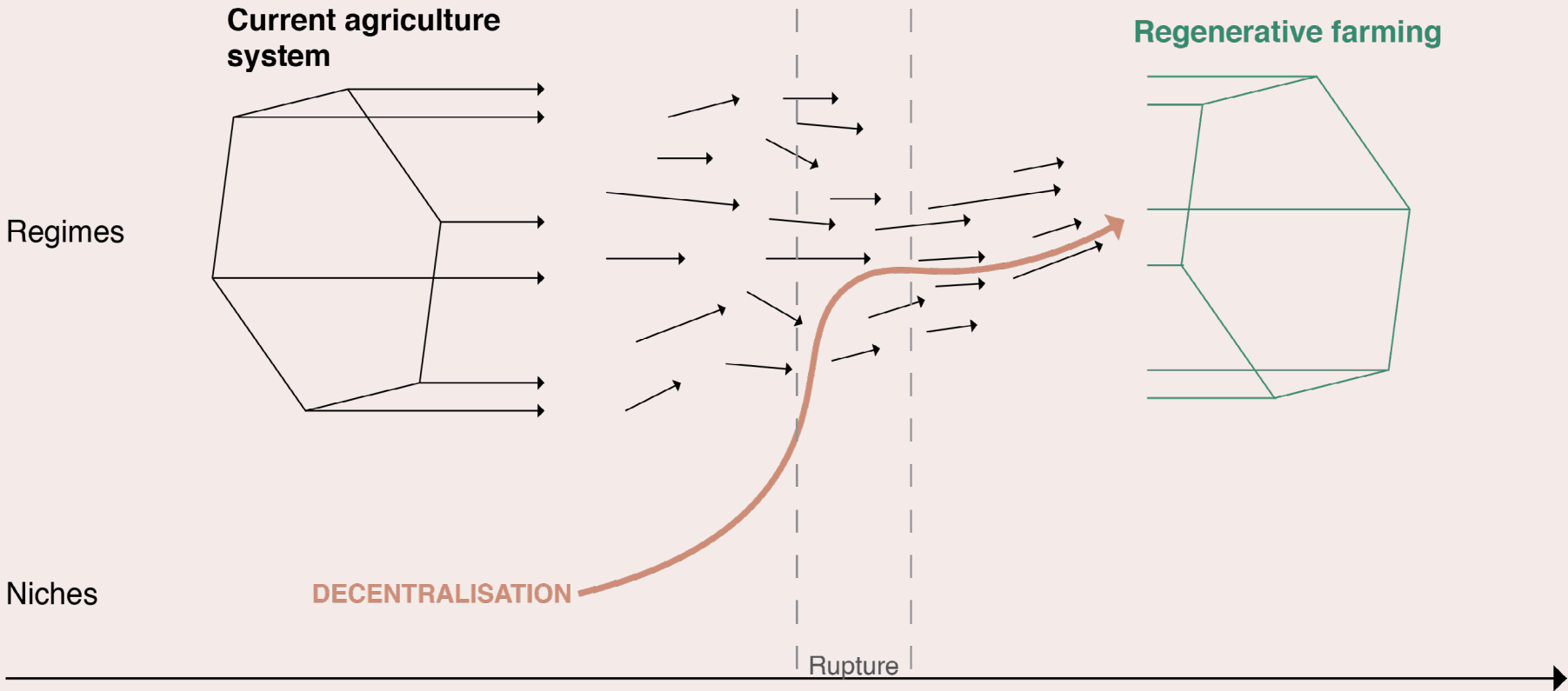


Figure 3: Adapted to the project context from Geels (2002)

This research explores the possibilities of a transition within the food system in Northwest Europe and the Netherlands. In order to do this to a full extent, the concept of transition and transition theory should also be discussed. One of the ways to approach this is through the Multi-Level Perspective (hereafter MLP) as was proposed by Geels in 2002. In a reviewed paper about socio-technical transitions to sustainability, Geels (2019) argues that in socio-technical transitions the systems in place and the more radical niche innovations are conflicting in a multi-dimensional environment.

Going back to the first article of Geels (2002), we can explain the MLP in more detail. The MLP consists of three levels: landscape, regime, and niche. Socio-technical landscapes consist of

deep structural trends and refer to wider and slow changing technology-external factors. In the case of this research, food security and climate change form the landscape. Socio-technical regimes concern the semi-coherent set of rules by which social groups are guided. Regimes account for stability within the system. For this research, this includes the current agricultural production system, policies related to this and the market. The last level of MLP is niche. Niches are understood as radical innovations and are protected from the regime as they act as incubation rooms. Decentralisation is regarded as a niche development as it is seen as a tool to break through the current socio-technical regime that is favourable to the unsustainable food system.

SUB QUESTIONS

For this research question to be answered, five sub research questions have been formulated:

- How is the sustainability transition currently affecting farming and food production in the Netherlands?
- How is regenerative agriculture different from the current agricultural practices in the Netherlands and how can it help farmers meet nitrogen level guidelines to reduce environmental impact?
- What could a decentralised agriculture food supply chain look like and what technologies could play a role in it; how can decentralisation facilitate regenerative agriculture?
- What are the social implications of agriculture decentralisation for relevant stakeholders?
- What are the critical factors to enable a socially just transition for human and non-human stakeholders towards regenerative agriculture?

VISION STATEMENT

In our vision, all (urban) settlements in North West Europe will be self-sufficient regarding food production and consumption. To be more specific, the food produced will be consumed in the surrounding areas and shorter food value chains are realised. Hence, food produced will be more tailored to the needs of residents. Only what is actually needed will be produced. This will result in less, if no, import and export of agricultural products. Furthermore, the current high density farming that is taking place in the Netherlands will be spread out over its neighbouring countries, such as Germany which is now the biggest importer of Dutch agricultural products. In our vision, we reimagine the boundaries of North West Europe where the length of flows is minimised and the production chain of agricultural products will become more sustainable. This will be achieved by practising regenerative agriculture.

This envisioned sustainable food system in which regenerative agriculture plays a major role will be practised in five different land uses:

1. Current natural areas that are protected will stay natural areas where no livestock is allowed;
2. Surrounding these natural areas a buffer will be placed. In some of these natural buffers, depending on the local context, forest farming is practised;
3. Where arable land is currently placed, monoculture will be replaced by polyculture or mixed crops;
4. Mixed crops and livestock will also be situated in land where there is currently arable land and livestock farms. Moreover, mixed crops and livestock, also referred to as farm parks, will be placed in natural buffer areas surrounding urban settlements. Here, city residents can engage in food production;
5. In our vision, the production of livestock is severely decreased and is only located in a few areas where livestock is already being held.

In 2070, NW Europe will have transitioned to a decentralised & sustainable food system in a socially just way, where regenerative agriculture provides everyone with a delicious meal.

VALUES AND GOALS

Biodiversity



Figure 4: Photo by Stan Versluis

Climate change mitigation



Figure 5: Photo by Markus Spiske

Regenerative agriculture



Figure 6: Photo by Tim Mossholder

Food security



Figure 7: Photo by Elaine Casap

Decentralisation



Figure 8: Photo by Redcharlie

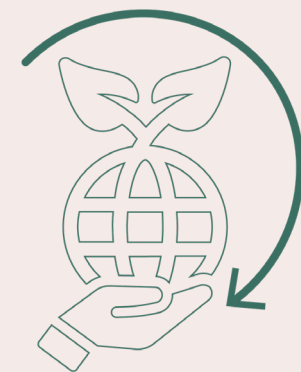
Social Justice



Figure 9: Photo by Zoe Schaeffer

For the project, we aligned some values that are important to us. The idea is to use those as a guide towards our goals and strategies. In the European Union, agricultural biodiversity is declining. However, agricultural practices are essentially dependent on it. An environment with high biodiversity implies increased soil, water quality and air quality (European Commission, 2023). Biodiversity levels are directly impacted by climate change which, in turn, is highly influenced by current

agricultural practices (Kay et al., 2019; van Zanten et al., 2018). Thus, we should seek ways of mitigating emissions of agriculture (IPCC, 2022). One possible way of improving this is through regenerative practices in agriculture (Quarles, 2018). Those practices also aim to improve food security while decentralising the food production. Lastly, the project plans to work along with the actors involved to guarantee a social just transition for all.



Minimise impact on nature

Following our values one of our goals is minimise the impact on nature cause by agricultural practices.



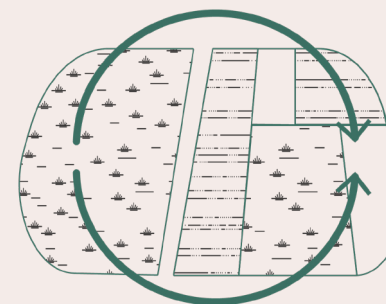
Bottom-up organisation

Our goal is to empower those that currently do not feel that represented. With a bottom-up organisation, we intend to create a more just environment where everyone is heard.



Local agri-food network

To achieve a sustainable future we have the goal of creating a network to unify producers and consumers. We believe that reducing the chain will improve quality and environment.



Transition of agriculture

The current way of doing agriculture is not sustainable anymore. One of our goals is to have a transition in the agriculture model to impact less nature while guaranteeing food security.

SDG AND EUROPEAN GREEN DEAL

Sustainable Development Goals - United Nations

In 2015 all countries member of the UN adapted the 2030 Agenda for Sustainable Development. On it are 17 Sustainable Development Goals (SDGs), strategic actions that tackle a series of issues regarding health, economics, and environment for example. For our project we selected some of these and specific targets of each. We can highlight:

2.3 - "By 2030, double the agricultural productivity and incomes of small-scale food producers"

12.3 - "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses"

16.7 - "Ensure responsive, inclusive, participatory and representative decision-making at all levels"

European Green Deal

The European Green Deal was presented in 2019 and it has as its main goal to transform Europe on the first net-zero continent by 2050. One of their strategies aims on agricultural practices, more specifically the "Farm to Fork" strategy targets a healthier food system, more sustainable and with less waste. (European Union, 2021) This is directly aligned with our goals of impacting less natural areas and creating opportunities for a network of farm producers and consumers.

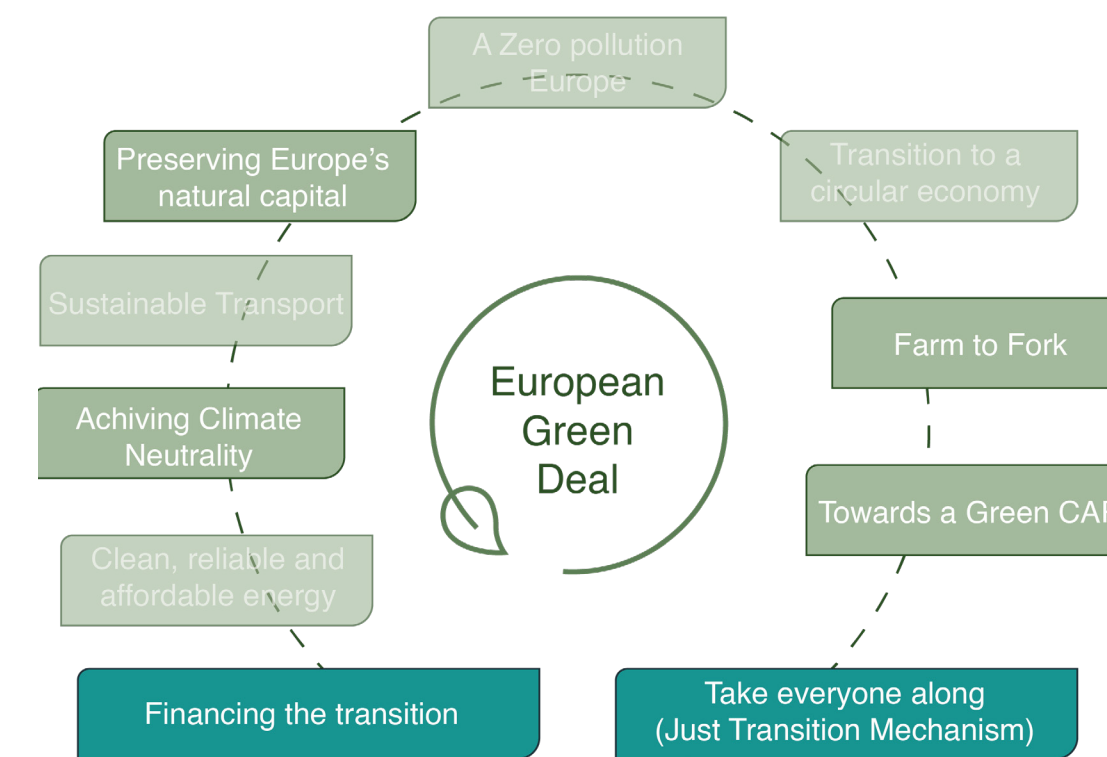
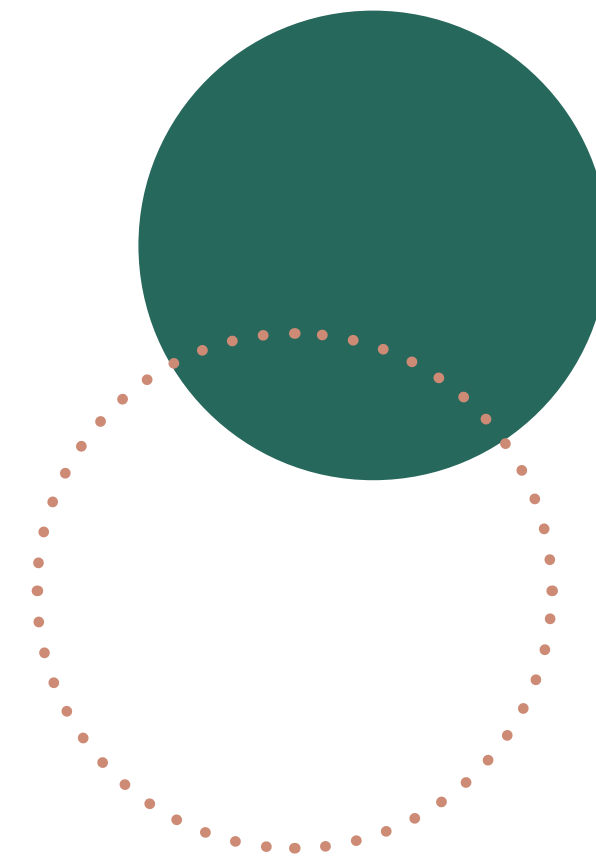
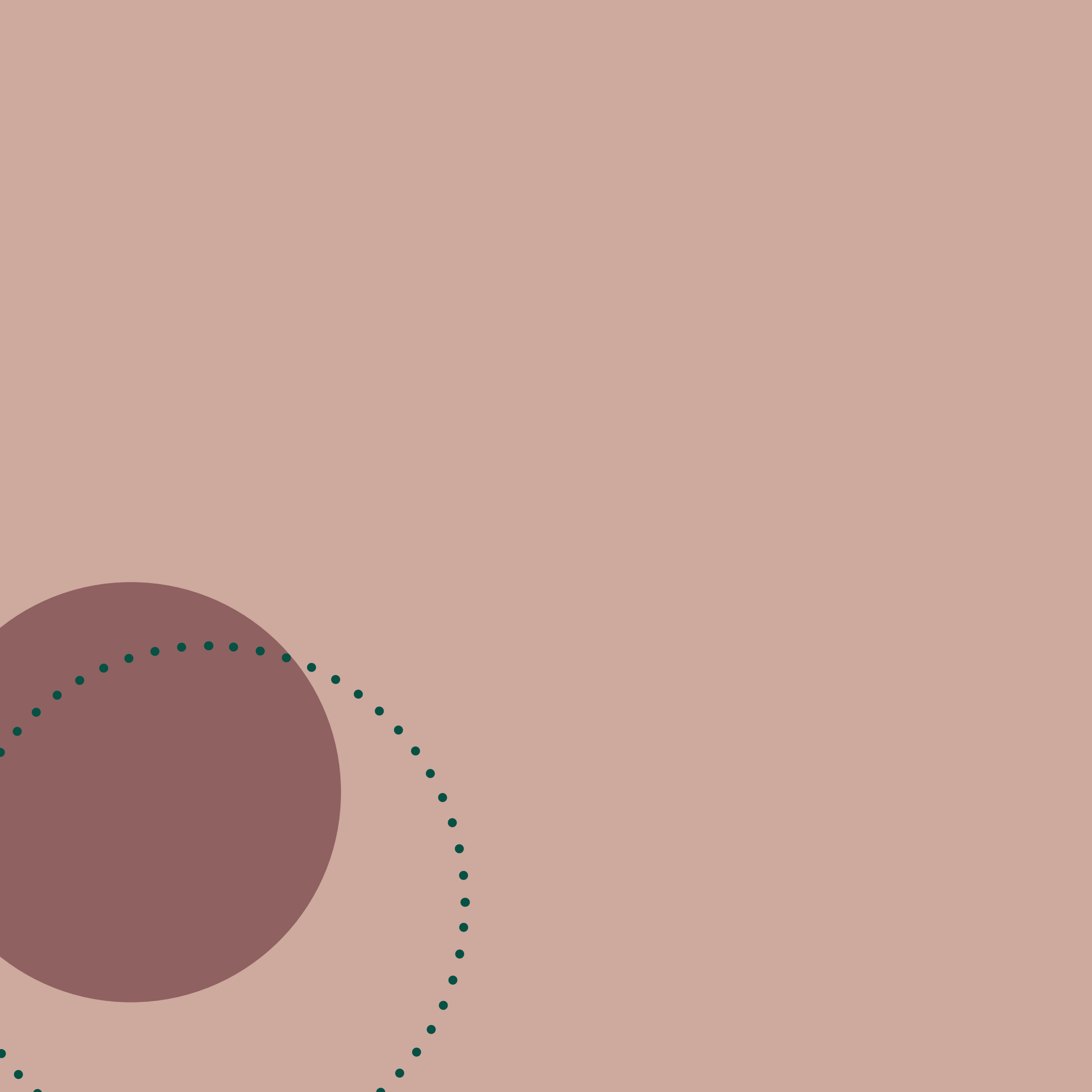


Figure 10: Adapted from European Commission (2021)

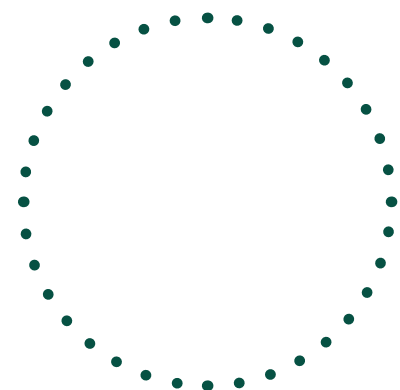
2 ZERO HUNGER	END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE
8 DECENT WORK AND ECONOMIC GROWTH	PROMOTE SUSTAINED, INCLUSIVE AND SUSTAINABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL
10 REDUCED INEQUALITIES	REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES
11 SUSTAINABLE CITIES AND COMMUNITIES	MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS
13 CLIMATE ACTION	TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS
15 LIFE ON LAND	PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS
16 PEACE, JUSTICE AND STRONG INSTITUTIONS	PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT, PROVIDE ACCESS TO JUSTICE FOR ALL AND BUILD EFFECTIVE, ACCOUNTABLE AND INCLUSIVE INSTITUTIONS AT ALL LEVELS
17 PARTNERSHIPS FOR THE GOALS	STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT

Figure 11: United Nations (2015)



2. METHODOLOGY

Theoretical Framework
Conceptual Framework
Methodology Framework



THEORETICAL FRAMEWORK

Climate mitigation

Following the Paris Agreement, the increase in global temperatures should be limited to 2°C above pre-industrial levels. To achieve this, global greenhouse emissions need to be minimised and carbon neutrality needs to be realised through mechanisms such as climate change mitigation (Shrestha & Dhakal, 2019). To be more specific, climate change mitigation aims at reducing greenhouse gas emissions and concentrations in the atmosphere (Zhang & Ayyub, 2021). One of the sectors in which this should be realised is in agriculture as it accounts for approximately 14% of global greenhouse emissions (Azadi et al., 2021). While the sector has a significant impact on climate change and the environmental externalities caused by it (van Zanten et al., 2018; Schreefel et al., 2020; Chapman et al., 2020), climate change also affects agriculture because of, for example, intensified precipitation and higher temperatures (Azadi et al., 2021). Agriculture has great potential to contribute to climate change mitigation as the incorporation of trees into agricultural lands provides increased carbon capture (Chapman et al., 2020). Here, soil also plays a major role as it can sequester organic carbon and therefore contributes to climate mitigation, soil health and increased food security (Amelung et al., 2020).

Besides minimising the global temperature rise, food security is also a high priority within the United Nations Sustainable Development Goals. Specifically, Goal 2 which aims at creating a world free of hunger by 2030 (United Nations, n.d.). Food security exists when “all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2008, p. 1). Moreover, further expansion of agricultural land is needed to meet the expected global food demand in 2050. This, however, is not desired as this within current practices will lead to an additional increase in greenhouse emissions (Bajželj et al., 2014; Fujimori et al., 2019).



Regenerative agriculture

For the Sustainable Development Goals and food security to be achieved, a more sustainable food system is necessary (Van Zanten et al., 2018) where existing ecosystems are protected and natural ecosystems are restored (Cook-Patton et al., 2021). With current practices, where pesticides, artificial fertilisers and fossil fuels are used, environmental degradation is unavoidable (Schreefel et al., 2020). One of the ways in which a more sustainable food system can be accomplished is through regenerative agriculture. The latter is a concept with widely varying definitions. Robert Rodale (1983), the forerunner of the organic farming movement, defined regenerative agriculture as farming that increases land and soil biological production base, while having minimal to no impact on the environment beyond the farm. Building onto this, Schreefel et al. (2020) highlight that regenerative agriculture enhances and improves soil health, water quality and availability, and nutrient cycling. In addition, crop rotations, cover crops and livestock integration are practices that are associated with regenerative agriculture (Giller et al., 2021). Through these practices, regenerative agriculture can play a role in mitigating emissions through carbon sequestration while also increasing crop resilience (Tore Helsether & Reid, 2023; Schreefel et al., 2020).

Agroforestry is one of the ways in which regenerative agriculture can be practised, and refers to the growing of trees in combination with the farming of crops and sometimes animals in interacting combinations (Sinclair, 2004; Nair, 2005; Nair et al., 2008). Agroforestry has major potential for climate change mitigation and adaptation, and also enhances carbon sequestration (Kay et al., 2019). However, externalities caused by climate change will jeopardise this mitigation capacity (Anderegg et al., 2020). That is why we should protect our forests and natural areas. Forest farming is a type of agroforestry that involves “the cultivation or management of understory crops within an established or developing forest” and integrates agriculture and forestry within the same landscape (Chamberlain et al., 2009, p.4). Van Dooren (2018) highlights that this variety of plants within different layers results in a self-sustaining system with minimal input of external energy and human efforts, while also minimising waste output.

Decentralization

It becomes clear that our food system needs to become more sustainable and that sustainable soil carbon sequestration practices need to be rapidly scaled up in order to sufficiently contribute to climate change mitigation. Nevertheless, in practice it seems that this is rather challenging. The Sustainable Markets Initiative Agribusiness (n.d.) identified three reasons why this, and the upscaling of regenerative agriculture in particular, is not happening: 1) the short-term economic case is not compelling enough for the average farmer; 2) there is a knowledge gap in how to implement regenerative farming; 3) drivers in the value chain are not aligned to encourage regenerative farming. Concludingly, coordination is necessary (Bodó et al., 2021). Salvia et al. (2021) also highlight this coordination and combination of mitigation and adaptation actions. But for this to be reached, local actors need to be given a more prominent role in decision-making. It is argued that political proximity to citizens increases the efficiency of allocation of resources at the local level (Bergh, 2004). Therefore, decentralisation is one of the tools that is essential for sustainable management and effective rural development (Larson & Ribot, 2004; Johnson, 2001). Decentralisation is defined as the process of shifting political, fiscal and administrative power from the centre or central government to the periphery or lower levels of government (Carney, 1995; Santagati et al., 2020; Antwi-Boasiako, 2010). Lockwood (2015) argues that decentralisation is beneficial to improving efficiency and increasing accountability of the government. However, it is also stated that the costs of decentralisation are due to coordination failure.

The concept of decentralisation knows three major forms: deconcentration, delegation, and devolution. Deconcentration refers to the process of spatially relocating responsibilities, power and authority from the central state to lower levels of government and local administrative bodies. This is viewed as the weakest form of decentralisation (Santagati et al., 2020; Bergh, 2004; Gamage & Zaida, 2005; Larson & Ribot, 2004). The second form of decentralisation, delegation, concerns the process in which local governments or semi-autonomous organisations are given autonomy, responsibility and authority for decision making and administration from the central government (Bergh, 2004; Gamage & Zaida, 2005; Khemani, 2020). Devolution transfers responsibility for governing and services to lower levels of governments, such as municipalities and provinces, that elect their own representatives and are therefore outside the direct control of the central government (Gamage & Zaida, 2005; Bergh, 2004).



Social just trasion

When discussing effective sustainable development, social justice should also be taken into account as the two are closely linked (Sabato & Fronteddu, 2020; Bennett et al., 2019). The aim of a just transition is increasingly featured in political documents (Newell & Mulvaney, 2013), for example a just transition for all is explicitly mentioned in Ursula von der Leyen’s (2019) plans for developing the European Green Deal. It should also be noted that animals are often absent in discussions about socially just transitions (Tribaldos & Kortetmäki, 2022). That is why, environmental justice is included as one of three forms of social justice. The other two forms that are elaborated on are: distributional and procedural justice. Where most forms of justice solely focus on the human aspect, the environment, nature, inherent value of animals and ecosystem services are the objects of justice in environmental justice (Glotzbach & Baumgartner, 2012; Tribaldos & Kortetmäki, 2022). According to Yaka (2019), framing the environment as an aspect of social justice is still difficult due to limitations within currently existing models of justice. In this research, environmental justice therefore follows the definition of restorative justice, as provided by Aragao et al. (2016), where the degradation or loss of ecosystem services is the main area of focus.

John Rawls (2020), one of the most influential scientists within social justice, states that justice is “a characteristic set of principles for assigning basic rights and duties and for determining what they take to be the proper distribution of the benefits and burdens of social cooperation.” Here, it becomes clear that the (fair) distribution of benefits and burdens across space and time makes up a fundamental part of what justice entails (Bennett et al., 2019; Yenneti & Day, 2016). In the case of a transition, the opportunities it will create as well as the costs of it should be shared in a fair way (Sabato & Fronteddu, 2020). Distributive justice also relates to the equal access to the benefits of ecosystem services (Aragao et al., 2016).

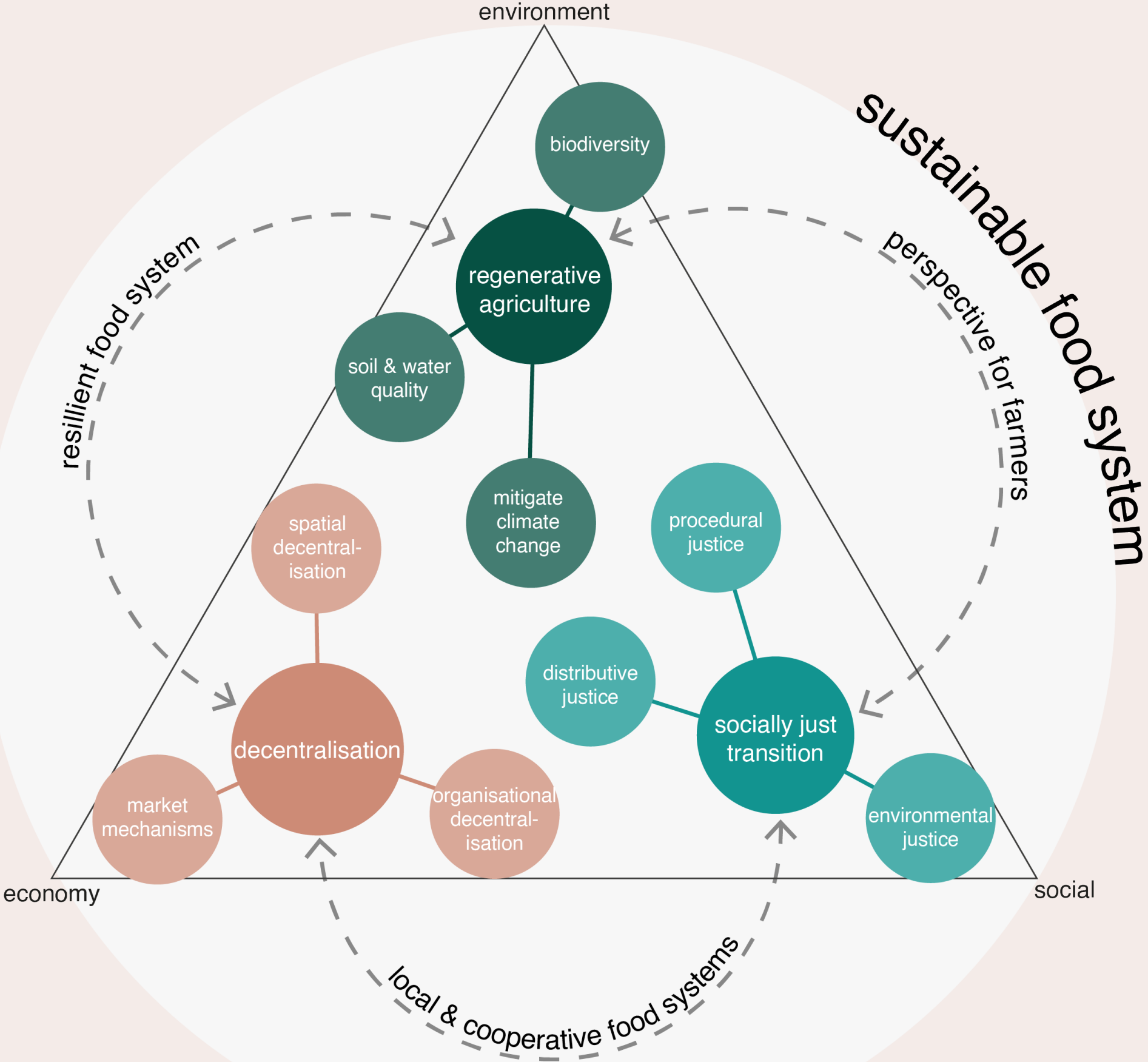
The third form of justice that this report focuses on is procedural justice and is related to the inclusiveness of citizens and all stakeholders in decision making and in policy implementation (Bennett et al., 2019; Aragao et al., 2016; Sabato & Fronteddu, 2020). To be more specific, procedural justice refers to the extent to which those who are (possibly) affected by a decision have the opportunity to contribute to the decision-making process (Dolan et al., 2007). This is relevant for this research as it is closely related to decentralisation because of the increased responsibilities for lower-level governments. This raises the question how this could be achieved in a procedurally just way where all stakeholders are involved and how economic and social benefits as well as burdens, such as losing land or livelihood (Yenneti & Day, 2016), are distributed. There are several proposed principles for achieving effective implementation in a socially just way. For instance, strategies and policies introduced should be context-sensitive and based on social consensus, policy frameworks should be coherent and integrated, regions and stakeholders that are affected should be supported, existing economic and social inequalities should be addressed, and an inclusive and transparent planning process should be followed (Sabato & Fronteddu, 2020; Tribaldos & Kortetmäki, 2022).

CONCEPTUAL FRAMEWORK

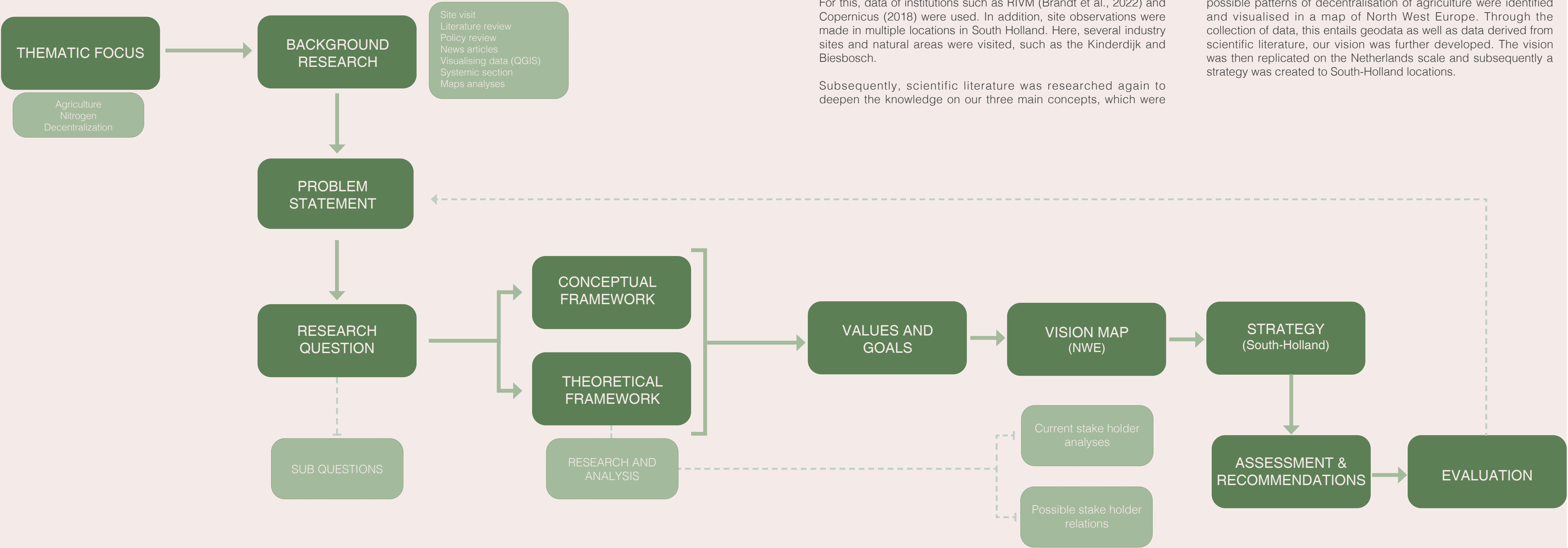
The conceptual framework visualises the three main elements of a sustainable food system in our research. It is placed within the social-economic-environment triangle and associates each with a project value. The location of each circle is thought to better accommodate each term in its respective position within the triangle. First, the environment element of the framework entails regenerative agriculture and incorporates climate change mitigation, biodiversity, and the quality of soil and water bodies (above and underground). Then, the social aspect relates to a socially just transition and is based on the three main pillars that lead to it. Finally, the economic element of the framework includes the concept of decentralisation. In our research, this implies the market mechanisms that will be applied spatially as well as organisationally. These market mechanisms are an important part of our exploration towards a more sustainable food system as capitalism and the significance of monetary

value and profits are threatening our environment. Alternative market mechanisms should therefore be considered.

The connection between those values induces three main outcomes. We believe that the conjunction of decentralisation and regenerative agriculture leads to a more resilient food system, once the distribution no longer is held by a few corporations, as is currently the case. Moreover, when connecting regenerative agriculture with socially just transition, we generate perspective for the farmers since, together with policies, they will be able to keep a fair price for their products. Lastly, decentralisation added to a socially just transition creates local and cooperative food systems dividing the long supply chain and guaranteeing the connection between producer and final consumer.



METHODOLOGY FRAMEWORK

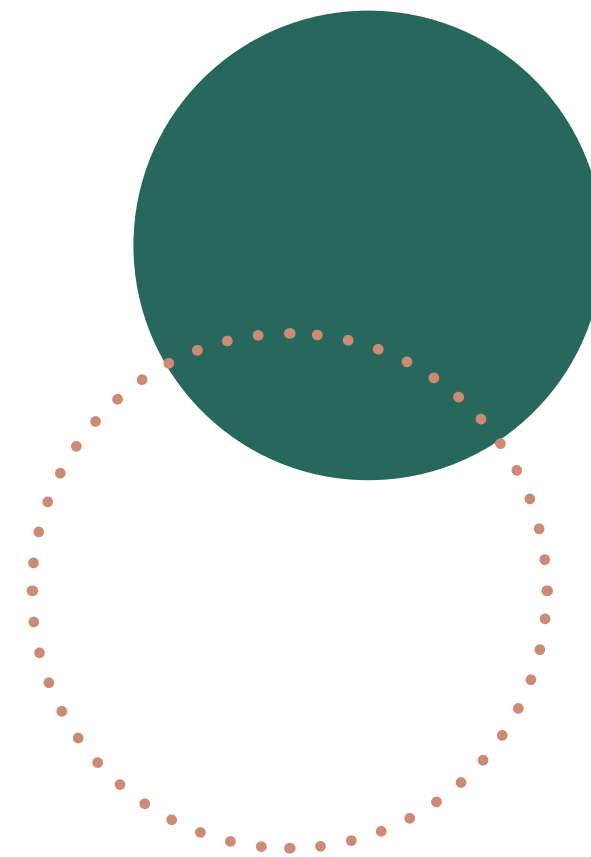


To answer the (sub) research question(s), multiple methods have been used. First, scientific literature and news articles were analysed to identify the current situation of agricultural practices and the externalities caused by it, but also to gain knowledge on the current economics. Besides literature and articles, geodata was used to spatially visualise the status quo. To be more specific, QGIS was used to produce maps on, for example, the nitrogen deposition, visualise where farms are located and soil biodiversity. For this, data of institutions such as RIVM (Brandt et al., 2022) and Copernicus (2018) were used. In addition, site observations were made in multiple locations in South Holland. Here, several industry sites and natural areas were visited, such as the Kinderdijk and Biesbosch.

Subsequently, scientific literature was researched again to deepen the knowledge on our three main concepts, which were

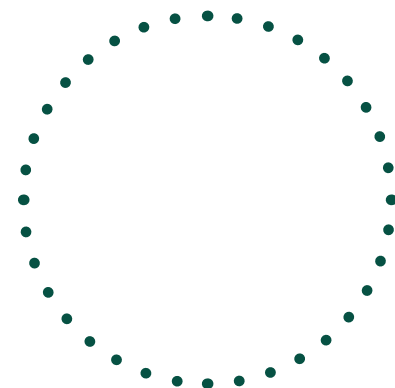
also used as main search terms for this qualitative research: regenerative agriculture, decentralisation, and social just transition. Concepts that were found during this research, such as Multi-Level Perspective, nitrogen deposition, soil biodiversity and blockchains, were used to analyse our three main concepts in-depth.

Moreover, through inductive reasoning a first spatial vision was produced. To be more specific, based on our observations the possible patterns of decentralisation of agriculture were identified and visualised in a map of North West Europe. Through the collection of data, this entails geodata as well as data derived from scientific literature, our vision was further developed. The vision was then replicated on the Netherlands scale and subsequently a strategy was created to South-Holland locations.



3. ANALYSIS

Agricultural land use
Soil is the base
Agricultural development
Nitrogen cycle
Nitrogen
 Nitrogen cycle
 Nitrogen hotspot
 Nitrogen emissions in NL
Last specs of nature
From field to fork
Recent policies
Socio-technical lock in
Public discourse
Conclusion



AGRICULTURAL LAND USE

An agricultural continent

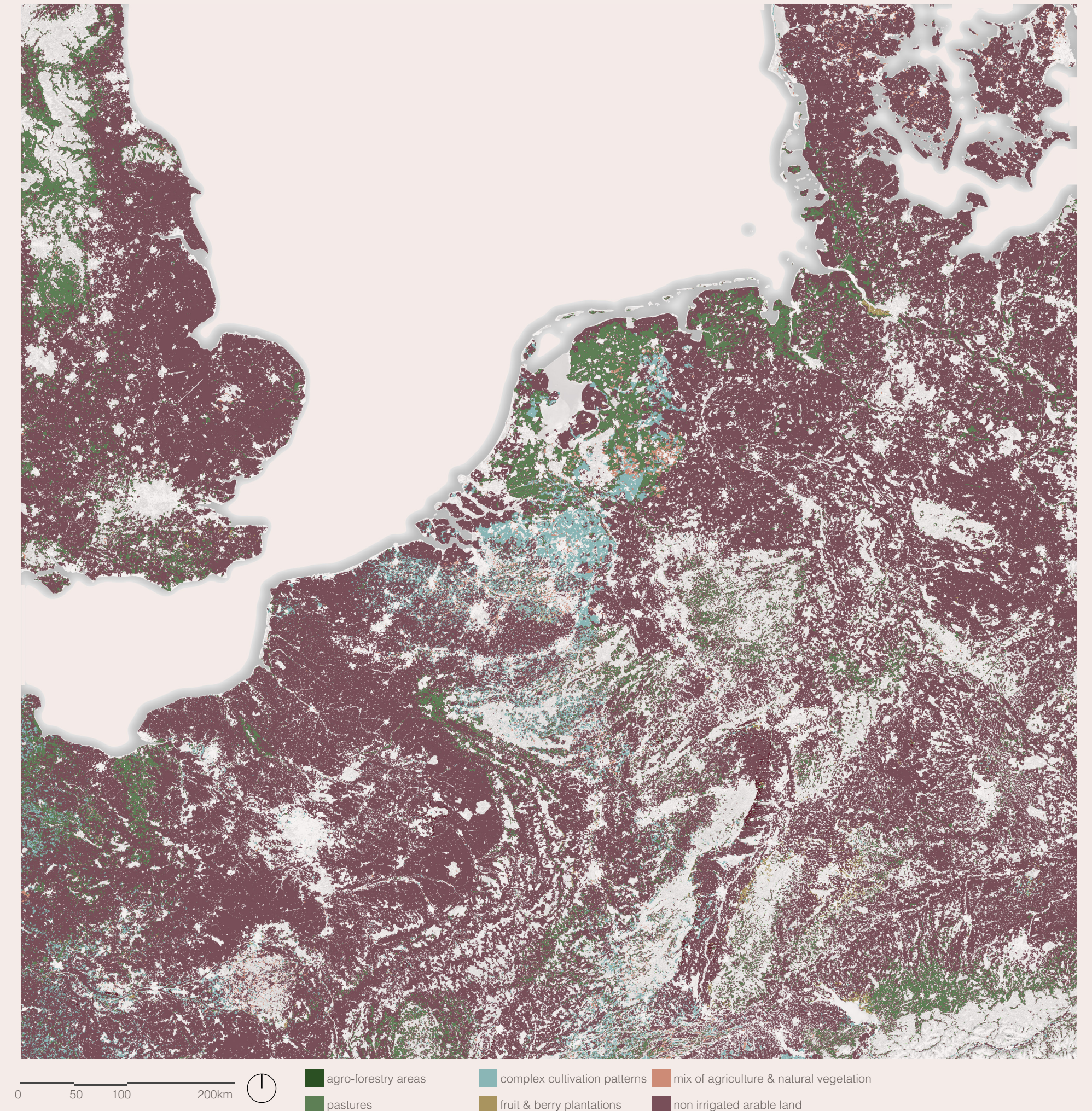
Agriculture based land

Agriculture is one of the most prominent land covers in the North West Europe area. More specifically, the largest part of agricultural land covers is non irrigated arable land, as can be seen on the map on the right. This is different for the Netherlands where mixed cultivation patterns and especially pastures are more dominant land covers.

Analysis

The following chapter will create an analytic foundation on which our vision and following strategy is based on by unpacking the developments that led to the area being this focussed on agriculture. Next to that, it describes the nutrient flows and biodiversity problems related to the imbalance in these flows, an imbalance that is mostly caused by the heavily livestock focussed sector. The chapter also analyses the current process from farm to fork and the exports of agricultural products, which are both very linear processes. Finally, the current societal problems and public discourse related to this are analysed. The conclusions drawn from all of the above will lead us to a vision for the spatial future of agriculture of North West Europe.

Figure 12: agriculture types based on Copernicus Corine land cover (2018)



SOIL IS THE BASE

The importance and limitations of soil

Soil dependency

Agriculture is highly dependent on the soil. Besides soil biodiversity, the soil type determines the possible agricultural uses of the land (WUR, 2022). The map on the right shows the different soil types in North West Europe. It is advised to switch between the map on the previous page and this one, to identify correlations. This process also informed the method of creating the vision maps, as explained later in the report.

Productive soil

Good soil quality cannot be taken for granted. The current quality of our agricultural soils is the result of the interplay of natural factors such as soil type and depth of groundwater and human actions such as fertilisation, ploughing and liming. As nutrients disappear via the run-off from harvested crops and natural processes break down the carbon present and acidify the soil, it is important to balance and maintain the soil. This balance focuses not only on carbon, nitrogen or phosphate, but also on the necessary soil structure and the living organisms in the soil. Soils by nature are not an infinite source of water and nutrients, an agricultural soil must therefore be managed. Only then will nutrient supply remain in order, sufficient water is available and roots can grow unhindered into the depths. Management also ensures that soil life is active to sweep through the soil, release nutrients and prevent disease-causing organisms from rearing their heads. This requires a smart interplay of fertilisation, cropping plan, drainage and tillage to keep productive agricultural soils productive (WUR, 2022).

Peatlands

Peat is present in The Netherlands and needs to be kept wet by maintaining the natural water table (currently water table is kept low for the sake of agriculture). When peat dries it oxidates and emits CO₂, and subsides consequently. Soil subsidence is also caused when heavy structures such as roads and houses are constructed upon soil with small grain sizes (e.g. clay), not only

peat (PBL, 2016).

Sand

Sandy soils are those that are generally coarse textured until 50 cm depth and consequently retain few nutrients and have a low water holding capacity. This makes sandy soil less suitable for cropping. Therefore fertilization of these soils is considered essential. Minimum tillage, maintenance of a cover crop, strip cropping, crop rotations, control of grazing and establishment of shelter belts and windbreaks are some of the protective measures to counter the high susceptibility of sandy soils to erosion (FAO, s.d.).

Soil really is the base

When comparing the soil map to the agricultural land use map, it can for example be noted that in the south of The Netherlands (Noord-Brabant) there is a relationship between the non fertile sandy soil and the mixed use of livestock and cropping. This has a very simple reason, being the fact the farmers need extra manure to fertilize the sandy soils.

Figure 13: Dominant soil type (DSTU) in the substratum top layer, determining the agricultural land use possible. Based on European Soil Database (ESDAC, 2006).



AGRICULTURAL DEVELOPMENT

The exponential growth of agriculture in the Netherlands 1900-2020

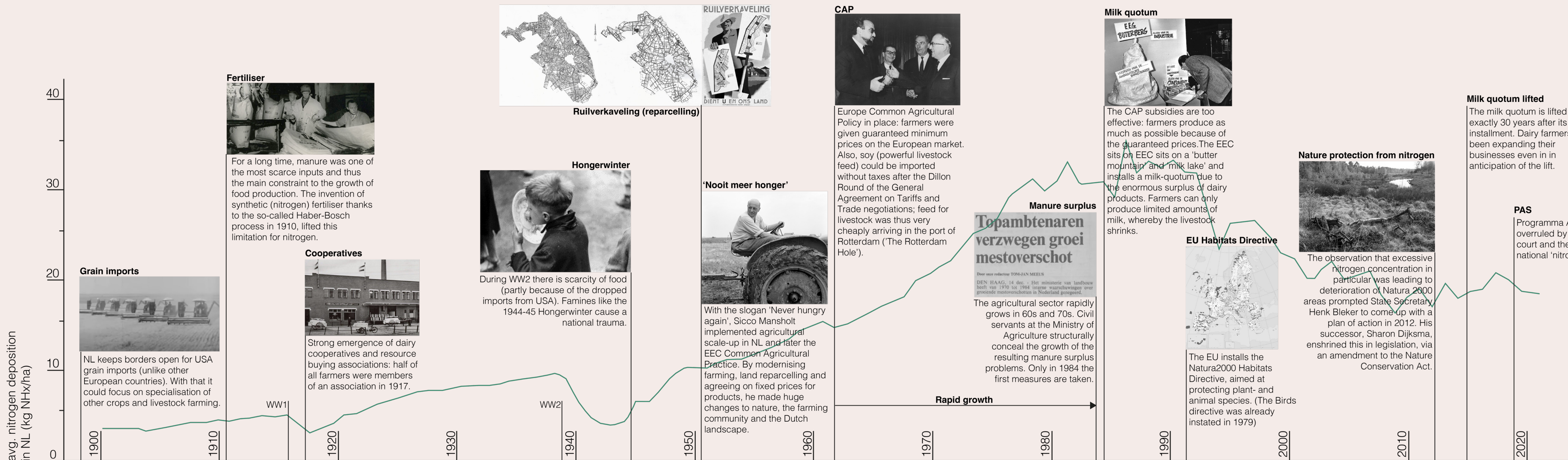


Figure 14: The timeline shows a selection of events and developments that brought the state of agriculture in the Netherlands to the way it is now. Data from CLO, 2023.

Becoming an agricultural powerhouse

The Netherlands is currently an agricultural powerhouse with which comes the environmental externalities. How did a country with a shortage of space come to this? What national and international developments influenced the agricultural sector and, most importantly, its spatial implications?

Agriculture now is far from sustainable

In his research on the sustainability of agriculture in the Netherlands, Smit (2018) shows the development of agriculture's footprint over the period 1950-2015. In doing so, he zooms in on the direct and indirect use of energy, land and labour. Indirect use here refers to

resources needed to make primary agriculture possible. With labour, for instance, this implies the personnel in the tractor factory, the people who grow soy in South America, the personnel who take care of transport (Smit, 2018). The same goes for energy and land use.

Land use

The results of this calculation exercise are telling. Direct land use for agriculture has decreased by about one-fifth since 1950 to 1.8 million hectares. But, this is offset by an increase in indirect land use elsewhere in the Netherlands or the world of almost 3 million hectares. In other words, we use far more land to enable agriculture than agriculture itself uses.

Energy

A similar picture looms over energy and labour. Due to mechanisation and economies of scale, the number of people that are employed in the agricultural sector is only a fifth of the number compared to 1950. In contrast, indirect labour has more than doubled and exceeds direct labour. Land does yield more (in kilograms of product and calorific value), but this requires six times more input of energy than before. "If you look at it this way, the sustainability of agriculture has only diminished over that period" (Smit in Kleis, 2018).

NITROGEN CYCLE

What goes around, comes around

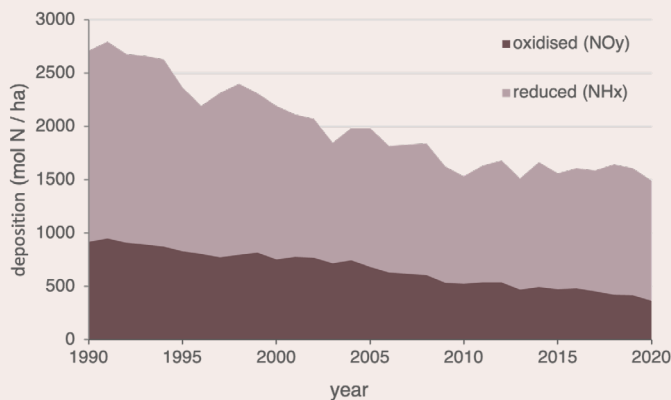


Figure 15: Nitrogen deposition in The Netherlands has declined due to technical innovations, this decline is however stagnating in recent years. (CLO, 2022).

Natural cycle

Nitrogen plays a crucial role in the synthesis of amino acids for proteins and other essential biomolecules like nucleic acids. The atmosphere comprises around 78% nitrogen, but plants cannot use it directly to produce protein due to its unreactive nature. Therefore, plants require other processes to convert free nitrogen (N_2) into usable forms, as only nitrates can be utilised by them. To acquire nitrogen in a usable form, plants must obtain it in a “fixed” state, incorporated into compounds like nitrate ions (NO_3^-) or ammonium (NH_4^+) which they can use directly. This process is performed by bacteria. Alternatively, plants can convert ammonia (NH_3) or nitrite ions (NO_2^-) to nitrate ions or ammonium for utilisation (Fowler et al., 2013). Subsequently, these plants are eaten by animals, animals are eaten by other animals, and so on. The egested material and bodies of dead organisms are broken down by decomposers into ammonia (NH_3), and so the cycle continues. The natural nitrogen cycle is shown simplified in figure 17.

Out of balance

The nitrogen cycle is heavily impacted by modern intensive agriculture, as can be seen in figure 19. Ammonia is predominantly produced in agriculture, particularly in livestock production, where protein-rich feed is provided to cattle, and protein contains nitrogen. Since cattle are incapable of absorbing all protein from their feed, nitrogen is present in the faeces and urine of these animals which is subsequently converted into ammonia. This issue is particularly prevalent with cows, although chickens and pigs also contribute. In addition, considerable amounts of ammonia are released when animal manure is applied to fields or when synthetic fertiliser is employed. Nitrogen oxides, on the other hand,

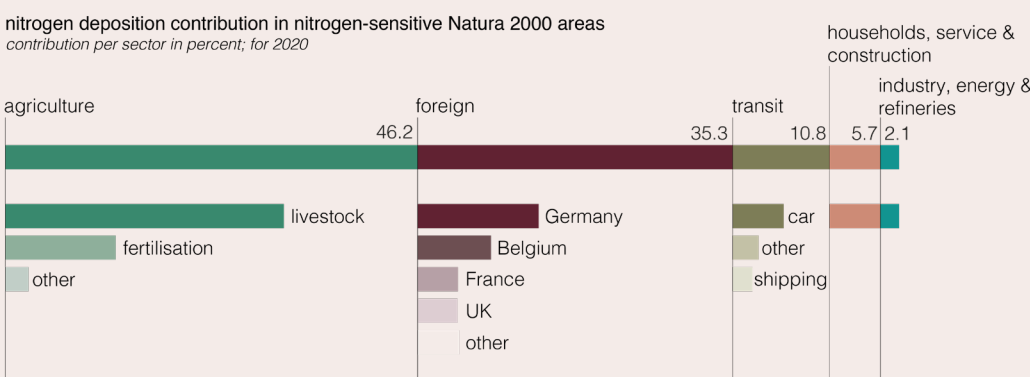


Figure 16: Nitrogen deposition only on Natura2000 areas per sector in % (CLO, 2023)

are mostly produced by burning fossil fuels and are present in the exhaust emissions of cars, aeroplanes, and industries.

Deposition

Ammonia and nitrogen oxides are carried by the wind in the air. Airborne ammonia dissolves more readily in water, making it precipitate with the rain much quicker than nitrogen oxides, which dissolve less well in water. Consequently, ammonia tends to settle closer to its source (Aan De Burgh et al., 2022). This is a problem for natural areas, where the deposition creates an imbalance, increasing nutrient richness and contributing to soil acidification. This decreases biodiversity and weakens bird abundance and other fauna. Moreover, the nitrogen oxides in the atmosphere lead to the formation of particulate matter and smog, making it harmful to human health as well (Sikkema, 2019). As seen in figure 15, nitrogen deposition in 2020, averaged over the Netherlands was 1490 moles of nitrogen per ha ($mol\ N/ha$). Nitrogen deposition has decreased by about 45 per cent since 1990. From 2010, the decrease has stagnated as ammonia deposition in particular has increased slightly. The total nitrogen deposition as of 2010 has thus remained almost constant (CLO, 2022). If only the nitrogen deposition on nitrogen-sensitive nature in Natura 2000 areas is considered, the contribution by Dutch agriculture comes out at 46%. In that case, road traffic and households/services/construction both contribute 6% to the nitrogen deposition on those nitrogen-sensitive nature areas. Moreover, in other countries neighbouring The Netherlands, agriculture is also the main source of nitrogen deposition (CLO, 2023).

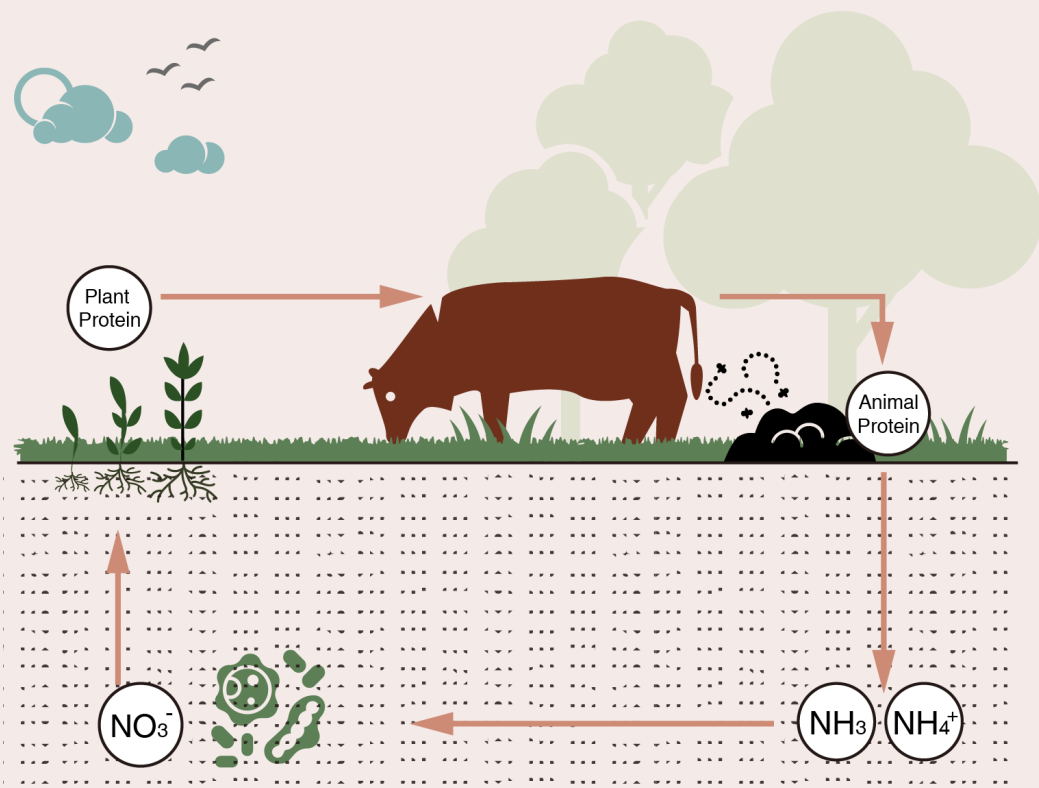


Figure 17: The natural nitrogen cycle, simplified (based on Britannica, 2023)

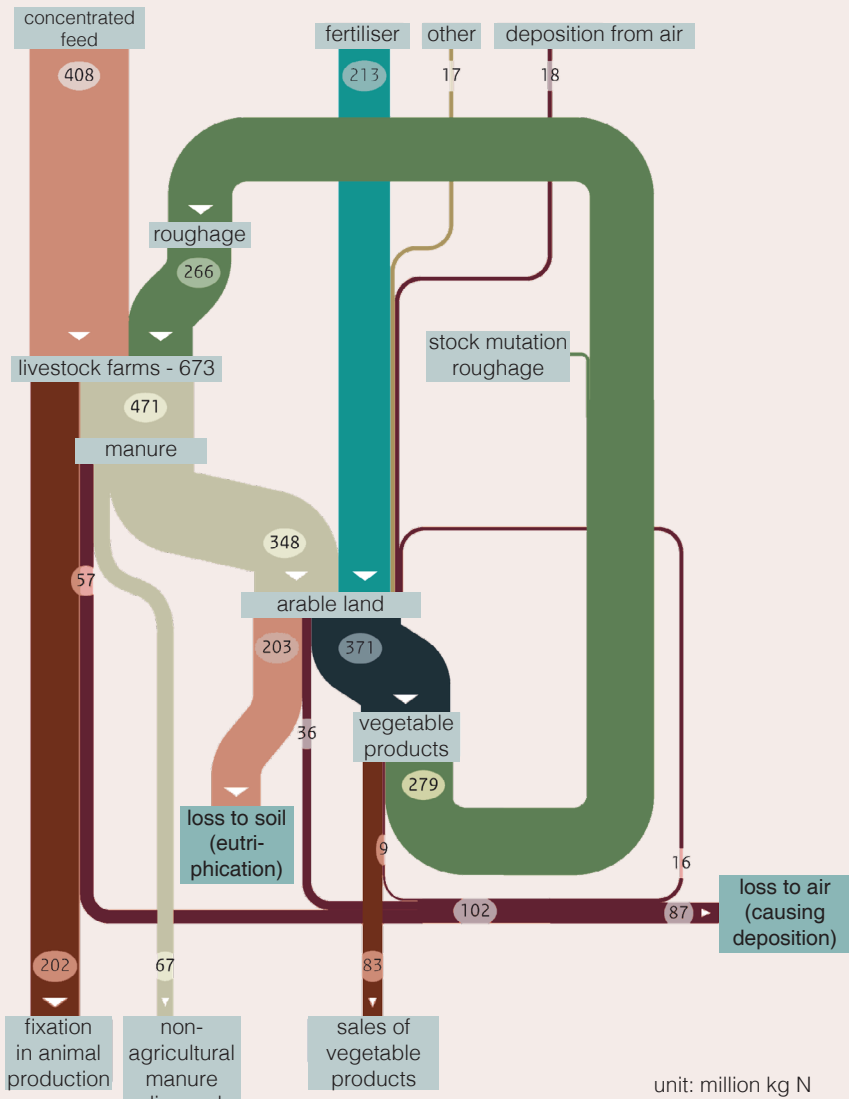


Figure 18: Nitrogen flows in the agricultural sector in 2021 (adapted from CLO, 2023a). The total loss to the environment was 290 million kg.

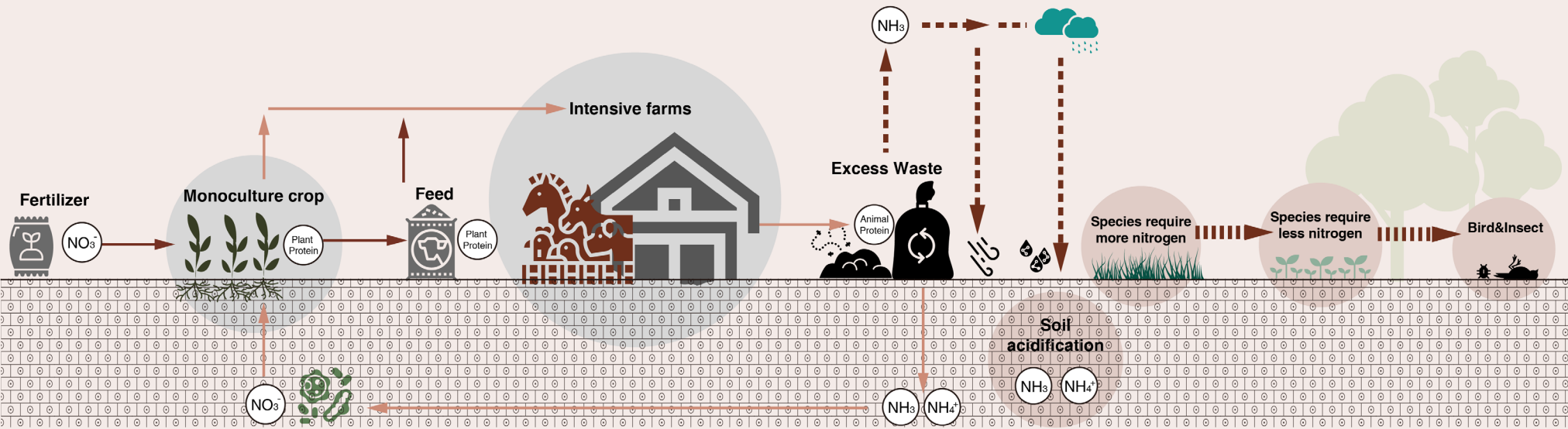


Figure 19: The nitrogen cycle is out of balance due to current intensive agricultural practice, leading to reduce in biodiversity (based on Aan De Burgh et al., 2022).

NITROGEN HOTSPOT

The role of North West Europe in the nitrogen problem

The North West Europe region is a hotspot when considering the nitrogen exceedance in the environment. This is visualised by the map on the right, based on European Environmental Agency data.

Livestock

Livestock farms are one of the main contributors to the nitrogen exceedance, as explained later in the report. In 2017 livestock represented around 40% of the agricultural sector in Europe which produced 10% of greenhouse gases (GHG) emissions. When considering feed, transport and processing, livestock represented 86% of GHG emissions among agriculture (European commission, 2020). During the same year, 63% of European croplands were used to feed livestock (GreenPeace,2019) Although not being the biggest producer of livestock, the Netherlands is the largest meat exporter in Europe with 8.8 billion euros in value. This is equivalent to 1.1% of the country's GDP and creates 98 thousand jobs. (CBS,2021)

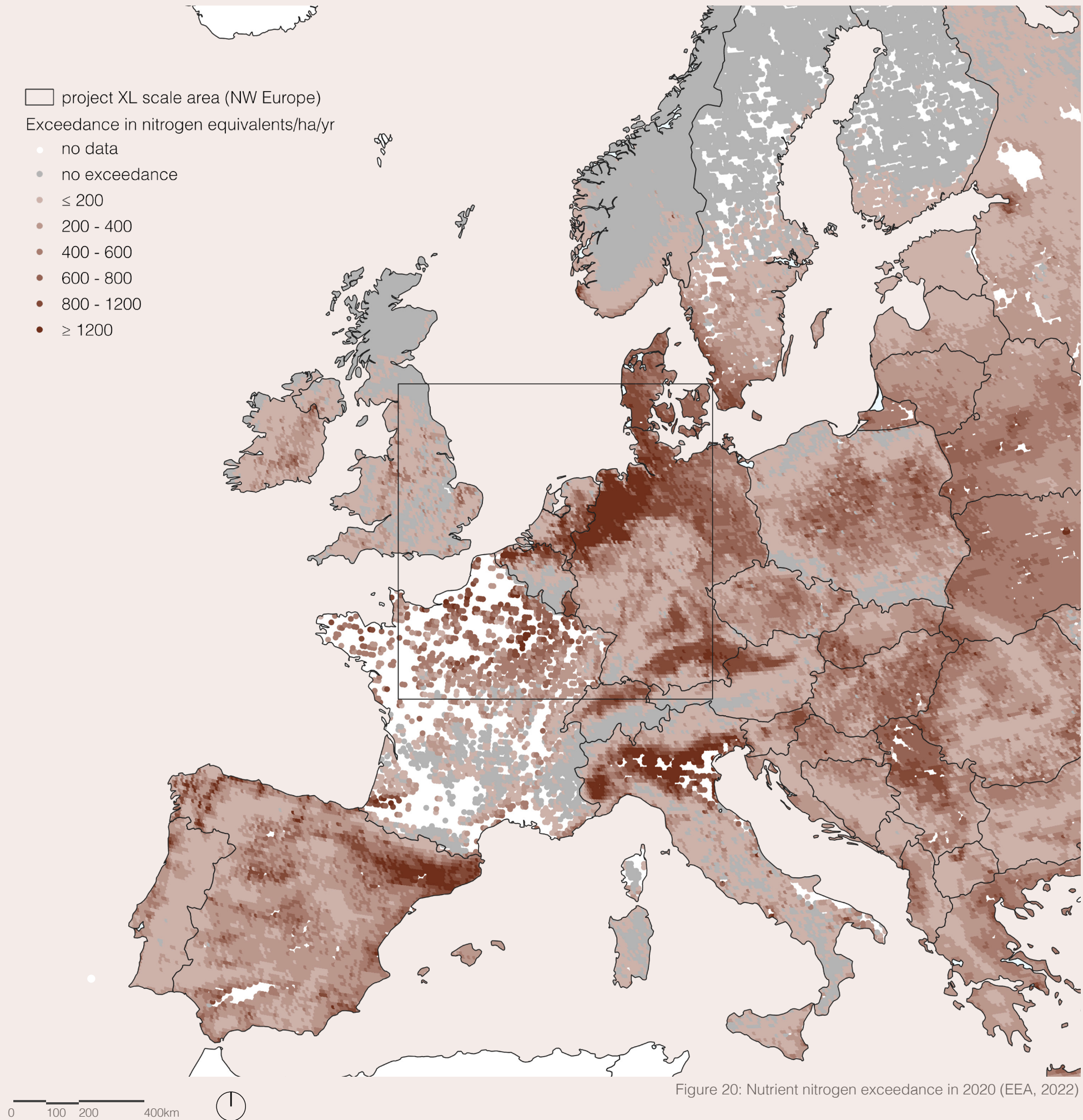


Figure 20: Nutrient nitrogen exceedance in 2020 (EEA, 2022)

EUROPE'S LIVESTOCK BARN

How livestock is dominating the food landscape

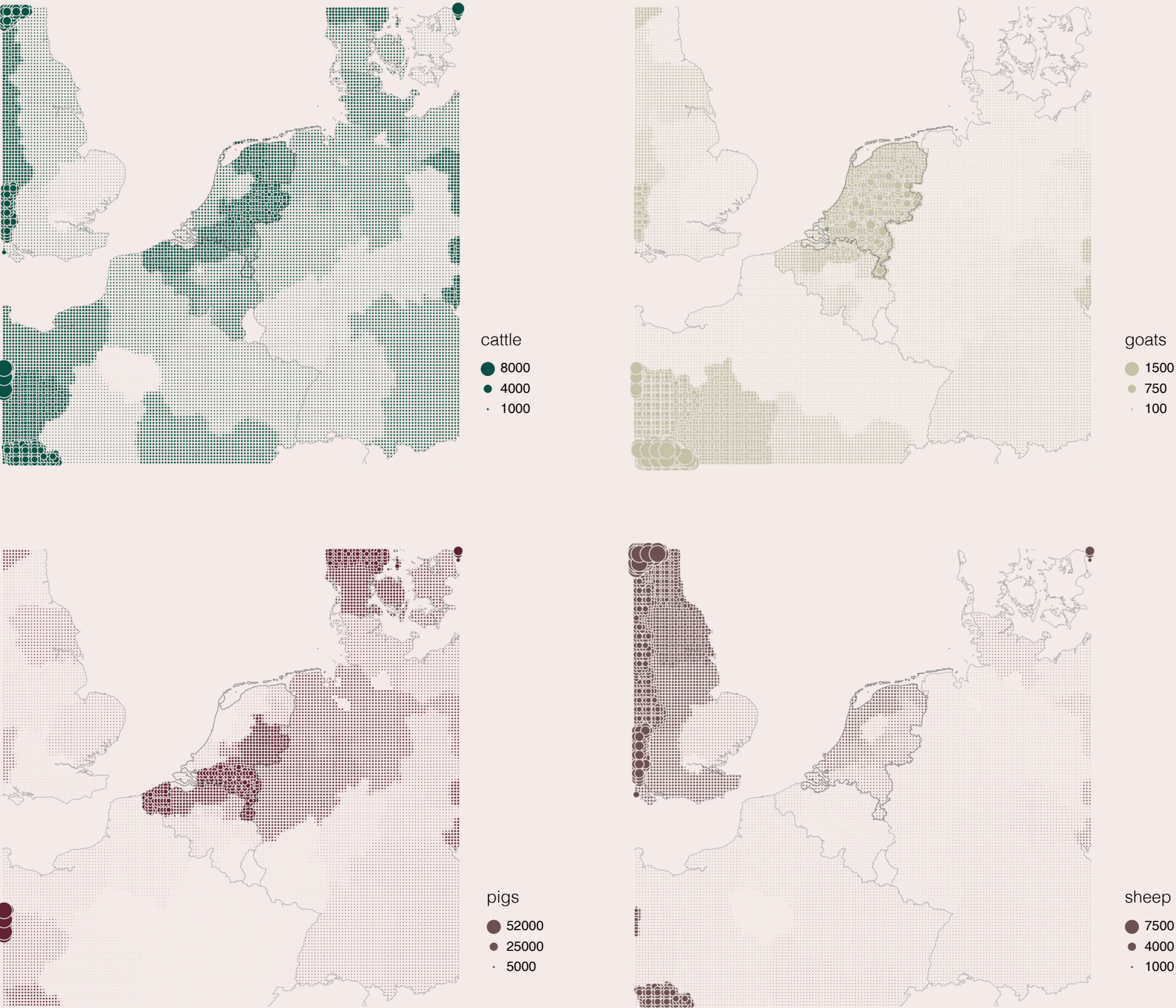


Figure 21: The four maps show the high density of livestock farming in especially The Netherlands. Data was interpolated on a 150x150 dots grid. Data from Eurostat (2023)

In 2020 in the Netherlands there were...

99.9 Million chickens 17.6 Million humans 3.8 Million cattle 8.4 Million pigs

Proportion between them

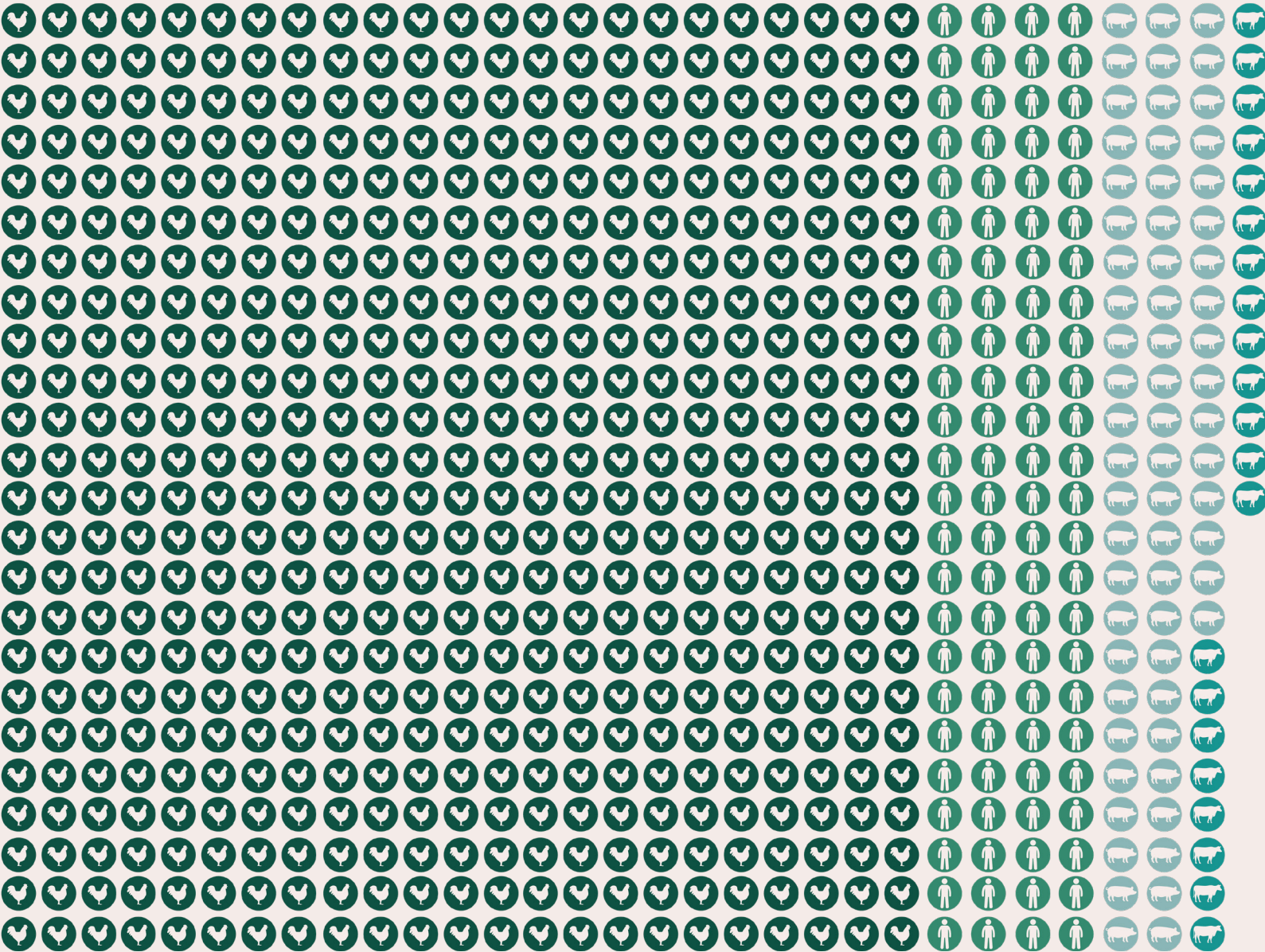


Figure 22: The proportion between livestock and people in The Netherlands is out of balance (CBS, 2021).

NITROGEN EMISSIONS IN NL

The spatial distribution and relation to nature areas

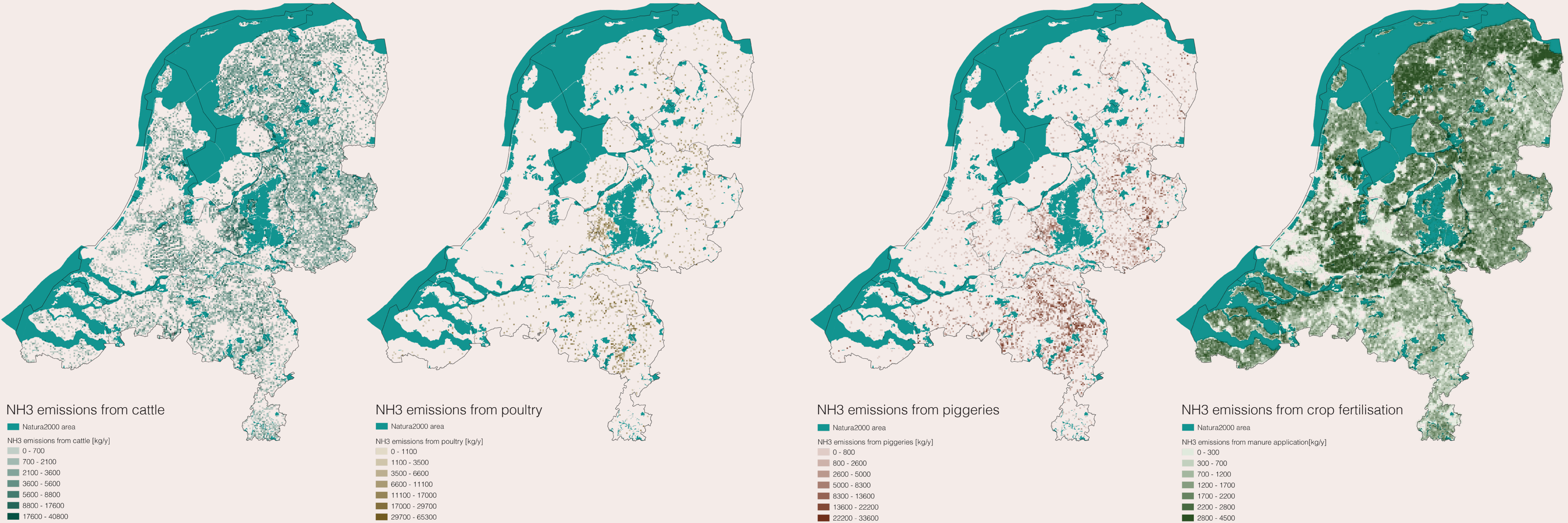


Figure 23: The above maps show in a 1x1 km grid the nitrogen (NH3) emissions from different agricultural activities, being cattle (pastures), poultry farms, piggeries and crop farming. The Natura2000 areas are shown as well. The highly clustered poultry and piggeries emissions have to do with the mega farms that are emitting enormous amounts of nitrogen. In contrast, the emissions of cattle and crop fertilization are more spread out over the agricultural lands. An explanation for the cattle might be the fact the outside grazing of the livestock is very common in the Netherlands. Finally, it is important to note the emissions of all three livestock categories are tenfold of the crop farming emissions. Emission data for 2020 from DASH Dataset (RIVM, 2022). Legends are classified using the Jenks (1967) natural breaks method in order to identify clusters.

THE LAST SPECS OF NATURE

Biodiversity crisis, not only in the small parts of nature left in the Netherlands

“Reducing nitrogen deposition is a prerequisite for restoration of nature in almost all natural habitats. The situation is most dire in dry forests and open nature areas on high sandy soils. Because once these soils are depleted by acidification, this is hardly recoverable and characteristic species of plants and animals cannot return.” - WWF, 2023

Biodiversity crisis

Europe’s nature is in serious, continuing decline, shows the recent large-scale assessment by the European Environment Agency (EEA, 2020). According to the report, intensive agriculture, urbanisation, and unsustainable forestry practices are the primary sources of pressure on habitats and species. Additionally, pollution of the air, water, and soil, along with illegal harvesting and unsustainable hunting and fishing have detrimental effects on habitats and species. Alterations to rivers and lakes, such as dams and water abstraction, invasive alien species, and climate change, further exacerbate these threats. Furthermore, the abandonment of agricultural land contributes to the ongoing decline of semi-natural habitats, such as grasslands, and the species that depend on them, including butterflies and farmland birds.

Nature health check

Commissioner for the Environment, Oceans and Fisheries Virginijus Sinkevičius said: “This State of Nature assessment is the most comprehensive health check of nature ever undertaken in the EU. It shows very clearly that we are still losing our vital life support system. As much as 81 % of habitats at EU level are in poor condition, with peatlands, grasslands and dune habitats deteriorating the most. We urgently need to deliver on the commitments in the new EU Biodiversity Strategy to reverse this decline for the benefit of nature, people, climate and the economy” (EEA, 2020).

The Netherlands

For the Netherlands, not only the few natural areas have biodiversity problems, the Living Planet Report by WWF shows (WWF, 2023). Field herbs, meadow birds, grassland butterflies, grassland mushrooms, field birds and small martens such as weasel and ermine are declining at rates around 80 percent (Turnhout & Drenthen, 2023). The biodiversity is declining in the whole country, even for agricultural lands, as can be seen in the graph on the right.

Nature protection a moral issue

Discussions and questions about nature protection often give rise to a more complicated one: what actually is nature? A strictly ecological answer does not suffice, because nature restoration is not just about species in protected areas. It inevitably involves moral ideas about how we see our relationship to nature and how much space we give nature. We are part of nature and, with the biodiversity crisis, we are not only violating other living beings but also making things very difficult for ourselves. These are moral issues. May we destroy the natural habitat if people elsewhere, people in the future and non-humans suffer? The dilemmas go high over, with global warming, zoonoses, hunger and war, but they also come close and have to do with detachment and alienation from the landscape we grew up in (Turnhout & Drenthen, 2023).

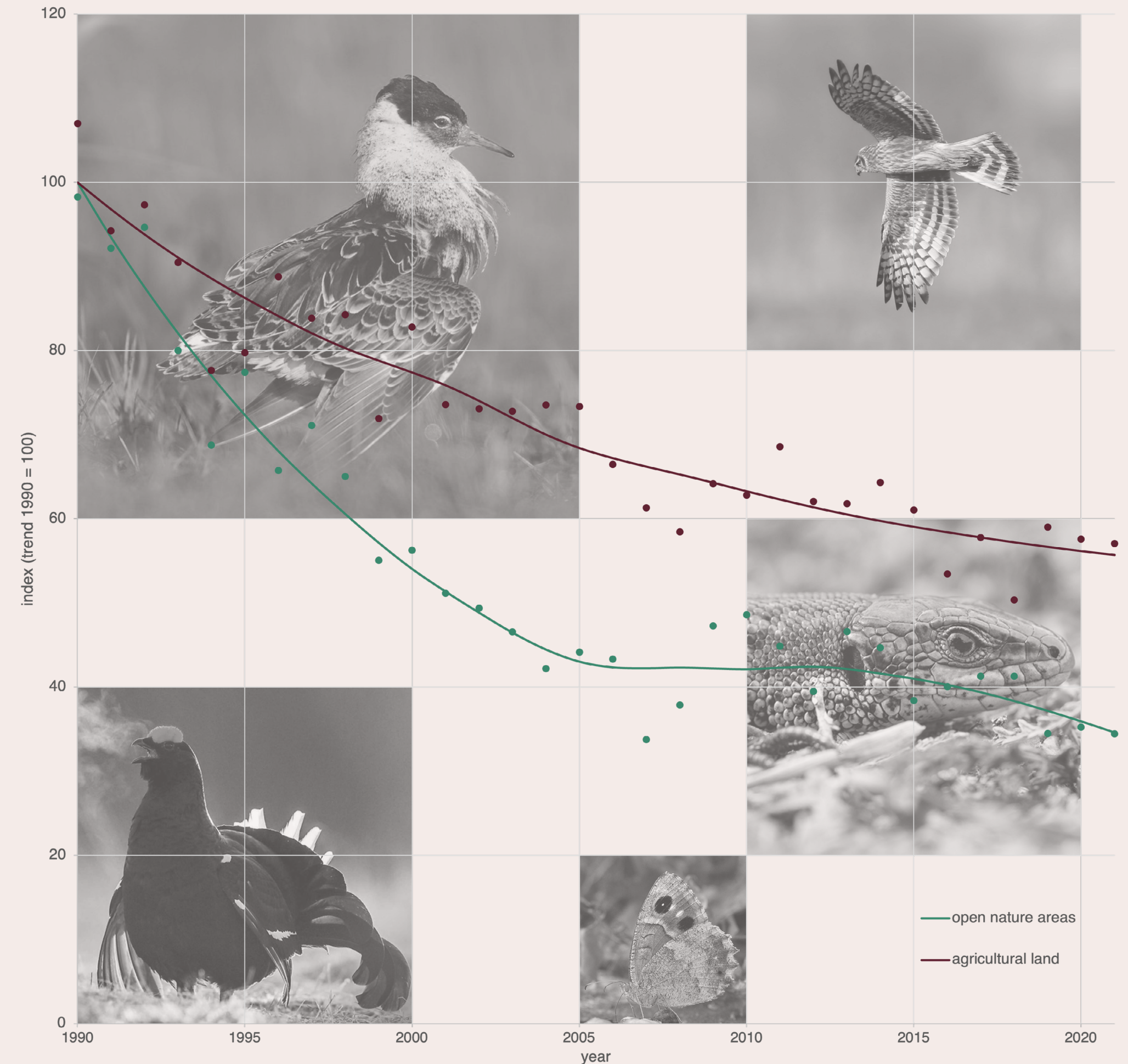


Figure 24: The biodiversity of agricultural lands and open natural areas - heathland, including raised bog and shifting sand, and open (i.e. non-forested) dunes - has reduced drastically since 1990. The species shown have reduced drastically in recent decades. (CLO, 2023b,c).

FROM FIELD TO FORK

Economy

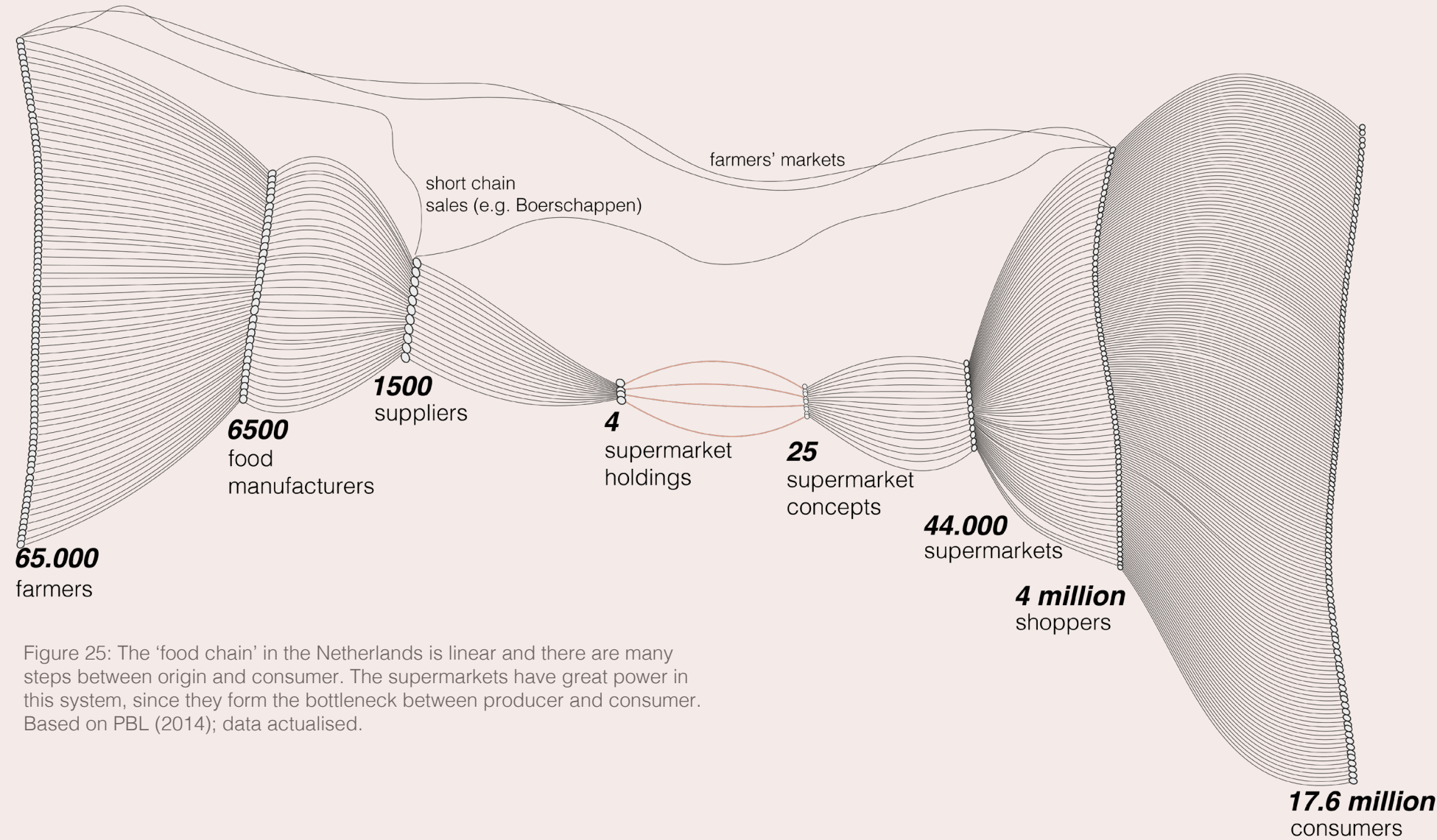


Figure 25: The 'food chain' in the Netherlands is linear and there are many steps between origin and consumer. The supermarkets have great power in this system, since they form the bottleneck between producer and consumer. Based on PBL (2014); data actualised.

The food chain

Every day in the Netherlands, shops and other outlets are full of a large supply of food. This does not happen by itself, nor is it without consequences. Behind the food on everyone's plate is a chain of farmers and fishermen, food manufacturers, traders, transporters and retailers (see figure 25). The entire chain 'from field to fork', and all the parties involved and their interrelationships, make up the food system. Today's food system consists of many different businesses, from the Dutch mussel fisherman, the grain farmer in France and the cattle fodder producer in South America to the corner baker and multinationals like Unilever and Nestlé represented on all continents. This means that the path from food to plate has become long, complex and diverse. The organisation of the food system is mainly determined by economic considerations of parties in the food system. These are mostly ultimately about profit maximisation, but factors such as trust, reputation and security of raw material supply also play a role. Consumers naturally have their own tastes and preferences, but they are also

strongly influenced by the social and cultural significance of food, marketing, prices and the supply of food. This includes not only what is on the shelves, but also, for example, the number of outlets selling food (Muilwijk, 2018).

Bottleneck of power

The production of the food the Dutch consume affects the living environment in the Netherlands and abroad. Considering the chain from field to fork, most of the effects on the living environment occur during the primary production process on the farm. This certainly does not mean that farmers are the only ones to influence the impact of food production on the living environment or that the solution should primarily come from their side. Other parties, such as retailers, food manufacturers, processors and even consumers also have great influence on the way food is produced and thus on the adverse effects on the environment. The immense power of, for example, the retailers in this system becomes clear from figure 25. Concludingly, bigger steps can be taken if these parties are also

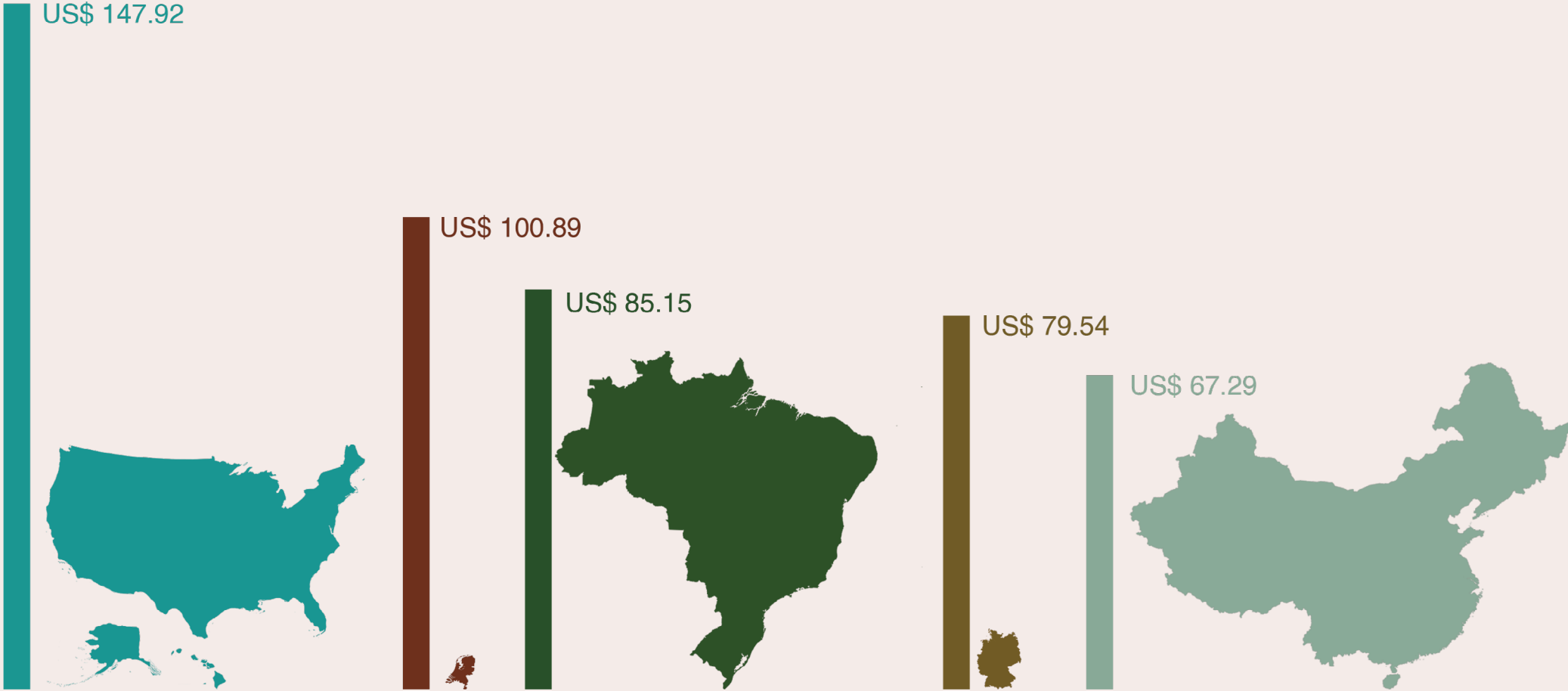


Figure 26: The Netherlands is the world's second largest exporter of agricultural products, leaving only the United States - a country 237 times larger in surface area - in front. Germany, a however larger country, also has a very high export rate. (Jukema et al., 2023)

part of the solution towards a sustainable food system (Muilwijk, 2018).

Export three quarters

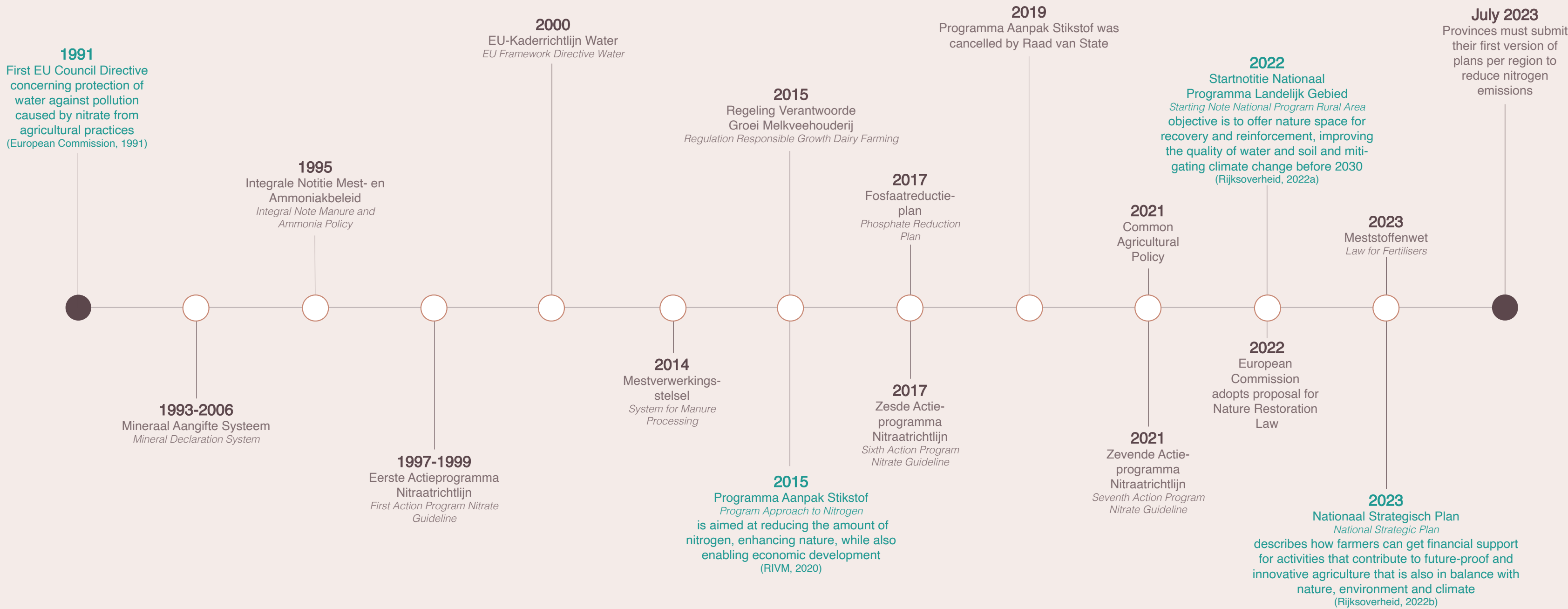
Three quarters of the food produced by the agricultural industry in The Netherlands is exported (Jukema et al., 2023). The most important market for both exports and imports of agricultural goods for the Netherlands is Europe. A total of 69.7% of exports go to the European Union (EU). In particular, the nearby markets of Germany (24% of exports and 18% of imports), Belgium (12% of exports and 13% of imports) and France (8% of exports and 7% of imports). The 122.3 billion euros in exports consists of Dutch-made goods (79.8 billion) and re-exports (42.5 billion). The product groups with the highest export value in 2022 are dairy and eggs (11.9 billion), ornamental plant products (11.5 billion), meat (11 billion), beverages (8.1 billion) and natural oil and fats 8.1 billion (Jukema et al., 2023).

New business model

In order to achieve sustainable food production, a new business plan that incorporates production processes that prioritises animal welfare, nature and landscape is required. Although this type of production is in line with society's sustainable food production ideals, it often leads to higher production costs and will probably lead to reduced export profits. Despite the social support for sustainable production, it remains difficult to generate profits (PBL, 2014). To offset the additional production costs, innovative revenue models and new markets must be developed. These changes necessitate the adoption of new organisational structures within the food chain, such as direct sales from farmers and horticulturalists to consumers. Additionally, producers and governments must persuade consumers to prioritise sustainability over price when making purchasing decisions.

RECENT POLICIES

Attempts at mitigating the externalities of current agriculture



The first EU directive

Over the past few decades, more and more focus has been put on policies that are in favour of natural development and protection and restoration of nature. The first directive, on European level, was released on 12th December 1991 and was focussed on the protection of waters against nitrate pollution that is caused by fertilisers and manure. The use of these nitrogen-containing fertilisers and manure induce contaminated surface water and eutrophication. Member States had the option to request an exemption for certain zones in which a higher maximum limit of nitrogen from manure would be accepted. The Netherlands has used this exemption in almost all areas, where currently a limit of 250 kg nitrogen per hectare per year, instead of the 170 kg

nitrogen per hectare per year, is in place on farms with at least 70% grassland (European Commission, 1991; Official Journal of the European Union, 2022).

Local policy

After this first Directive was introduced, all Member States are obliged to submit an Action Program Nitrate Guideline every four years that is in line with the Directive of the European Union. In addition to this, the Netherlands has also introduced several other policies targeting nitrates, phosphorous and other manure processes. For instance, in 2014 the Mestverwerkingsstelsel was introduced which was aimed at farmers that cannot dispose all manure from their animals on their own land and are therefore

required to have a certain percentage of this surplus processed (Rijksoverheid voor Ondernemend Nederland, 2019).

Taking soil into account

Where some policies are mainly focussed on manure and water quality, more and more policies are now also taking the environment and soil quality into account. Here, the Nationaal Programma Landelijk Gebied serves as the most recent example. The main objective of this program is that the government wants to provide more space for nature to recover and strengthen itself, while also increasing water and soil quality and fighting climate change before 2030. The program also mentions its aim for a transition towards sustainable and circular agriculture (Rijksoverheid, 2022a).

Figure 27: The above timeline shows policies by governments on different scales, for the recent decades, aimed at mitigating the externalities agriculture brings to the environment.

SOCIO-TECHNICAL LOCK-IN

The Dutch nitrogen crisis explained

Rural resistance

The many measures that governments are taking or trying to take to reduce greenhouse gas and nitrogen emissions from agriculture are meeting a lot of resistance from rural areas, especially in the Netherlands (Köning, 2022). The last decade, attempts to reduce nitrogen emissions in compliance with EU regulations aimed at safeguarding nature reserves have been largely ineffective. However, in 2019, a significant turning point occurred when a decree from the highest Dutch court bestowed unexpected power upon previously ambiguous regulations. As a result, any activity that results in the production of nitrogen, such as the construction of buildings, roads, and other infrastructure, must now be accompanied by corresponding reductions in nitrogen emissions elsewhere. This new regulation has affected the construction of new housing and infrastructure which has been constrained by the need to reduce nitrogen emissions, despite the country's housing shortage. In addition, daytime speed limits on motorways have been reduced in the hopes of lowering emissions while allowing other sectors of the economy to continue functioning. Furthermore, Schiphol Airport, one of the busiest airports in the world, has purchased farms to shut them down in order to allow planes to continue taking off (The Economist, 2023).

Nitrogen crisis

The current nitrogen crisis has affected the Netherlands on a broad scale, with the nation shifting from a bastion of free-market liberalism in Europe to something akin to a planned economy with a “Minister for Nature and Nitrogen Policy” at the helm. It became apparent that a piecemeal approach would not suffice and in 2022 a comprehensive strategy was presented to halve nitrogen emissions by 2030. As part of this strategy, the government has pledged to pay €24bn to buy out large emitters, primarily farms, with a target of reducing livestock numbers by almost a third (Rijksoverheid, 2022a). Consequently, the provincial elections of March 2023 have been dominated by the political party BBB (BoerBurgerBeweging, translating roughly to FarmerCitizenMovement). This ‘party for the farmer’ is voicing the great resistance and desperation of farmers caused by the top down, rigorous government measures.

Farmers trapped

The desperation of many farmers may lie in the dawning

realisation that - spurred for decades by policy, bank and interest groups - they have swum into a trap that is difficult to turn back into. It is the trap of the globalised high input/high output model. A trap with ever-shrinking hoops that, the further you swim into it, offers an increasingly narrow financial-economic perspective for fewer and fewer farmers (Sijmons, 2022).

Shrinking hoops

The first hoop is the investments needed to stay in the race or to reduce environmental damage. Willingly borrowed by the bank, these investments have left many farms with a high debt burden (NOS, 2023). It makes it difficult to fund a change in direction: a farmer in red cannot do green. The second hoop is the lock-in effect, the steep increase in production has not proportionally improved farmers’ income situation but mainly lowered prices. Mainly supermarket chains and consumers have benefited. The third hoop is land prices. The shortage of space in the small country that is the Netherlands has encouraged intensive land use, thereby driving up agricultural land prices. To give an idea: at an average 70,000 euros per hectare, the agricultural land price in the Netherlands is more than twice as high as in Germany and almost ten times the average hectare price as in France (Kadaster, 2023). That money has to be recouped left or right, which throws a bucket of cold water over all kinds of initiatives to extensify land use, for increasingly pressing environmental reasons. Turning in the trap is further complicated by the pilots who led the way to intensification: the compound feed, milk and meat industries. These sectors are already almost as big as the primary sector itself and are resisting such transition if there might any change that this could erode their revenue model.

Lock-in situation

With a shortage of space and almost half of the country occupied by agriculture, a precarious future for many farmers, a political upstanding of the rural area, and a government proposing damage-controlling measures of its own decades-long policy, there is no simple way out of this. All in all The Netherlands finds itself in a socio-technical lock-in situation, where there is a need for a vision guiding the development towards a sustainable alternative for the currently overgrown, oversized bio-industry that is quite literally squeezing out the land.



Figure 28: Collage of news headlines about the nitrogen crisis in the Netherlands. (RTL Nieuws, 2023; RTL Nieuws, 2023a; Meijer, 2023; Vleeschwaar, n.d.; BBB, 2022; Heyden, 2022).

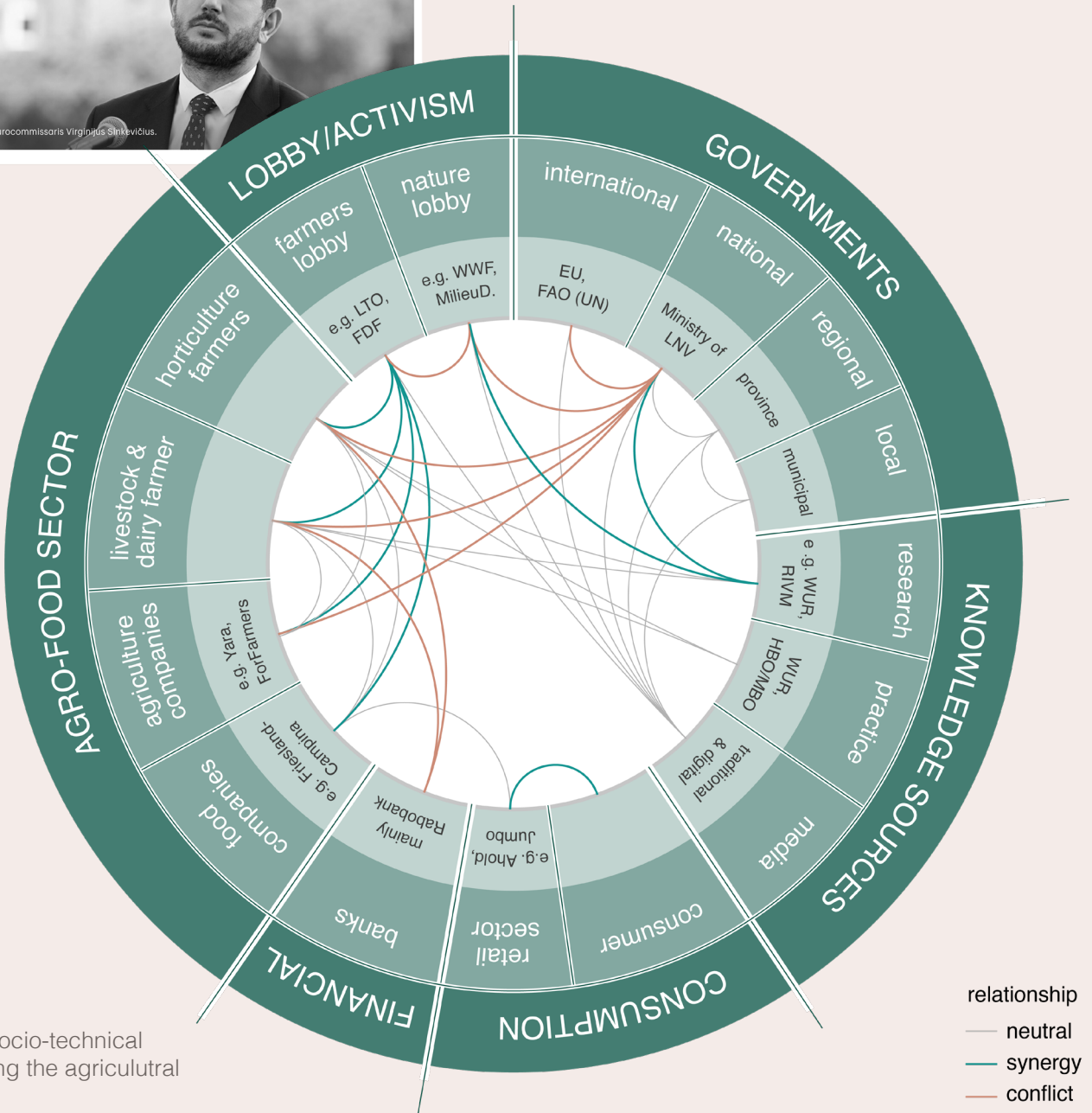


Figure 29: Conflict synergy diagram of the current socio-technical lock-in situation present in The Netherlands regarding the agricultural future of the country.

PUBLIC DISCOURSE

The current state of the public debate

The big picture

The current public discourse about the future of agriculture is putting forward the need for a transition towards sustainability. This is sustainability for both the environment, but also for the farmers. The figure on the right shows different public figures voicing this discussion.

Voices to be heard

It becomes clear that there are many different stances to and perspectives on the current agricultural system in Europe and the Netherlands. This is also highlighted by the four significant figures in the European and Dutch climate change and agriculture discussion. All quotes highlight the critical state of our current food system. Greta Thunberg, known for her climate activism, draws attention to the dire consequences of humans’ disconnection with the natural world. Antonio Guterres, the current Secretary-General of the United Nations, points to our war on nature. Caroline van der Plas, a Dutch politician, suggests that the current nitrogen crisis in the Netherlands is emblematic of broader problems. Finally, Frans Timmermans, Vice President of the European Commission, emphasises the need for policy makers to make efforts to transition towards more sustainable agricultural practices. All in all, these four quotes can be seen as an urgent call to action.



“Our relationship with nature is broken.”

Greta Thunberg
Climate activist

“For too long we have been waging a senseless and suicidal war on nature.”

Antonio Guterres
Secretary general of United Nations



“Nitrogen is symbol for everything that is wrong with the Netherlands.”

Caroline van der Plas
Party leader of BoerenBurgerBeweging

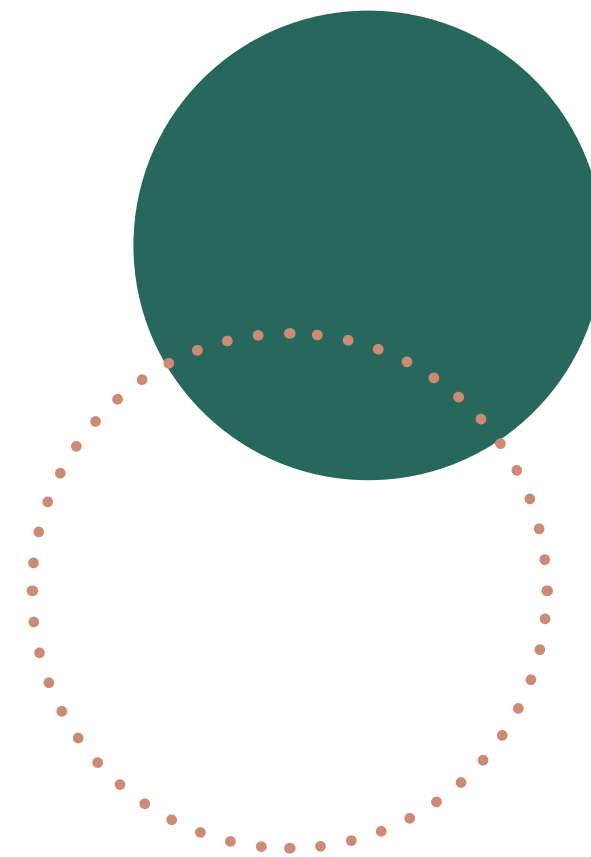


“I was very disappointed that the European Council and the European Parliament are sticking to an agricultural policy that is not sustainable and that cannot continue like this.”

Frans Timmermans
Executive vice-president European Commission

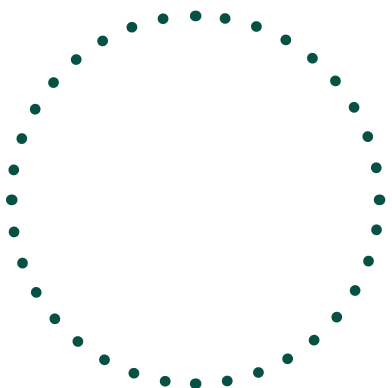


Figure 30: Quotes by public figures taking part in the discussion about the future of agriculture. (Thunberg, 2021; Guterres in UN News, 2021; Thiel, 2023; Nicolas, 2020) Images: ©Twitter/@GretaThunberg; ©FABRICE COFFRINI/AFP; © LandBouwLeven/Jan Cees Bron; © Elsevier Weekblad/Jelte Wiersma.



4. VISION

A collective answer
Regenerative agriculture
Land cover transitions
Determining the future land use
Vision map for NW Europe
Decentralisation
Vision for a decentralised food chain
Social justice
Shift in stakeholder relations
Power-interest matrix
Vision map for South Holland



A COLLECTIVE ANSWER

To answer the question posed at the end of the previous chapter, we must first synthesise the findings from our analysis and then contextualise them for the scale of NW Europe. For this, we return to our sub-research questions related to the three main dimensions of our conceptual framework:

- How is **regenerative agriculture** different from the current agricultural practices in NWE and how can it help farmers meet nitrogen level guidelines to reduce environmental impact?
- What could a **decentralised food supply chain** look like and what technologies could play a role in it?
- What are the implications for a **socially just transition** of agriculture decentralisation for relevant stakeholders?

The vision chapter provides an answer to these questions and sets them in a spatial and socio-economic context. Coming together, the insights we gathered create a framework for transitioning the land use we have today into one that would mitigate the negative effects of excessive nitrogen levels and ensure that they are on their way down to a natural nitrogen balance. We start off with the scale of NW Europe. In the analysis chapter, we saw how concentrated livestock production is in certain areas that make The Netherlands and parts of France really stand out. The reasoning for such a high density could be zoning laws, favourable grazing lands or simply the path of history. In The Netherlands, which clearly dominates the landscape among all main types of cattle, the cause for such large concentration seems to be the massive food export from a very small territory (see figure 19 in Introduction Chapter).

Not only the good travel across borders, but also the nitrogen associated with their production. The high concentration of

livestock farms, along with areas of intensive crop farming become a source for excessive nitrogen through manure and fertilisation, which doesn't stay in one place. Although travelling smaller distances than nitrogen oxides (see analysis chapter– figure 19), ammonia from manure and chemical fertilisation deposits in natural areas both in and outside the country of origin. Most of the dutch exported goods are consumed in Germany, France and Belgium- countries in its immediate vicinity (see Introduction chapter under Exports). These countries rely on the dutch meat, dairy and vegetables and if supply were to shorten, they would likely increase their domestic production or look elsewhere- a zero sum with a nitrogen surplus. This is why working on the scale of NW Europe and beyond is crucial to bringing nitrogen levels down in any single country of the area.

If we want to create a more sustainable food system we must base it both on international and local cooperation. Current food production systems are linked through the market, but not so much through governance. The EU directive on Birds and Habitats (1972/1992) on keeping nitrogen levels low in Natura2000 areas is intensifying social polarisation in the Netherlands, where the limit of intensive farming seems to have been reached and the way out is unclear (see chapter Analysis). In the neighbouring countries this is not yet as big of a problem, but how will this change once The Netherlands can't produce as much food export anymore? This makes it a collective problem requiring a collective answer. With the approaches of administrative and fiscal decentralisation, our proposed vision addresses the current political incoherence in order to make the regenerative transition both feasible and socially just.



Figure 31: Crop fields near Biesbosch nature reserve

REGENERATIVE AGRICULTURE



Aiming for a sustainable food system in Northwest Europe, our vision focuses on a transition towards regenerative agriculture and shorter food supply chains. In the theoretical framework (see Methodology) we gave an explanation of the main concepts/principles around regenerative farming. It is now time to contextualise it in the NW European region in order to understand the variety of soils, land uses and how they impact the nitrogen flows towards natural areas.

To know what interventions we need to create a regenerative agricultural systems, we first need to determine the nomenclature of RA typologies, in other words, the list practical interventions that fall under regenerative agriculture and that we can implement in our case area based on the pre-existing conditions.

The set of icons on the right (figure 33) illustrate the regenerative practices as outlined by the Guidebook for Regenerative Farming by Soil Hero Foundation. These practices attempt to

maintain the topsoil nutrient capacity and soil biodiversity, avoid chemical fertilisation, make use of symbiosis effects between crop species and with animals, use bio-based compost and fertilisers, reduce agriculture intensity to allow soil recovery, make use of soil-restorative capabilities of certain plant species, maintain the soil water retention capacity, reduce soil compaction by heavy machinery and prevent soil erosion.

In our vision, we include the more spatially related principles of mix crop/ diverse crop farming along with mob grazing, agroforestry and nitrogen fixing legume crops as main elements. The rest of the regenerative agriculture principles, such as the principle of no or shallow till and phasing out artificial nitrogen are implied in all of the areas as they have a less spatial nature. In the following chapter, we show the land use transitions based on these principles of regenerative farming and how they will shape our cultivated landscapes between nature and city.

Regenerative Toolbox

Crop rotation plan

Use your own seeds

Increase crop diversity

Deep-rooting crops

Use leguminous crops

Plant winter covers

Plant perennial crops

Geographic optimisation

Use lighter tools

Incorporate straw and crop residues

Employ shallow tillage or no till

Phase out artificial fertilizers/nitrogen (N)

Use cover crops as green manure

Mob grazing

Use biofertilizers

Use solid manure and green compost

Mix crops (2 crops)

Install cultivation strips and agroforestry

Implement field margins

Install rugged vegetation

Figure 33: Regenerative Toolbox

LAND COVER TRANSITIONS



Figure 34: Land cover transition

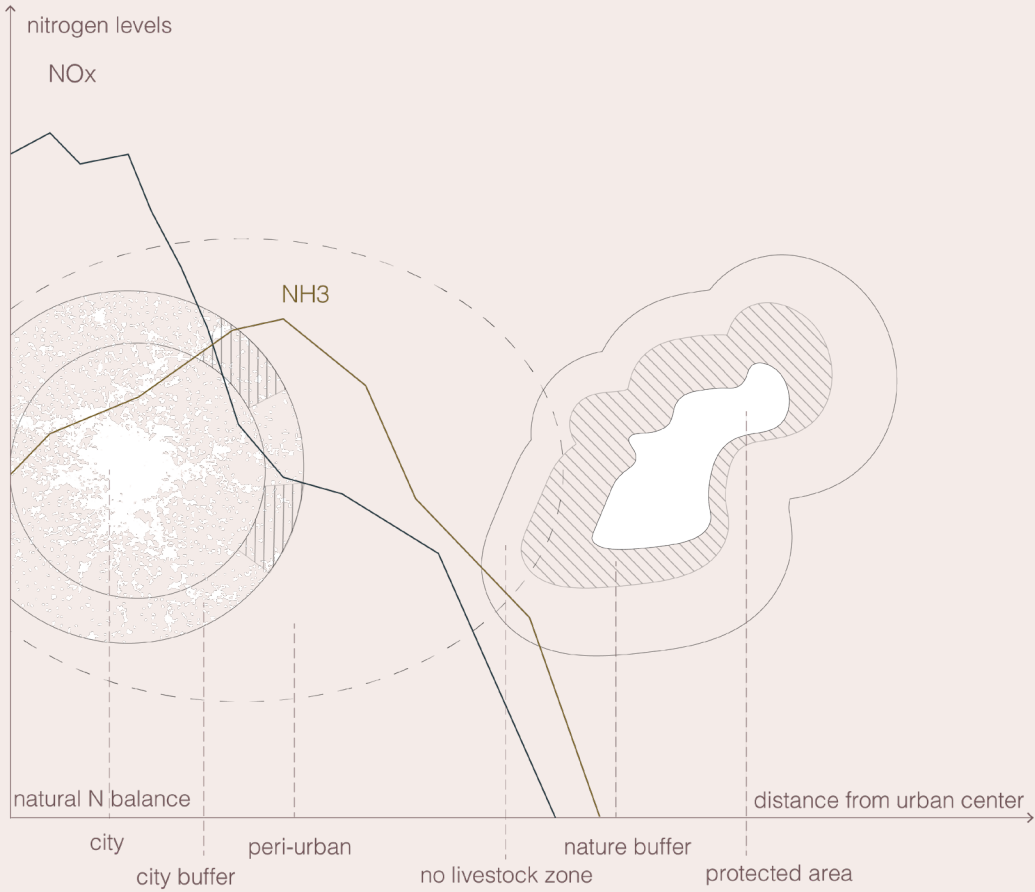


Figure 35: Spatial arrangement of zones and buffers.

Our vision prioritises protection of natural areas as guardians of local biodiversity. In order to keep nitrogen from accumulating inside natural reserves, over-fertilising and acidifying the soil (see analysis under Analysis), we come up with a spatial arrangement of buffers and zones suitable for certain future farm uses. In figure above (figure 35) you can see a diagram of a city (left) and a protected natural area (right). The latter is surrounded by a nature buffer: a semi-natural area that has a main function of preventing unwanted emissions into the natural habitat. Certain crops, as we have learned from the previous chapter, have a capacity to fixate nitrogen and prevent it from leeching further. The nature buffer area is where we envision such crops to both compensate for the loss of agricultural produce (currently these areas are often used for cultivation or livestock), but also to protect natural areas from excessive nitrogen depositions. It also serves as a more accessible natural area and can be used for recreation and self-harvesting. The width of the nature buffer is adapted to its spatial context (proximity of emitters) and shape of the natural area as outlined by Khoroshev A. (2023). Livestock, being one of the greatest emitters of nitrogen (see Analysis chapter) is further excluded from a “no livestock zone” around the nature and nature buffer area. The peri-urban area is where we have a greater freedom of choosing future regenerative farm uses, which depend on soil type and how the land is used currently. Starting from the left, we likewise transform the areas close to city borders. Beginning as small sub-urban agro-forestry farms, the belt around the urban area closes to become the new city buffer. To bring fresh food closer to the table and reduce the divide between the city residents and farmers, we propose the creation of farm parks where food production can become

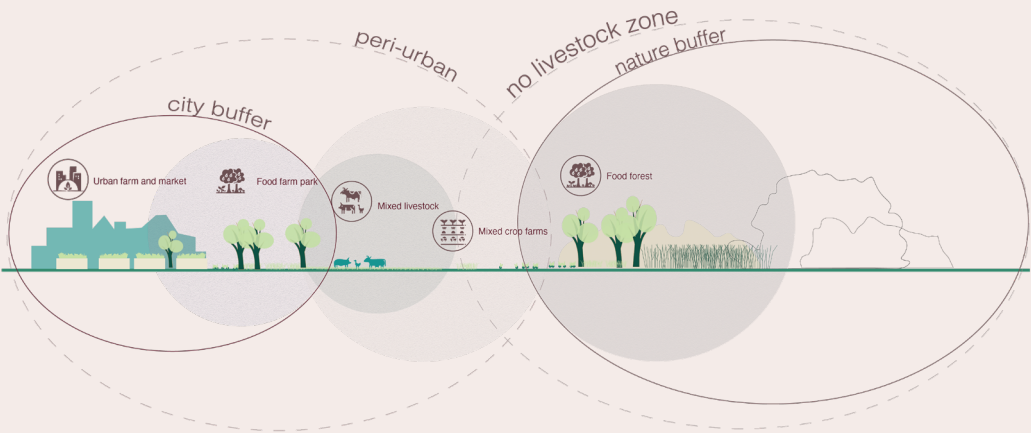


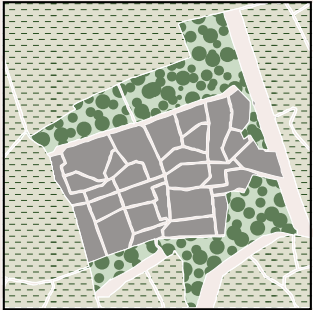
Figure 36: section of zones and buffers with potential land uses (functions).

part of an accessible sub-urban recreational landscape. The main idea of this entire configuration of zones and buffers is to create barriers between emitters (city, industry and livestock) and natural areas while creating bridging uses of recreation, cultivation and community spaces inside those protective buffers.

Within NW Europe, current land uses beyond the urban and besides those covered by water or industrial use can be roughly aggregated into arable land, pasture land, complex cultivation patterns, and nature. In low-lying areas, like those of The Netherlands, we find the typology of polders- parcels of land separated by drainage canals that allow to control the water table level (Corine Land Cover). Often the polders are used for livestock, where land is more suitable for grassland grazing rather than crop cultivation. When this happens on peat soil, it is continuously drained so that grass can grow. As peat is exposed to the air it oxidizes releasing CO2 and subsides as a result of shrinking. This means that the polder must be drenched further and so the cycle repeats itself (PBL, 2016). This is one of the reasons why considering soil type is important for a sustainable regenerative transition, but we must also consider the practicalities of growing certain crops in different soils and the protection of arable lands such as loam soils.

On the left page (fig 34), we synthesise the regenerative lessons from the previous section and the spatial arrangement outlined above into a simplified set of transitions for the intensive current uses of conventional cultivation and livestock production according to its proximity the city or natural area borders.

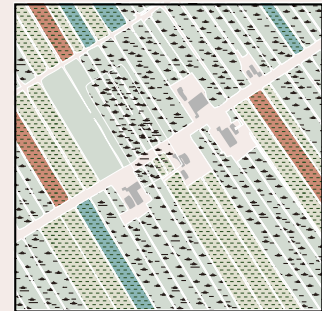
LAND COVER TRANSITIONS



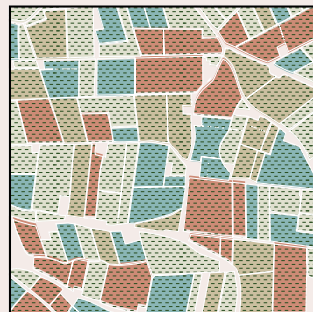
City Buffer



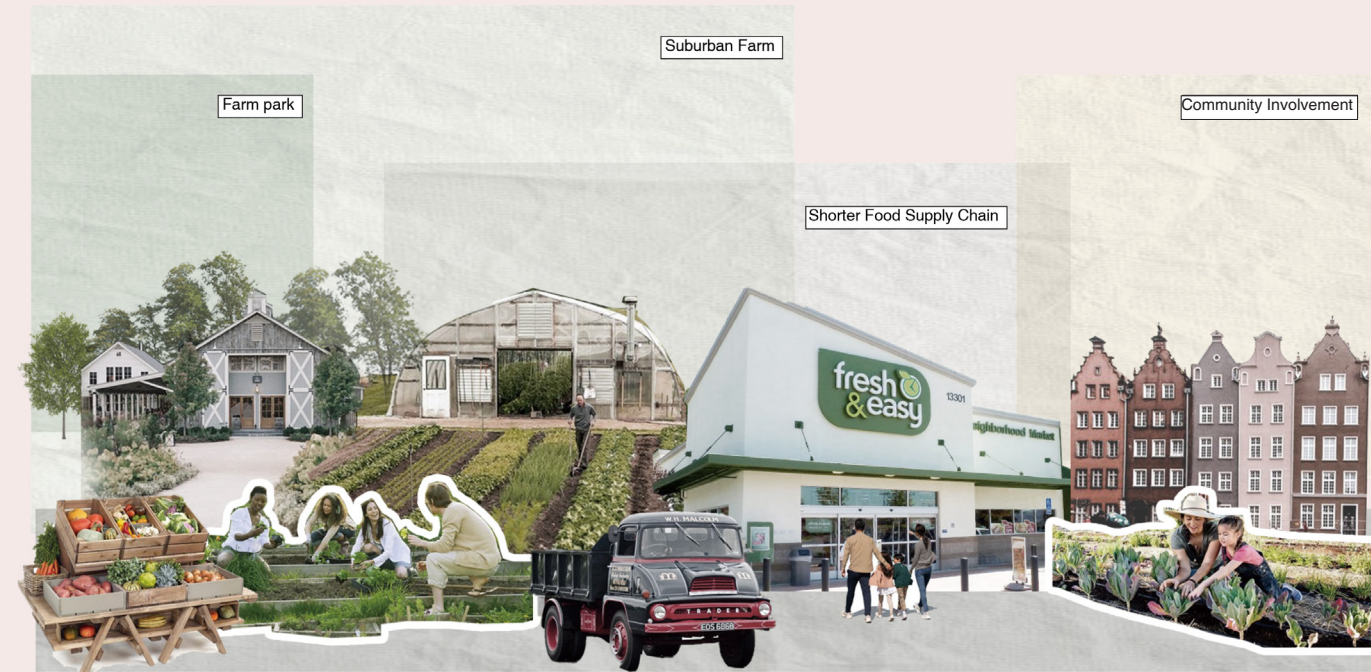
Forest Farming



Mixed Farming



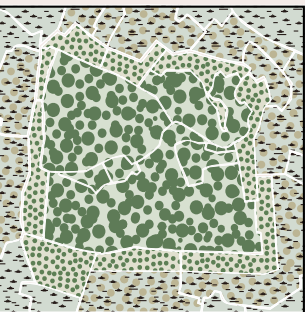
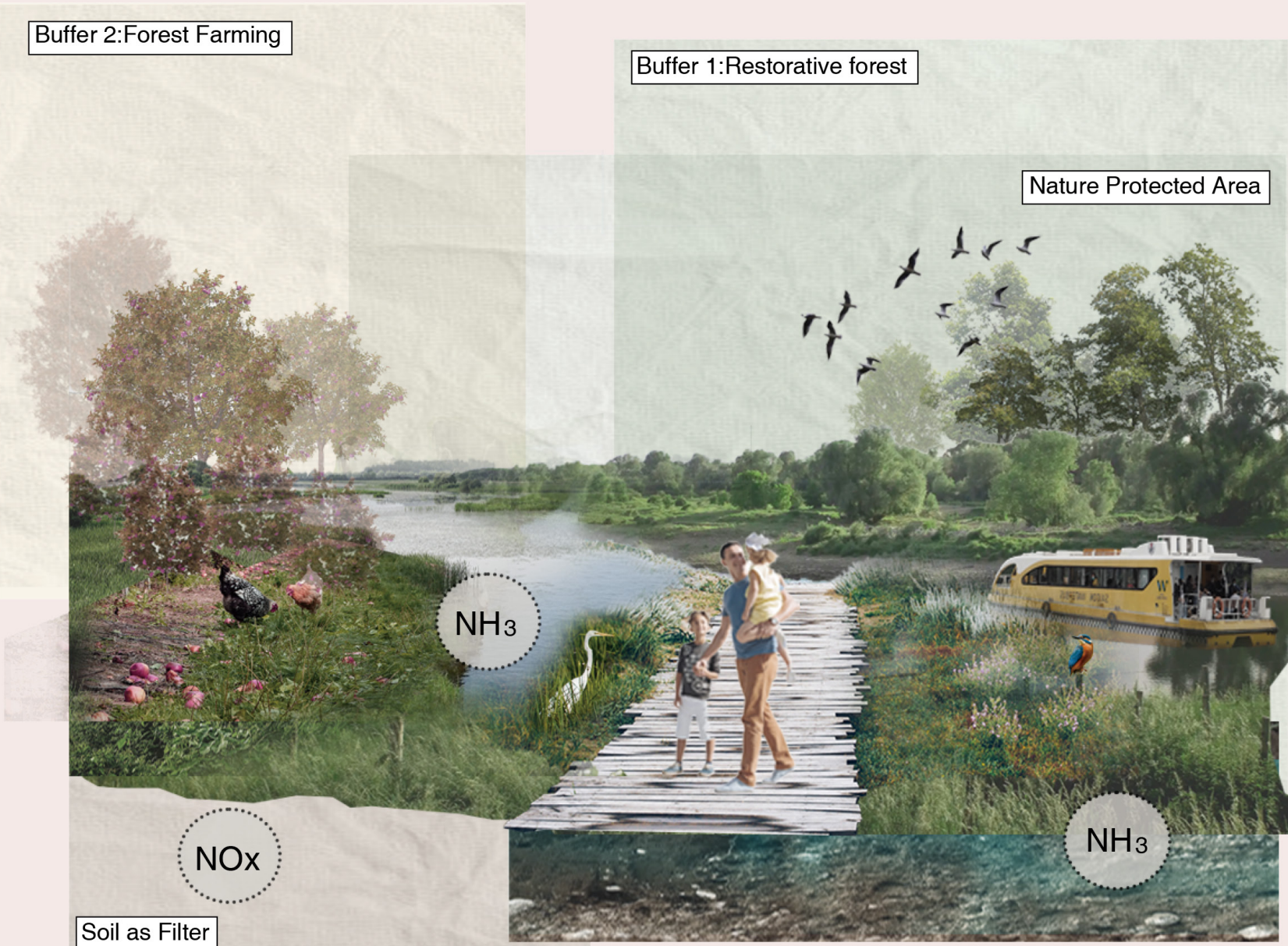
Mixed Crop



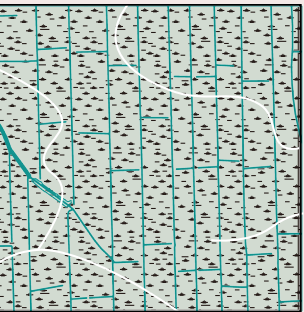
Buffer 2:Forest Farming

Buffer 1:Restorative forest

Nature Protected Area



Nature buffer



New nature

Figure 37: Land cover transitions

DETERMINING FUTURE LAND USE

	Layer type	Livestock	Mixed crop + livestock	Mixed crop	Forest Farm	Natural Areas (Forest/ Wetland)
SOIL	Sand	—	—	+	+	+
	Clay	+	+	+	+	+
	Silt	+	+	+	+	+
	Loam	—	—	+	+	+
	Peat	?	—	—	—	+
LAND USE	Arable (non-irrigated)	—	?	+	+	+
	Mixed (Complex agriculture patterns)	—	?	+	+	+
	Pasture	+	+	+	+	+
ZONES & BUFFERS	Nature Buffer	—	—	—	+	+
	City Buffer	?	+	+	+	+
	No –livestock zone	—	—	+	+	+
	Peri–urban	+	+	+	+	+
	Protected areas	—	—	—	+	+

Figure 38: decision matrix

The optimal land cover in our regenerative vision depends on a variety of factors. Considering this context is essential, as ecological and socio-economic systems are incredibly diverse in their nature. What works well for one place, might be unnecessary or even harmful to the other. Holding on to this idea, we further differentiate using the decision matrix on the left (figure 38) the suitability of certain soil types for our five main future agricultural uses (columns):

1. Livestock
2. Mixed crop with livestock (also referred to as mixed farming)
3. Mixed crop
4. Forest Farm (both in city buffer and nature buffer zones)
5. Natural Areas (while existing natural areas remain untouched, we create new ones where no other use seems sustainable).

The logic of the decision matrix on the left is as follows:
1. As we start drawing our vision map we identify distribution and variety of soil types. These are listed as rows in the section “soil types”.
2. We then check for the current land use, to know what we are transitioning these are listed in section “land uses”.
3. We then overlay the main zones and buffers following the spatial arrangement illustrated by figure 34. These are listed in section “zones and buffers”.

Each row has a symbol for each future land use, determining if such future use is assumed sustainable, both environmentally and socially:
+ means the future use is favourable or possible for the row parameter
— means the future use is unfavourable or impossible for the row parameter
? shows ambiguity. It means that the future use is highly

dependent on the more local context and should be assessed on an individual basis
Whenever we encounter a combination of a soil type, land use and zone we overlay their corresponding symbol in a boolean multiplication logic. For example, when we have a **no-livestock zone** where we currently have a **pasture on clay** soil: we get the following row:
– livestock (–*+*+ = –)
– mixed crop+livestock (–*+*+ = –)
+ mixed crop (+*+*+ = +)
+ forest farm (+*+*+=+)
+ natural areas (+*+*+=+)

The ambiguity preserves the input value:
–*? = –
+*? = +

All future uses that receive a positive result are plausible for the area, however depending on the urgency to restore soil the right side of the table is preferable (forest farm, natural areas), whereas conventional economic profitability increases to the left hand side along with less changes being necessary to the current use. As a general rule, we propose not to introduce livestock where it is currently absent altogether but attempt to reduce the intensity of livestock in the existing livestock farms.

This method of determining a favourable future land use serves more as a guidebook, rather than rule book. This is because such a classification, as any model, is produced by simplifying and generalising input factors and has its limitations when applied in practice. As we will see in the strategy chapter, this guidebook helps us to determine future spatial arrangements but should always be open to additional land-uses and interpretations in order to respect the local context, with its ecosystem, community and economy.

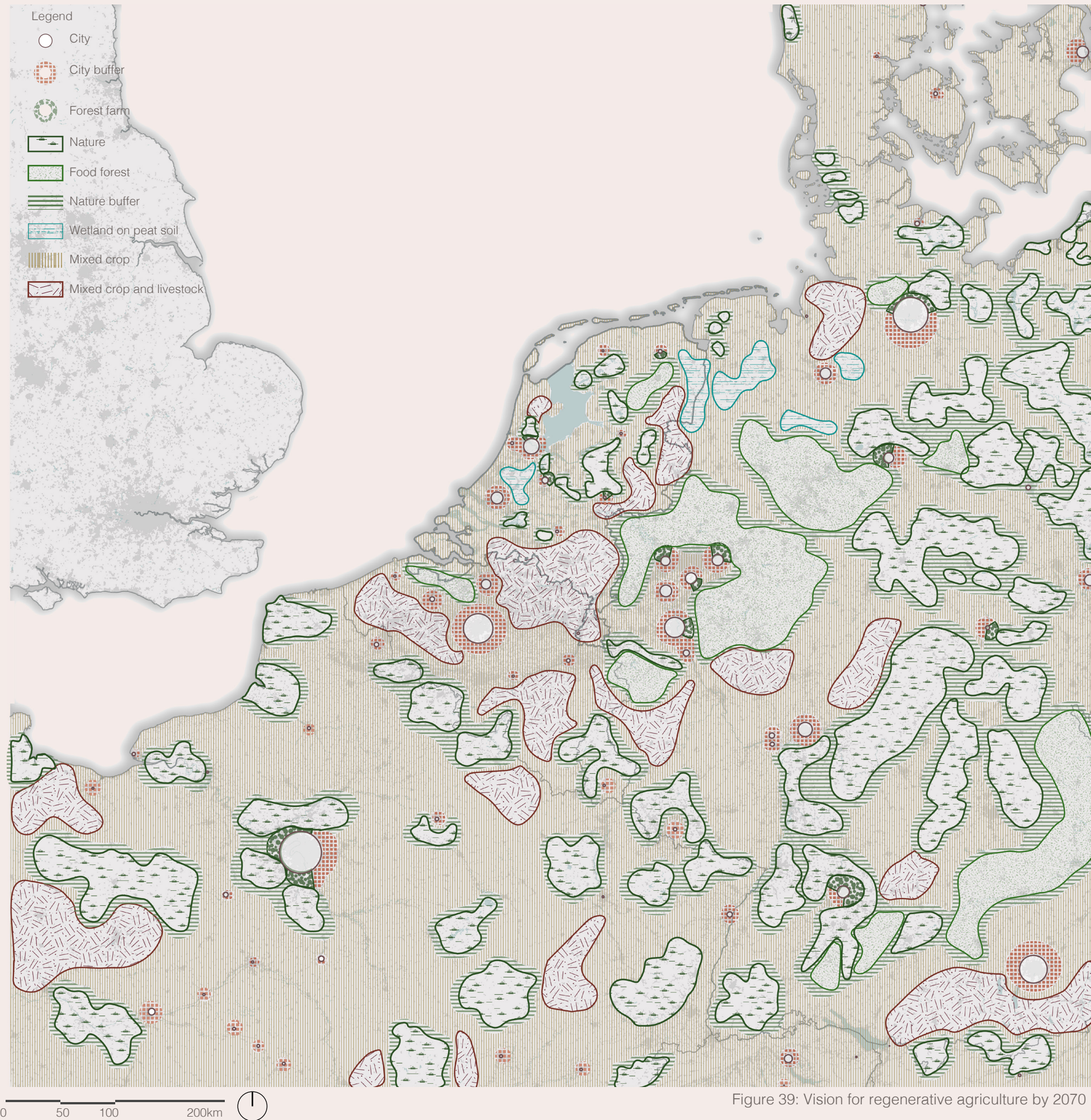


Figure 39: Vision for regenerative agriculture by 2070

VISION FOR NW EUROPE

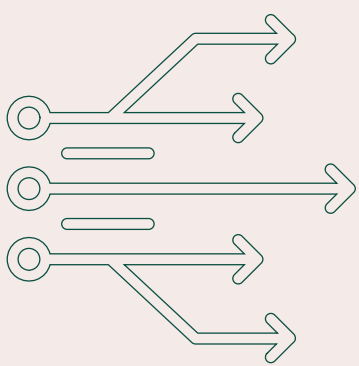
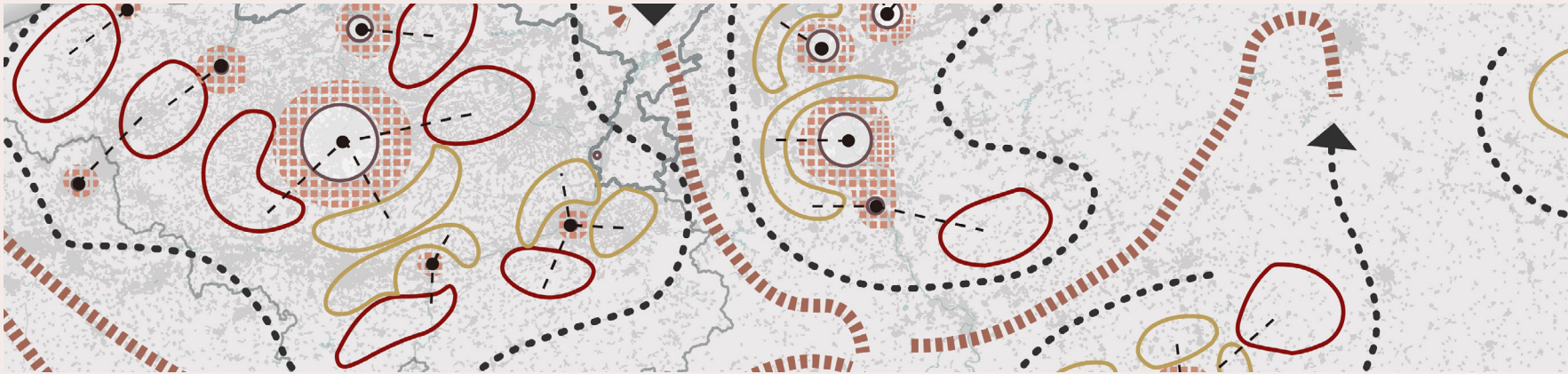
As we apply the decision matrix (figure 38) to the scale of NW Europe we start to see our vision map for the region. Here, for example, for areas in which the top layer of soil is predominantly peat (northern parts of the Netherlands and Northwest Germany), a natural area was chosen as the future land use in order to prevent peat oxidation and land subsidence. Due to the large scale, the elements of urban areas are selected from only the largest cities. The protected areas are natura 2000 reserves governed by the EU Birds and Habitats directive.

We can see here how a number of different structures emerge from the diverse NW European context. We also see that the structures share a certain similarity of grouped typologies. This is helpful when we attempt to design policies that would be applied to the entire region as the conflicts and synergies existing between the spatial elements of city buffers, peri-urban zones, nature buffers and nature areas are to an extent

reproducible across the entire region. This spatial conflicts serve as one of the layers that we work on in order to fulfil the land-use transition in socially just way. Imposing a nature reserve onto land occupied by pastures might sound like a great idea from an ecological perspective but only exacerbates the social divide between farmers and the rest of society, and is likely to hamper any change at all. In the section on social justice and further in the strategy chapter we use this conflict layer to identify the necessary shifts in our society along with the compromises to be made.

The question now, however, is what this new structure means for the economical and political structure? What needs to happen in order to facilitate a transition to a new and shorter food chain, the urgency of which we outlined in the introduction to this chapter? We tackle these questions with the approach of political, fiscal and market decentralisation.

DECENTRALISATION



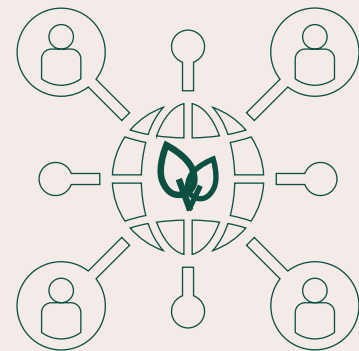
Devolution is the strongest of administrative decentralisation as it transfers “authority for decision-making, finance, and management to quasi-autonomous units of local government with corporate status” - World Bank (2013).

From fiscal decentralisation approaches, we select co-financing of projects with monetary or labour contributions due to the added flexibility in finding resources and its capacity for community building (Dovey, 2012).



By shifting general state revenues for specific uses related to the land-use transition, the transition projects can have more funds available from the national budget.

In terms for market decentralisation, we have to maintain a balance between a bottom-up approach and a just access to the common goods. Transitioning from farmland to semi-natural areas means a drastic life change for farmers who previously cultivated the land. Allowing farmers to become the nature owners and managers is a way of offering an alternative (Dietz et al.,2003). This would classify as a market deregulation approach (World Bank, 2013).



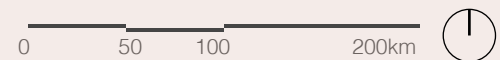
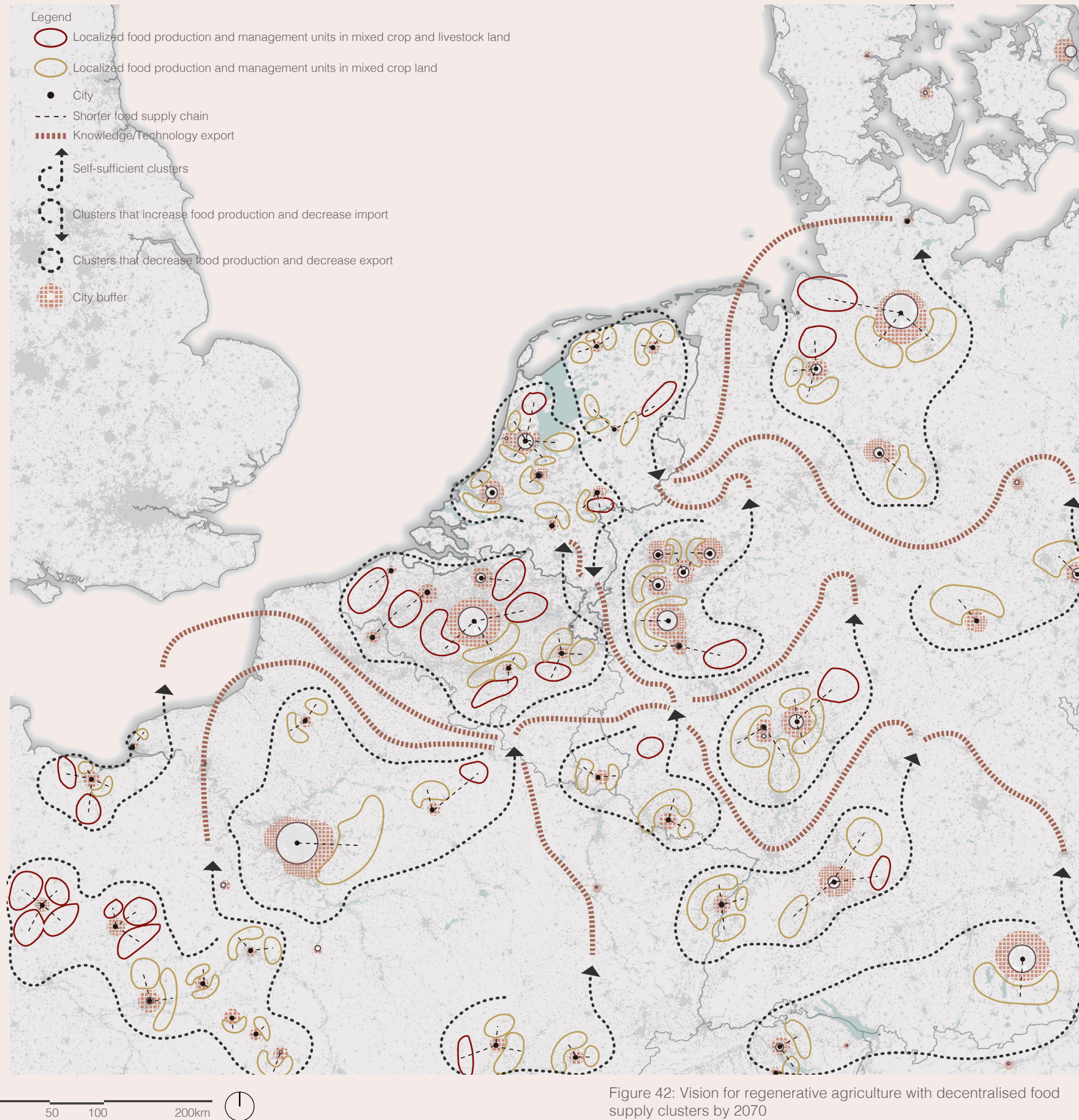
Decentralisation is one of the approaches that can be taken when disrupting and making the shift in the current socio-technical regime (see figure 3 in Introduction and Methodology chapter). Using the schematic outlined by the World Bank (2013) (figure 40) we assess the decentralisation approaches with the greatest potential for our vision (figure 41).

Using decentralisation as a transition strategy along with international cooperation can facilitate the creation of a decentralised food network with shorter supply chains. We explore how this may look in the next section.



Figure 40: Decentralisation approaches, adapted from World Bank (2013)

Figure 41: Selected decentralisation approaches



A DECENTRALISED FOOD CHAIN

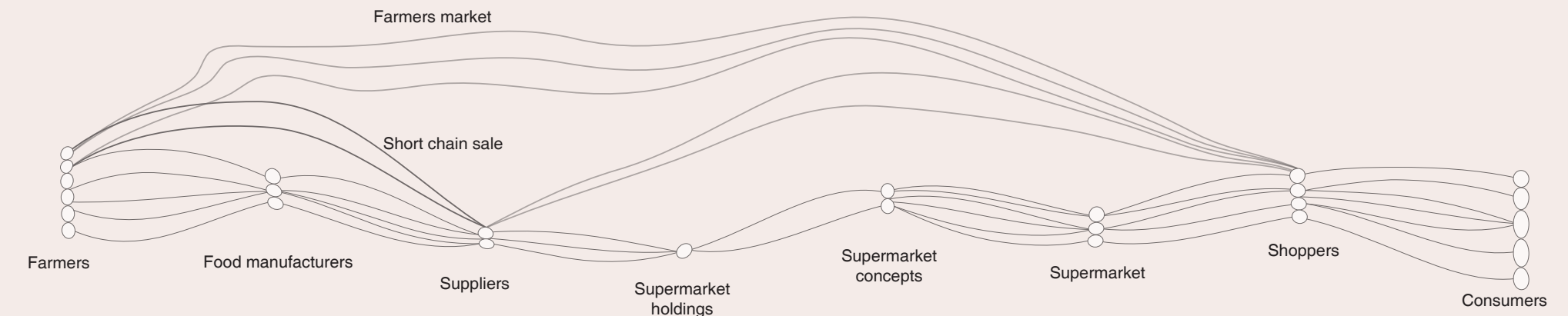


Figure 43: Food chain by 2070

In the Analysis chapter, we showed the current bottlenecks in the dutch food supply chain. By 2070, the same network can look very differently (figure 43). With shorter supply routes we can minimise emissions and increase accessibility to fresh products. The vision map on left shows a decentralisation layer to the vision on page 68. By aggregating urban areas and surrounding agriculture lands into (almost) self-sufficient clusters we are preventing long distance transportation of products. Fluctuations in supply and demand, however, can and should be exchanged between neighbouring clusters in order to distribute resources with maximum efficiency. This system does not imply a total ban on imports and exports, but guarantees a base sufficiency for daily food products.

SOCIAL JUST TRANSITION



Figure 44: A socially just transition includes all stakeholders.

Social justice is the third dimension of our vision. The question we ask here is: What are the implications for a **socially just transition** of agriculture decentralisation for relevant stakeholders? To understand how our transitions will influence the people of the area, how it will affect their daily life and outlooks for the future, we take a bigger look at where our vision stands on the EU level and amongst other political and technological movements. On the SWOT diagram on the right (figure 45) we show the assumed position of the various stakeholders towards our project as well as general strengths and weaknesses of the proposed agricultural transition. We see a big divide between farmers and national governments representing international organisations, a polarisation we discussed during the Analysis chapter. We also see that consumers have a big power

in what will happen with our food chain. Being on the consumer side, people vote with their wallet for the goods they want to see. The regenerative transition will inevitably affect what food we have on the table: it will become more seasonal and less exotic. A big attitude shift will therefore be necessary to one day live in a sustainable and short supply chain world. There can be many ways to achieve this: through education, awareness raising, systematic subsidies, etc.. The key, however, would be to include people as much as possible in making the transition work. Public participation can facilitate the adoption of this new way of life. Specifically on the very local level, the sense of ownership over new farm uses and natural reserves would be crucial to their upkeep and maintenance (Healey, 1996).



Figure 45: SWOT Analysis

A SHIFT IN STAKEHOLDER RELATIONS

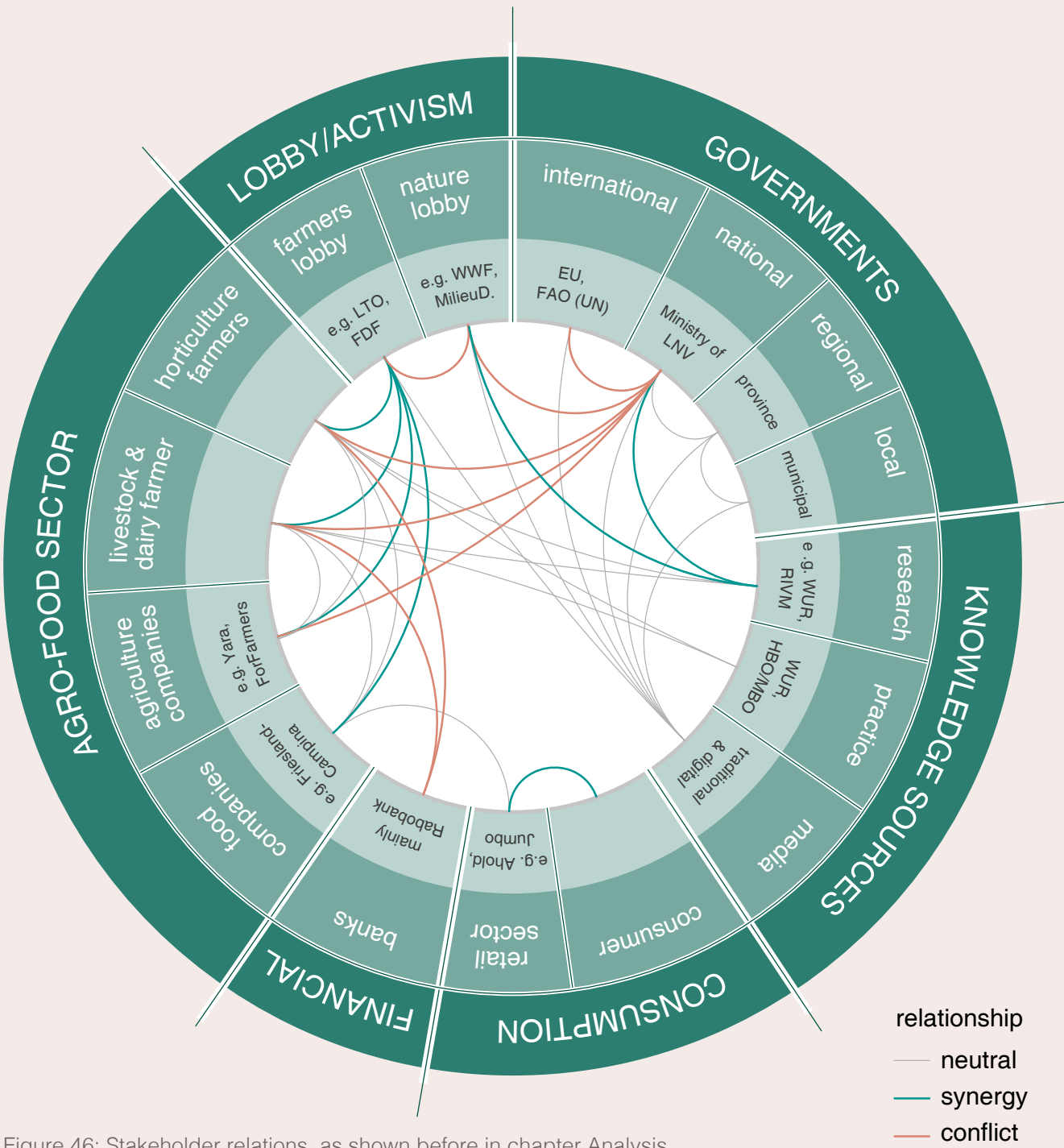


Figure 46: Stakeholder relations, as shown before in chapter Analysis.

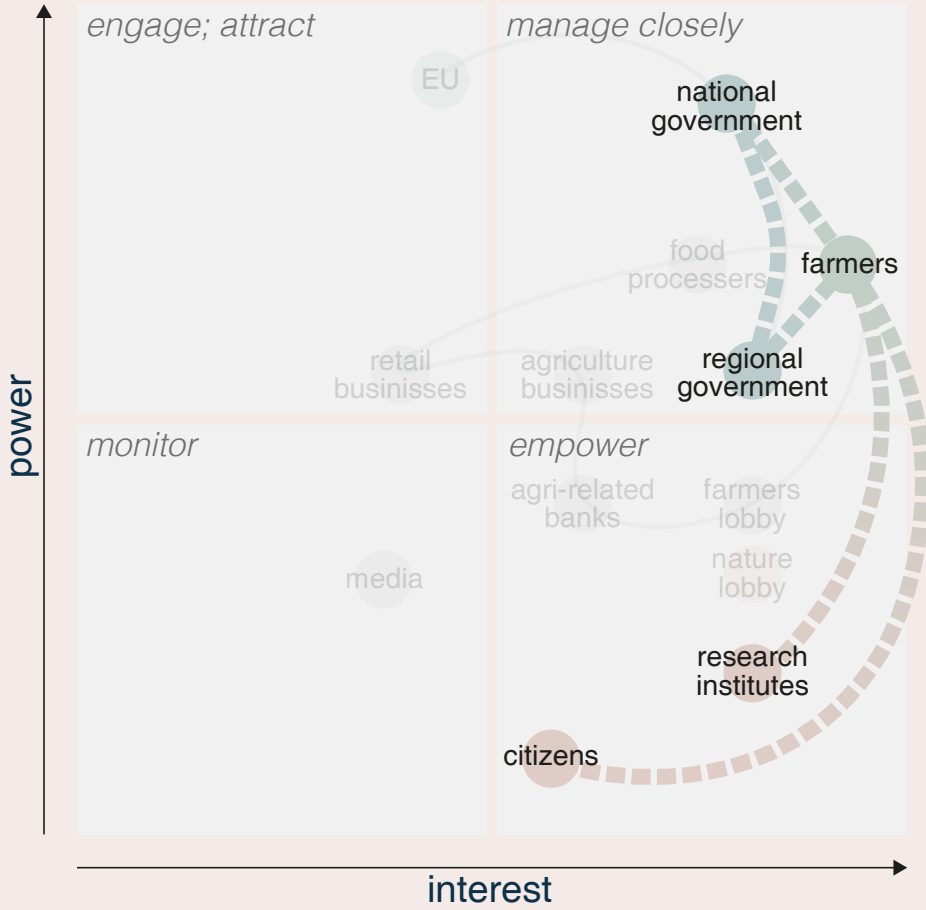


Figure 47: The stakeholder power interest matrix shows the intended strengthening of relationships

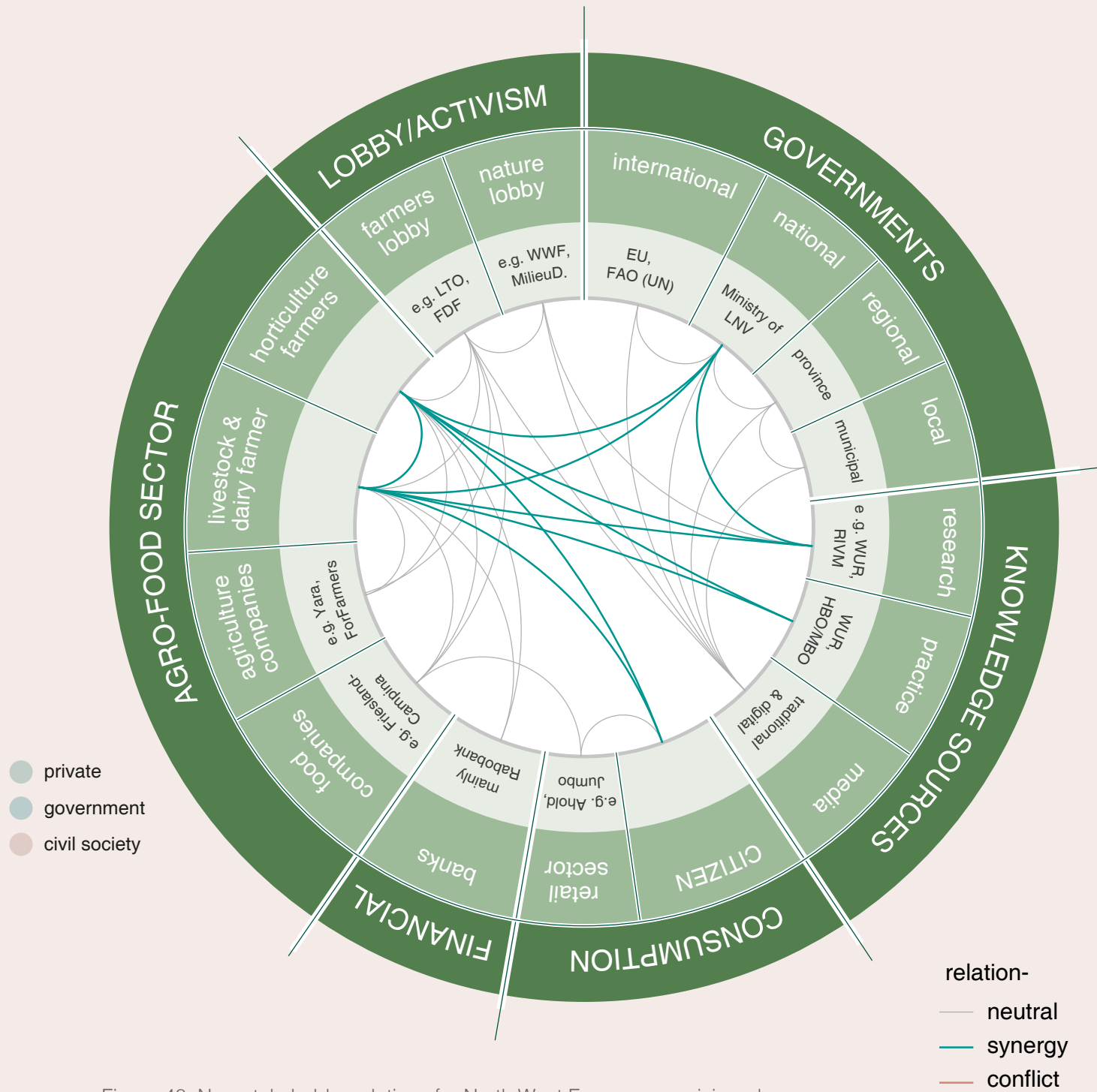


Figure 48: New stakeholder relations for North West Europe as envisioned.

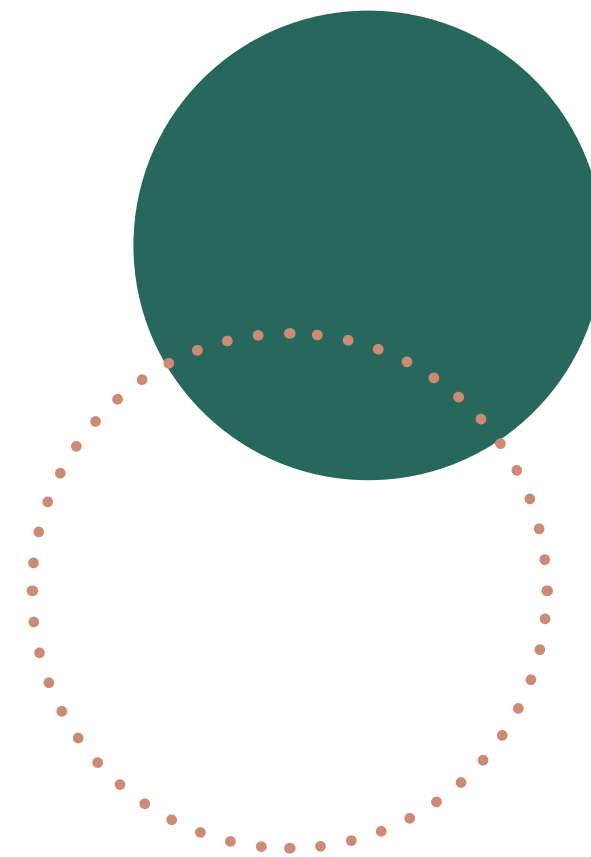
VISION FOR SOUTH HOLLAND

A way to test our vision is to see how it reacts to different scales. As we zoom into the South Holland province in The Netherlands, we begin to see more variety in the topology of buffers and zones. There are now cases where a natural area is in the immediate vicinity of an urbanised region or when pastures

are inside a protected area. In South Holland, the biggest Natura2000 area is de Biesbosch national park. So that we can go more in detail and develop a timeline for transitioning to the new regenerative farm uses, we will continue with a strategy for transforming the cultivated areas around the park.

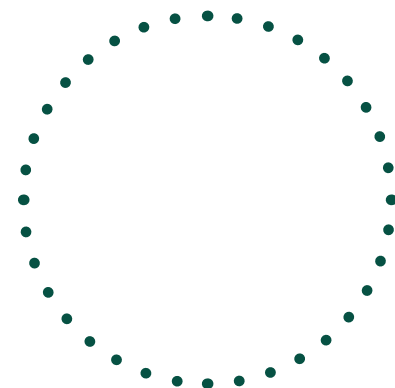


Figure 49: Vision for South Holland by 2070



5. STRATEGY

Biesbosch
Conflicts map
Hoeksche-Waard Municipality
Introduction and current land cover
Strategy interventions & future land cover
Perspective section
Timeline & actors
Molenlanden Municipality
Introduction and current land cover
Strategy interventions & future land cover
Perspective section
Timeline & actors
Strategy full timeline, goals, synergies



BIESBOSCH

Introduction

National Park De Biesbosch is one of over 20 national parks in the Netherlands and is the biggest freshwater tidal area in Europe (Nationaal Park De Biesbosch, n.d.). The area covers 9.000 hectares in total and is home to countless plant and animal species (Beleef De Biesbosch, n.d.). It is therefore of great importance to protect this natural area. In figure 50, we see that the area neighbouring the Biesbosch contains high concentrations - namely 292 to 1.174 kg/ha annually - of nitrogen depositions. To put this into perspective, we can compare it with the guidelines of the European Union that stipulates the maximum amount of nitrogen in an area as 170 kg/ha per year (Official Journal of the European Union, 2022). The nitrogen levels in De Biesbosch therefore by far surpass this maximum value.

As most nitrogen depositions, those that reach De Biesbosch are emitted by the neighbouring farmland. This farmland is the focus area of our strategy. For the region surrounding Biesbosch, we propose several strategical interventions to protect this natural area in the future.



emissions that deposit on Biesbosch
kg / ha annually

- 5 - 20
- 20 - 50
- 50 - 100
- 100 - 300
- > 300
- Biesbosch



Figure 50: Nitrogen impact on the Biesboch, data from (RIVM, 2022)

BIESBOSCH

Introduction to the area around Biesbosch

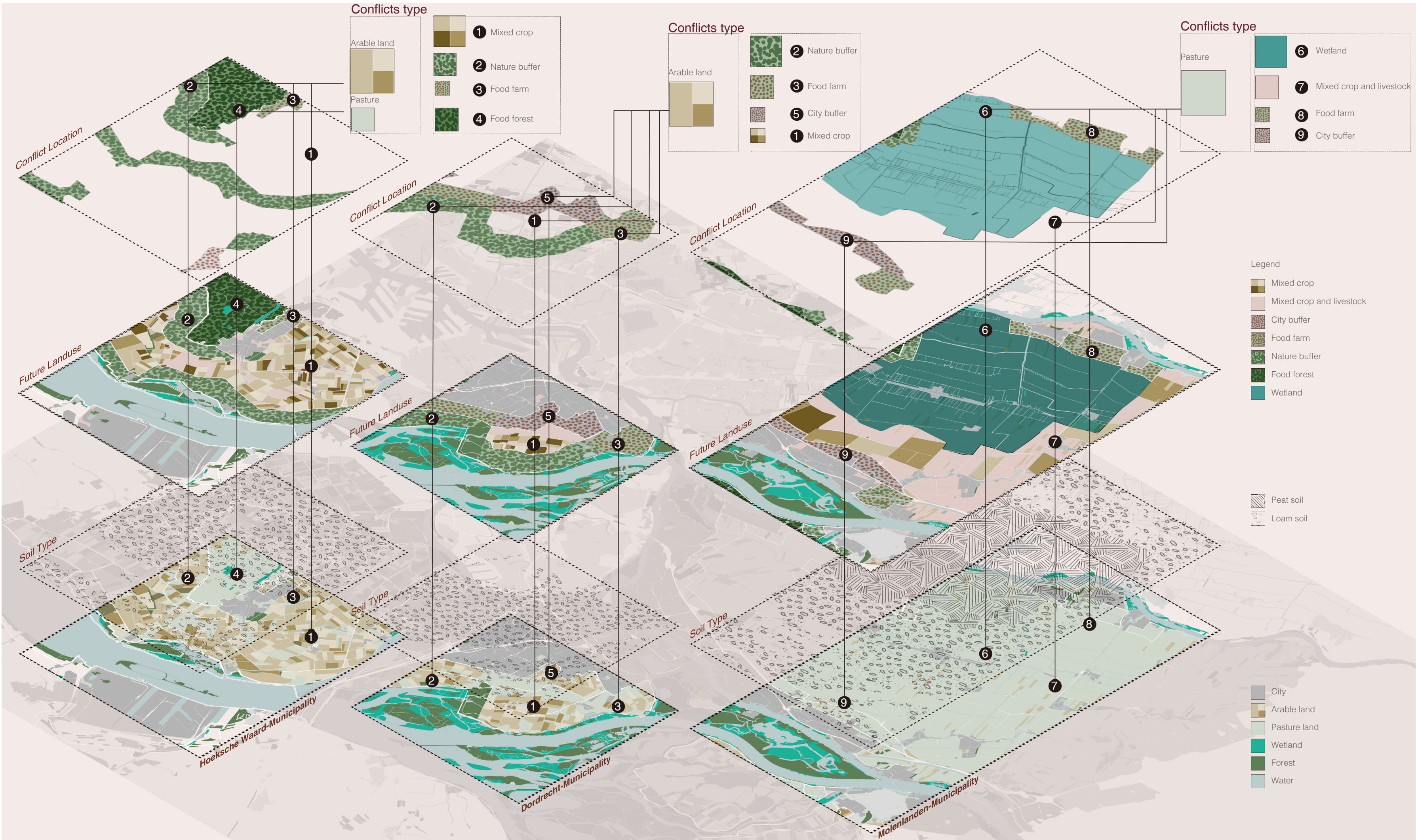


In the area surrounding Biesbosch National Park, we encounter a variety of typologies. Several small villages and towns but also cities, like Dordrecht, and different agricultural lands can be found. Most agricultural land in this area is a polder landscape and therefore partly classified as wetland. In our vision, wetlands are referred to as natural areas.

Because of the diversity of land uses in this area it can be used as an exemplary area for our vision. Contextualising our vision, all land cover transitions discussed in our vision (see Chapter 4. Vision) are covered in this specific area. For our strategy, two main focus areas/ municipalities are chosen: Molenlanden and Hoeksche Waard. The municipality of Molenlanden is situated to the North of Biesbosch, Hoeksche Waard to the West.



Figure 51: Adapted from Google Earth



To better understand the area and possible conflicts on it, we divided the map of the Biesbosch and surrounding areas in different layers. From bottom-up, the first layer describes the current land use. Here, we can highlight the high amount of arable lands and pastures. On the second layer we observe two main soil types (peat and loam): we will give special attention to the peat land as it requires special treatment due to peat oxidation (see chapter 3. Analysis). The third layer includes our proposed land covers which were chosen based on the methodology table presented in the chapter 4. Vision. Finally, the fourth layer presents the conflicts that appear when we put forward out land cover transitions. An example of such a conflict is when current pasture land occurs inside of a future natural area. In this case we propose that no livestock should be held inside of this area which, consequently, results in a conflict with the livestock farmer.

Figure 52: Conflicts map

HOEKSCHE WAARD-MUNICIPALITY

Introduction



Figure 54: Adapted from Google Earth

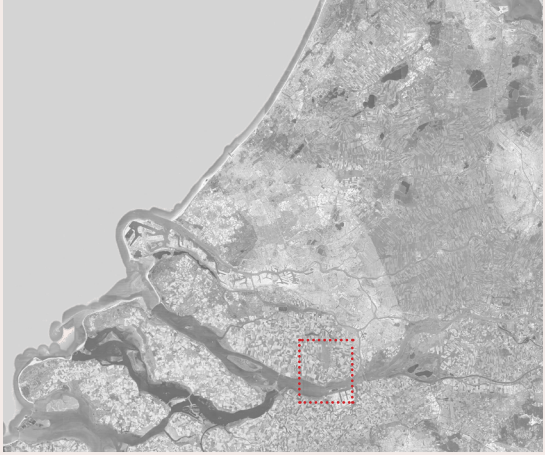
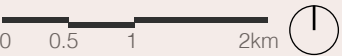


Figure 53: Hoeksche Waard location

Gemeente: Hoeksche Waard
Province: South Holland
Surface area: 323,7 km² (Wikipedia, 2023)
Agricultural area: 184,50 km² (CBS, 2022)
Farms: 336 (CBS, 2022)
Residents: 88.715 (CBS, 2022)
Cattle: 4.508 (CBS, 2022)
Soil Type: Loam



In 2019, the Hoeksche Waard municipality started the plan of FoodLab Hoeksche Waard. This project proposes the idea of being an open laboratory that explores the food production in the region. The Foodlab includes a Roadmap for current and future agri-food initiatives, a shop for local products and even a logo to help the customer identify a local product. The goal is to strengthen the relation between the consumer and producer, and improve local knowledge, education and nature experience.

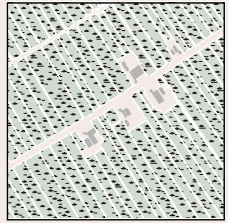
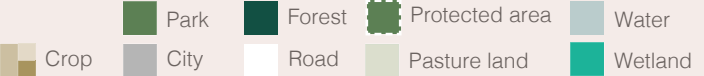
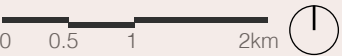


HOEKSCHE WAARD-MUNICIPALITY

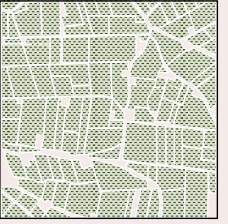
Current land cover



Figure 55: Adapted from Corine Land Cover, 2018



Pasture



crop

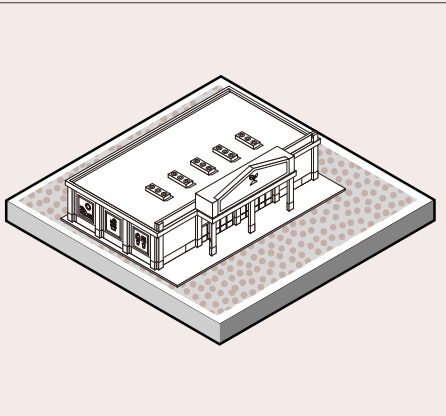
For this area we zoom in on the municipality of Hoeksche Waard. More specific on the Strijen neighbourhood and the Natura 2000 polder area. Within this area, the port of Moerdijk can also partly be seen. Within this port, big companies like Shell and Essel are present. However, for this project the impacts of these companies are not being explored further.

The current land use is formed by two main types. The pastures in the region are occurring predominantly inside of the polder region, with some fields spread in the rest of the region. The livestock creation is mainly focused on sheep and dairy cows. The rest of the area is mostly occupied by arable land being mainly occupied by potato production.

HOEKSCHÉ WAARD-MUNICIPALITY

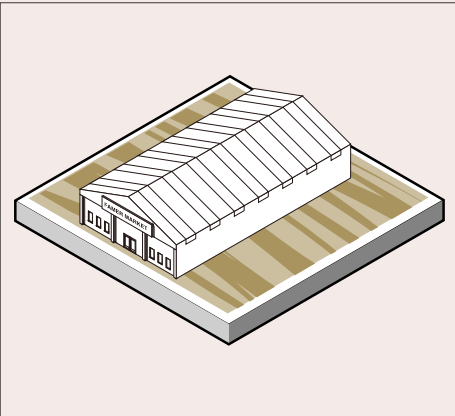
Strategy interventions

Community Center



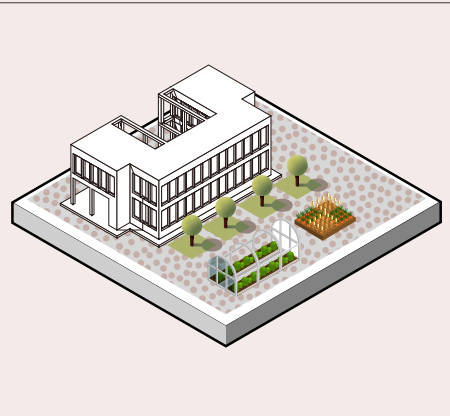
The idea of having a community centre is to improve the social bonds among the residents. It can pose as a place that is used to celebrate local festivities, spreading important information, and offering health-related services. For a region where agriculture is the dominant land use, the community centre might also promote the sharing of information and goods through hosting lectures and events

Farmer Market



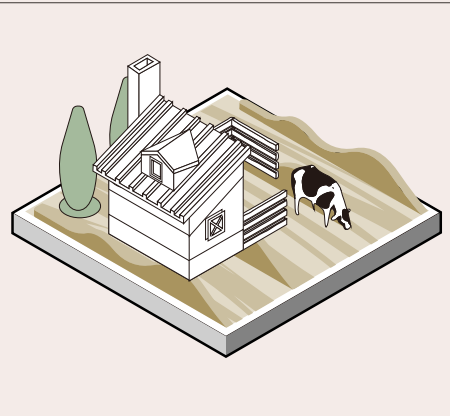
Following the proposed FoodLab Hoeksche Waard plan, we suggest the development of farmer markets in order to facilitate access to local products. With several sales points across the region the producer might increase its sales. This also helps the consumer to easily localise what is produced within the region.

Education Center



With an educational centre it is possible to spread knowledge of regenerative agriculture and sustainable farming practices specifically for the region. The idea behind this is to give the community the skills to continue with the agriculture heritage forming specialised workers. It can also create a network with other educational facilities which further spreads the knowledge that is obtained.

Adventure Farm



The FoodLab project also mentioned adventure farms. The implementation of such adventure farms can attract more tourists and locals to enjoy the farmland environment. The idea is to make crop and farmland physically accessible to the visitors to interact with the producer and products. This will create a deeper connection and understanding of the food chain.

HOEKSCHÉ WAARD-MUNICIPALITY

Future landcover



Figure 56: Based on current land cover by Corine Land Cover



Mixed crop

Instead of having a big concentration of the same crop type and livestock in an area, we plan to have mixed crops. This will happen not only inside of the same plot, using crop rotation, for example. But also, among different plots, improving the whole biodiversity of the area.



Food forest

At the same time, food forests are introduced at the junction of farmland and forests in protected areas. In this way, the natural buffer zone can also undertake part of the food production function. The food forest follows our plan of improving biodiversity and the connection of people to their environment. Those spaces can be accessed by the inhabitants not only as producing places but also as leisure areas.

HOEKSCHE WAARD-MUNICIPALITY

New landcover and intervention in perspective section

- Regenerative landcover
- Regenerative agriculture intervention
- Decentralisation intervention
- Social justice intervention
- Future events/activities contributing to social justice

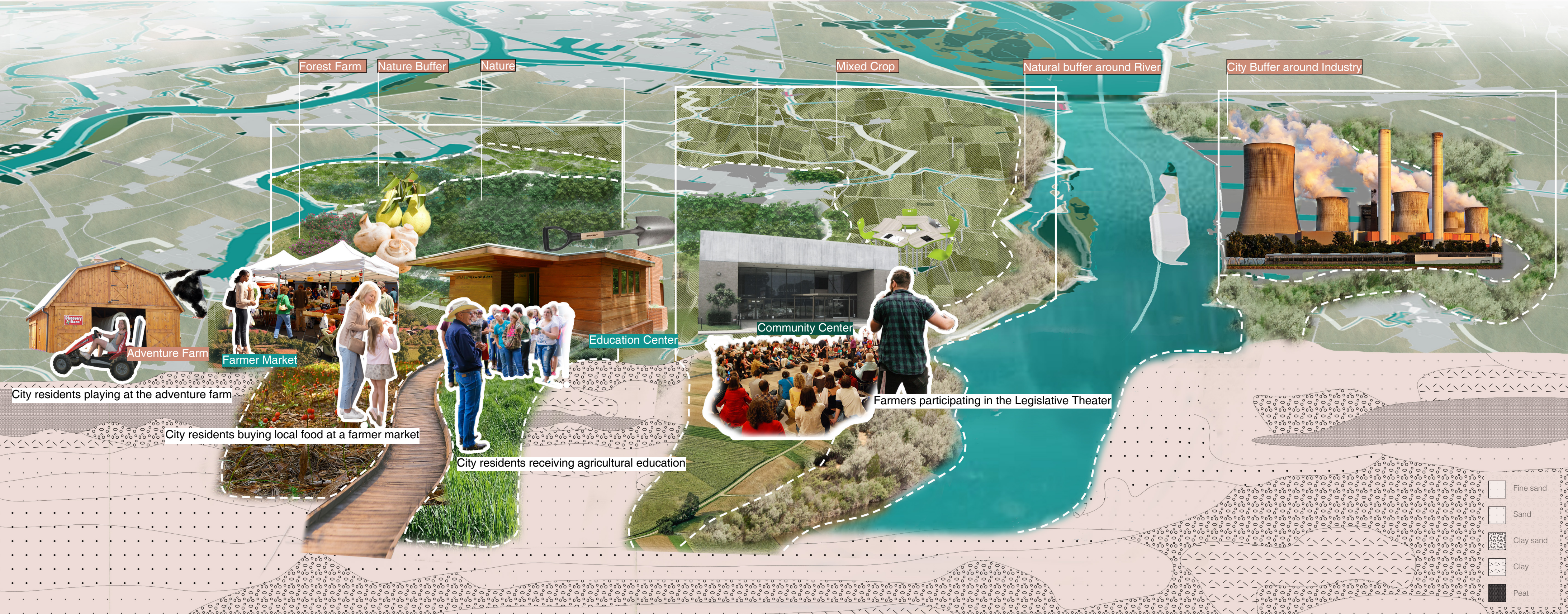


Figure 57: Collage of Hoeksche Waard

HOEKSCHÉ WAARD-MUNICIPALITY

Timeline and actors

The strategy of Hoeksche Waard starts with the removal of livestock from natural areas and buffers. This must be supported by subsidies and policies and also requires community involvement, fostering a community based governance. These two milestones need to be achieved before 2030. The second landscape transition will happen when those areas previously used as pastures can start receiving mixed crop farms. With governance strategies and creation PPPs we intend to re-

educate the farmers to be nature stewards. This strategy is supported by the creation of a knowledge centre that before 2050 will increase the local knowledge and facilitate the sharing of it. With the development of the nature buffers these areas can be used for the implementation of food forest areas. By 2060 the milestone is guaranteeing a place where citizens can at the same time contribute and experience those areas.

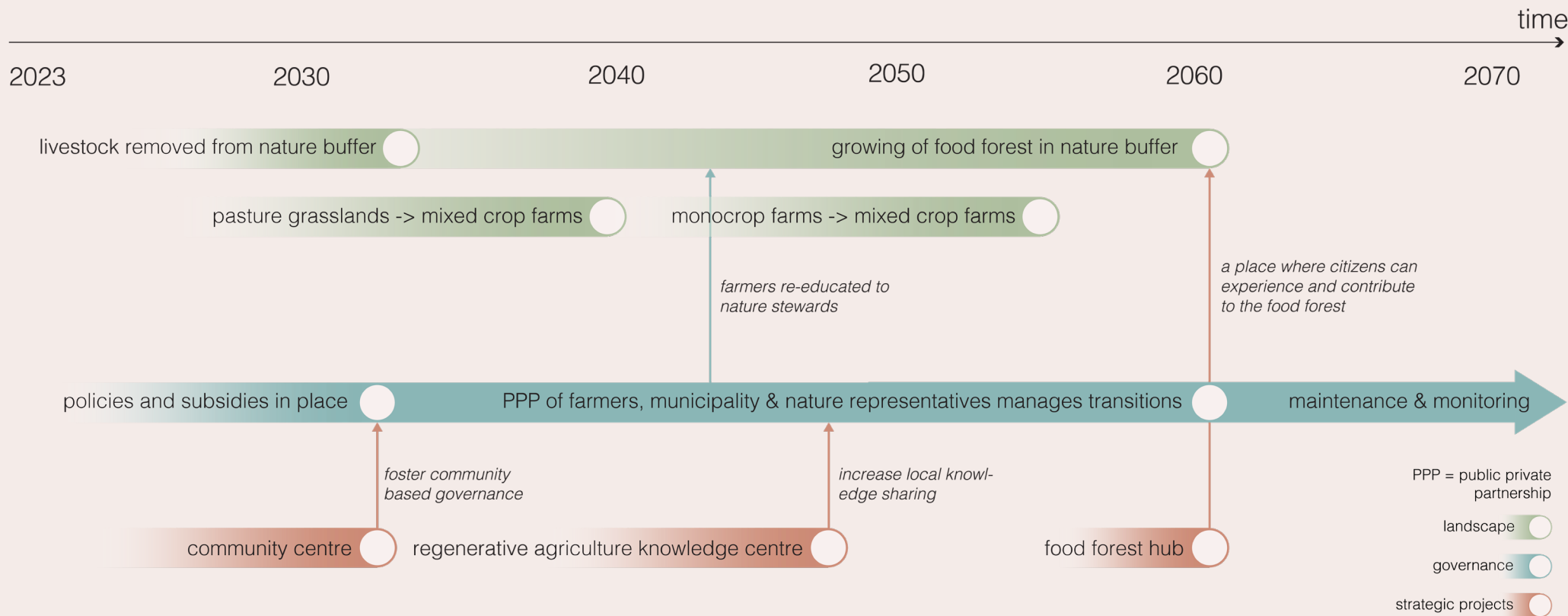


Figure 58: Hoeksche Waard:strategic timeline

"No more farming at the expense of nature and at the expense of biodiversity, so no more fertiliser and no more pesticides. Agriculture here is perhaps the most innovative, but the least sustainable. The Hoeksche Waard - with all its potential - needs a sustainable boost"

Figure 59: Said professor on transitions Jan Rotmans during a talk on local sustainability in Municipality Hoeksche Waard on 24th of January 2023. "Things are not at a standstill here". Reference was made to the recent visit of Minister Van der Wal, who spoke with great appreciation of the innovative agriculture in the Hoeksche Waard (Hoeksche Waard Duurzaam, 2023). Image: Jan Rotmans (s.d.).

"In our new shop, our current range has been considerably expanded. Besides dairy and ice cream, visitors can buy jams, honey, mustard, cheese, chocolate, juices, quinoa and sweet potatoes, all from the Hoeksche Waard region. [...] It is valuable to see up close where our food comes from and that we reduce the distance between farmer and consumer."

Figure 60: Quote by farmer's shop owner Petra Commijs and civil servant Paul Boogaard. Foodlab Hoeksche Waard is a collective name for initiatives led by the municipality that contribute to a better future for farmers. This involves focusing on healthy soils through research and development in the field of sustainable agriculture, short chains that reduce the distance between farmer and consumer, and education (Gemeente Hoeksche Waard, 2022; HoekscheNieuws, 2022). Image: C. Streefkerk in HoekscheNieuws (2022)



"About 500 kilometer of colourful field margins grace the field in Hoeksche Waard, one of our pilot regions in the Netherlands. During ten years these flourishing margins are a concept in the entire country and beyond. It isn't only a feast for the eye, but also good for the liveability of people and animals."

Figure 61: FABulous Farmers is an EU-INTERREG pilot in which 12 parties from 5 EU countries are working together to come up with measures that contribute to a more sustainable agriculture in the EU. The Hoeksche Waard is one of the 12 pilot areas within the FABulous Farmers project. The use of field edges is one of the 10 FAB measures being studied within the project. In it, the ecological and economic values of field edges will be assessed over the next four years. The Hoeksche Waard is one of the regions within the EU with the highest density of field margins within the EU. This makes Hoeksche Waard extremely suitable for this study. Within this research, various farmers, Collectief Hoeksche Waard, HWL, RIVM and Universiteit of Amsterdam are working together intensively (info & image from CCHW, 2019).

MOLENLANDEN-MUNICIPALITY

Introduction



Figure 63: Satellite map of Molenlanden

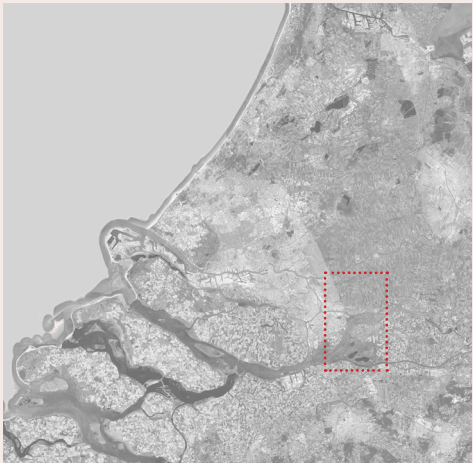
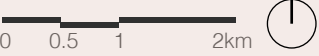


Figure 62: Molenlanden location

Gemeente: Molenlanden
Province: South-Holland
Surface area: 191,58 km² (Wikipedia, 2023)
Agricultural area: 143,60 km² (CBS, 2020)
Number of farms: 377 (CBS, 2020)
Residents: 45.143 (CBS, 2022)
Cattle: 38.910 (CBS, 2020)
Soil type: Peat

MOLENLANDEN-MUNICIPALITY

Current landcover

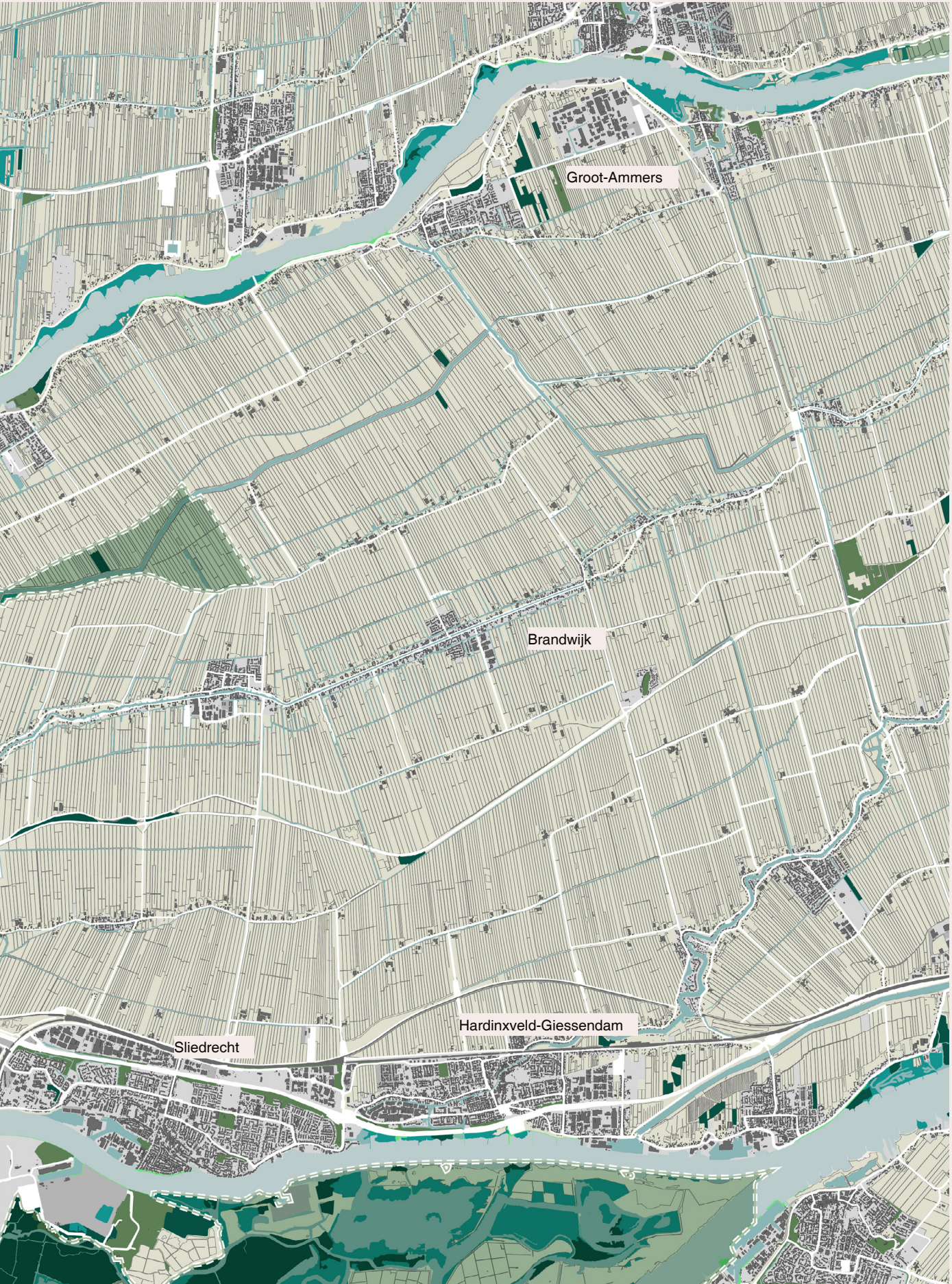
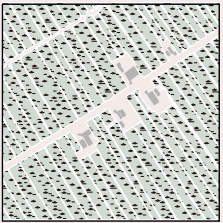
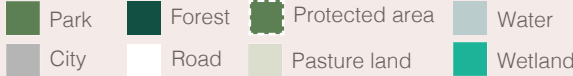
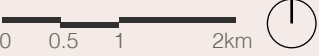


Figure 64: Current landcover of Molenlanden



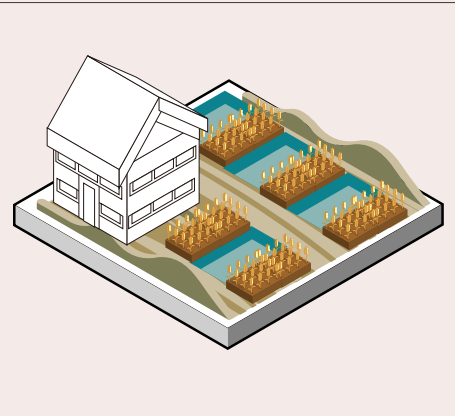
Pasture

For the strategy, an area inside of the municipality has been chosen. The specific area and its borders can be seen in figure 62. Currently, most of the soil inside this area is used for agriculture, and more specifically for pasture. The land is surrounded by water, where in the north the river Lek is located and in the south the river Beneden Merwede. Throughout the area a polder landscape can be observed, where the borders of the water bodies function as wetlands. East of the village of Brandwijk, there is a protected area in which a small forest and part of a river are situated. Towards the south of the research area, the two villages Sliedrecht and Hardinxveld-Giessendam are located. Even more to the south, a park and forest can be found.

MOLENLANDEN-MUNICIPALITY

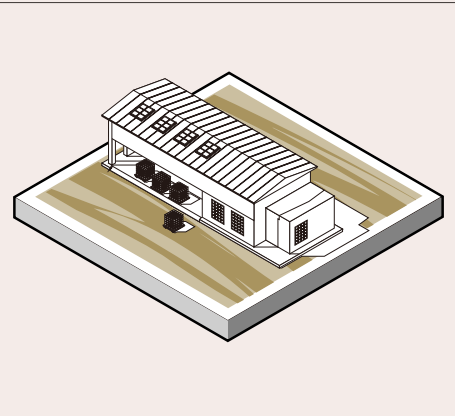
Strategy interventions

Fishing Farm



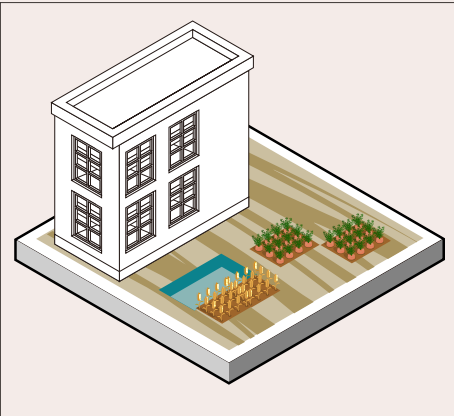
Fishing farms are a way of producing fish by constantly measuring and controlling the fish using intelligent technology (Wang et al., 2021). By using this method, we create an opportunity to cultivate fish and seafood without causing disturbances to the surrounding environment or affecting the ecosystem balance. Besides, it can attract tourists and visitors who are interested in fishing activities or recreational activities that involve water-based activities.

Farmer Cooperatives



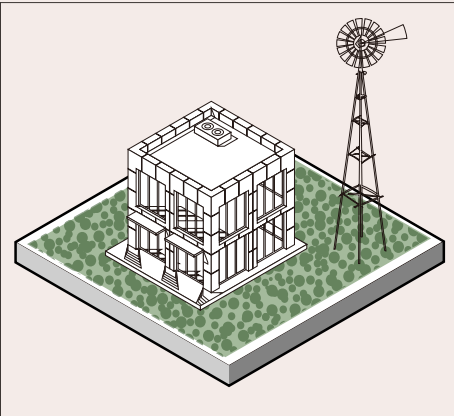
Farmer cooperatives are introduced in the municipality of Molenlanden as they pose an opportunity for farmers and other stakeholders to come together and facilitate a dialogue between them. By promoting such conversations, we ensure that the transition of pasture to wetlands and aquaculture will support the economic interests of farmers and, therefore, maintain their support for the transition towards a sustainable food system.

Knowledge Sharing Center



In our strategy for the region, the current land cover and use will transition. For this to succeed, knowledge about the new land uses needs to be shared. In the Knowledge Sharing Center, farmers and agricultural experts will come together and share knowledge. The mutual sharing of knowledge between farmers and experts promotes collaboration and cooperation, and deepens and broadens the skills of the different groups.

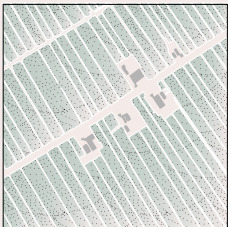
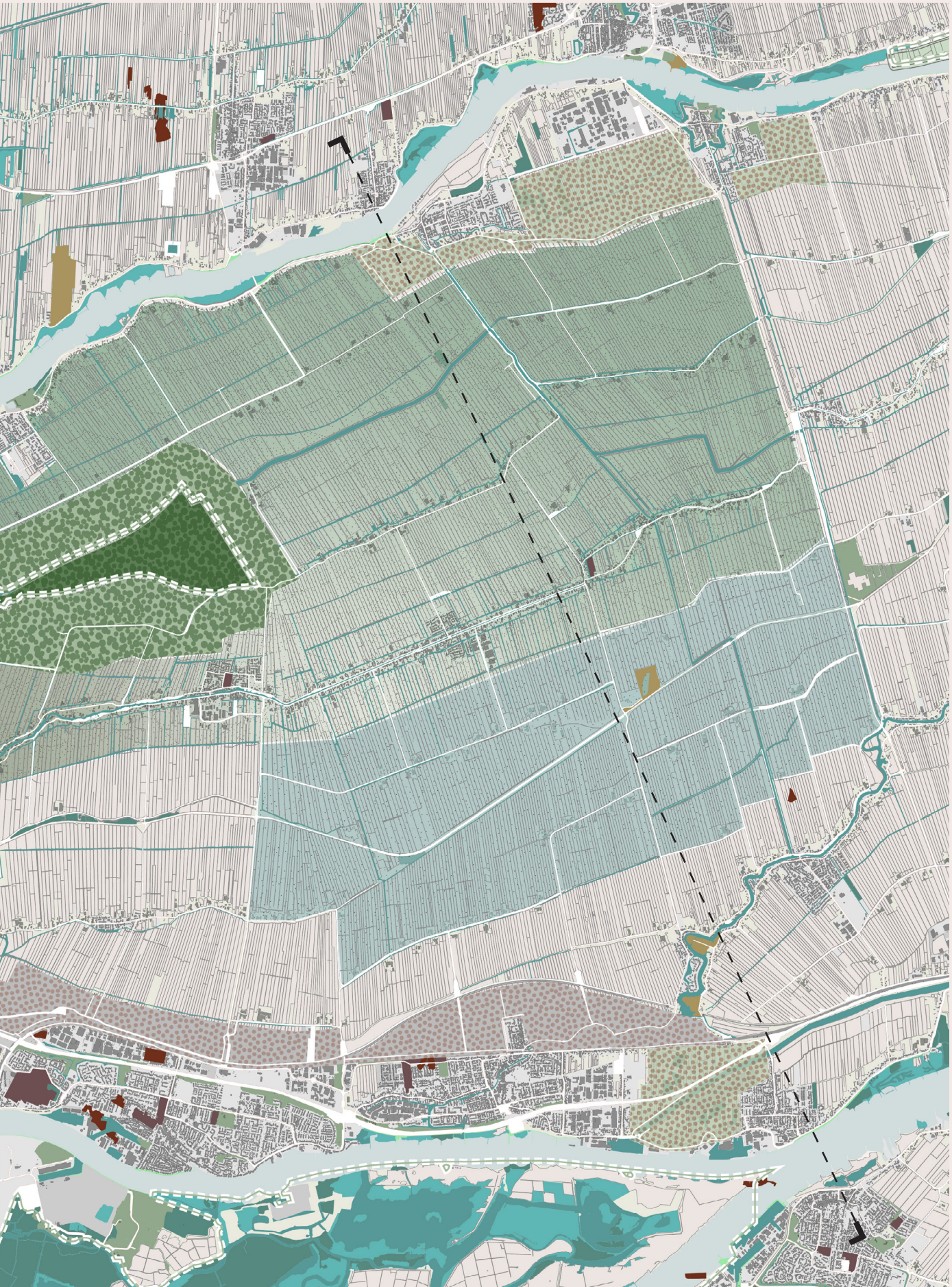
Wetland Management site



As the last strategy intervention for Molenlanden municipality, we plan to introduce a Wetland Management Site. This Site will help prevent water pollution, provides flood control, protects and conserves wetland biodiversity, preserves and enhances carbon sequestration in the soil, and provides opportunities for education and recreation.

MOLENLANDEN-MUNICIPALITY

Future land cover



Aquaculture



Wetland

The future land cover of the chosen research area within the municipality of Molenlanden will mostly consist of new wetlands and aquaculture. Where the current land cover consists of pasture, in 2070 there will be aquaculture and wetlands. The replacement of current pasture landscapes with natural areas and wetlands, such as aquaculture, is in line with the goals of the Dutch government to conserve, restore and protect natural landscapes.

Around the protected area that is currently located within the municipality, a nature buffer will be placed. To the east of the village Hardinxveld-Giessendam as well as in the southern city buffer of Groot-Ammer, a food forest is introduced. Furthermore, a city buffer is established around the edges of the Slidrecht and Hardinxveld-Giessendam. In the other areas, a combination of mixed crops and livestock is introduced.

Figure 65: Future landcover of Molenlanden



MOLENLANDEN-MUNICIPALITY

New landcover, intervention and events

- Regenerative landcover
- Regenerative agriculture intervention
- Decentralisation intervention
- Social justice intervention
- Future events/activities contributing to social justice



MOLENLANDEN-MUNICIPALITY

Timeline and actors

Our timeline goals for Molenlanden start with governance actions. We believe that it is important to establish policies and subsidies foreseeing the interventions. For the first strategic project we plan the creation of community centres and pathways in the wetland region, bringing the residents and tourists to explore these areas. The first milestone we intend to achieve is to foster community based governance by 2030. In the meantime, all the pasture grassland that is present on wetlands is going to be removed. Together with PPPs we plan to achieve

this landscape transition and re-educate the farmers to become nature stewards by 2040. Before 2050 the second strategic project is the creation of a knowledge centre. It has the intention of increasing the local knowledge on regenerative agriculture and also spreading this to other regions. The wetlands will continue to develop and by 2060 they can support the creation of aquaculture farms. For that the knowledge centre plays a role in educating the farmers for this new agriculture type.

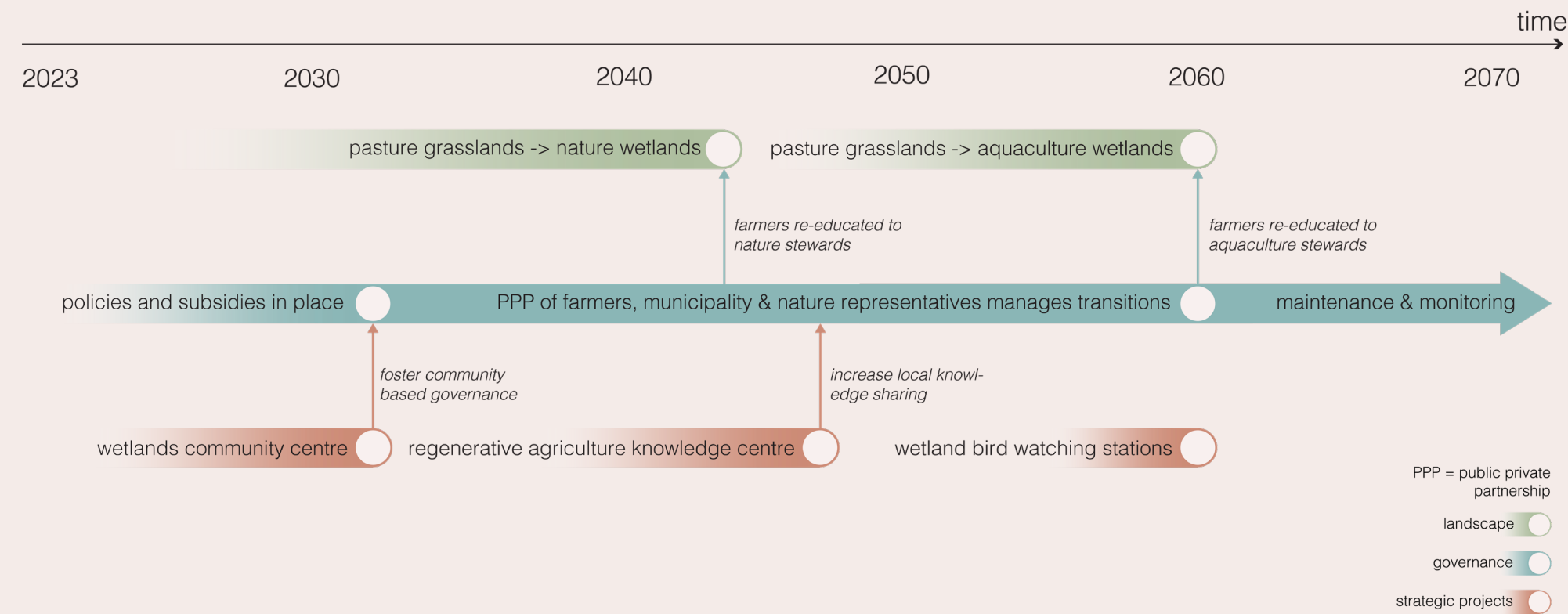


Figure 67: Molenlanden:strategic timeline

Farmer Jasper Meerkerk showcases an underground water infiltration system that aims to provide sufficient wet spots in the meadows in spring so that birds have better nesting opportunities in the Natura2000 area.

Figure 68: The Donkse Laagten pilot is part larger project All4Biodiversity. In Alblasserwaard, the project is implemented by the province, Staatsbosbeheer, agricultural collective Alblasserwaard-Vijfheerenlanden, the Green Circle Cheese and Soil Subsidence (led by De Graafstroom) and Rivierenland water board. (Het Kontakt, 2023); image: S. Tellier in Het Kontakt (2023)

"We all chose maximum production in agriculture after the war. Now people act as if this was an idea of farmers alone. Meanwhile, land prices have risen and farmers' debts have increased. As a result, farmers often have little room to change. It is frustrating for farmers that their efforts are undervalued. Recognition is needed. And direction over their own future."

Figure 69: Mattias Verhoef (Brandwijk), Peter Heikoop (Nieuwland) and Kees Baan (Molenaarsgraaf) are taking part in a pilot with pressure drainage. It is one of the examples in Alblasserwaard where a transition to sustainable agriculture is being worked on in close cooperation with farmers. (Het Kontakt, 2021); image: P. P. Klapwijk in Het Kontakt (2021)

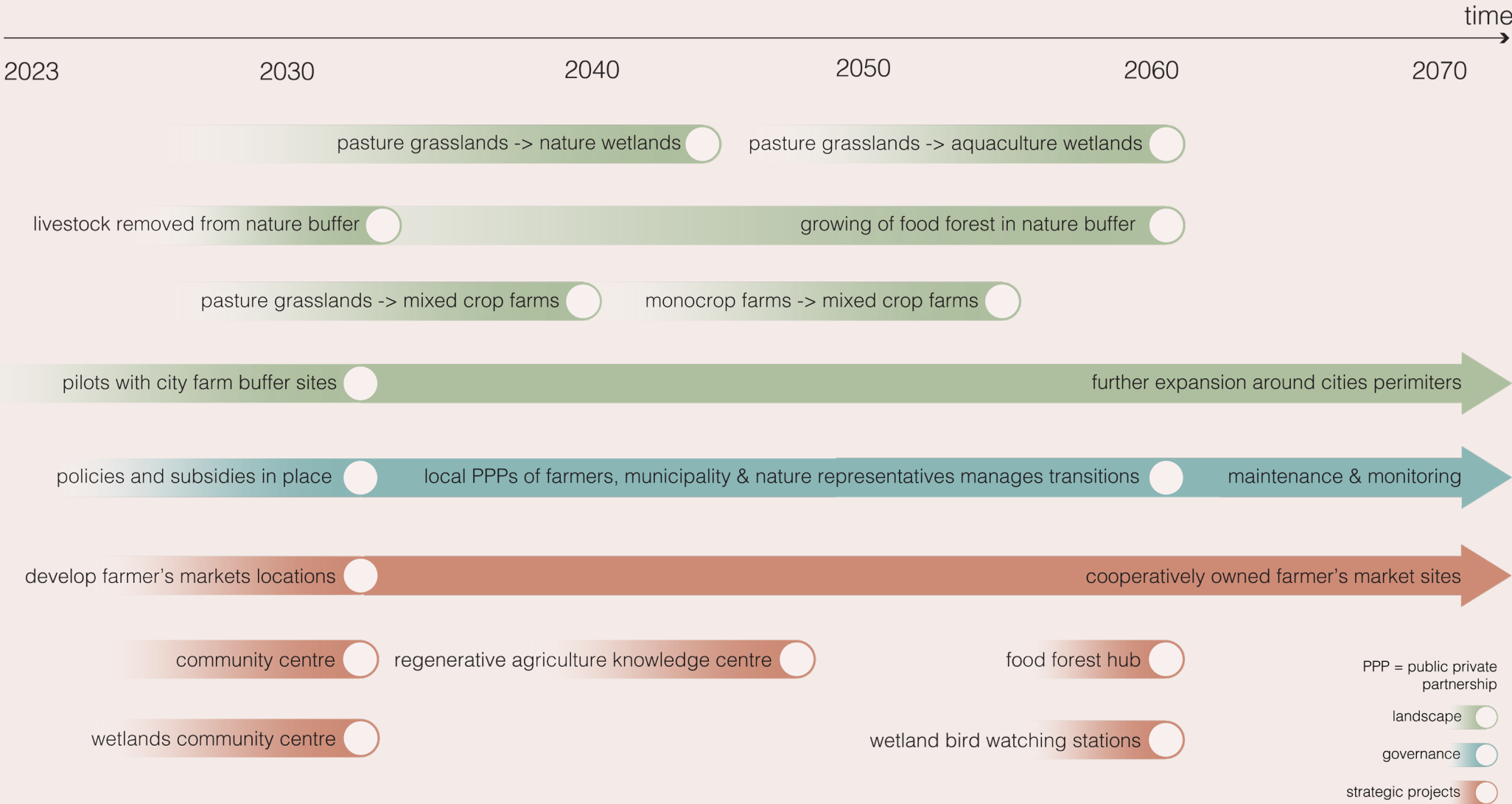


"Extensification of agriculture is needed in 250-metre-wide buffer zones around Natura 2000 areas to reduce nitrogen deposition there. This involves some 160,000 hectares. Extensification means fewer livestock per area of land and arable farming with less environmental impact through, for example, less use of manure and by raising groundwater levels."

Figure 70: Dr. Baayen of WUR is concluding from his study that the above strategy is also economically viable for farmers if the government properly directs its budget for agricultural innovation from the EU, the Common Agricultural Policy. (Baayen et al., 2021); image: Royal FloraHolland (2023)

BIESBOSCH

Timeline and actors



Placing the two individual strategy timelines together it is possible to notice that the governance layer is very important. Creating policies, subsidies and PPPs will help the transition happen easier and with less conflicts. For the landscape part, it is important to place the projects in pilot spaces to further expansion, however it is also important to start those projects fast, already implementing them by 2030. Finally, for the strategic

projects the development of farmers markets and community centres will improve the connection between producer and consumers. This will also increase the connection between the community, changing the way agriculture is perceived, guaranteeing the maintenance of sustainable practices and cultural heritage.

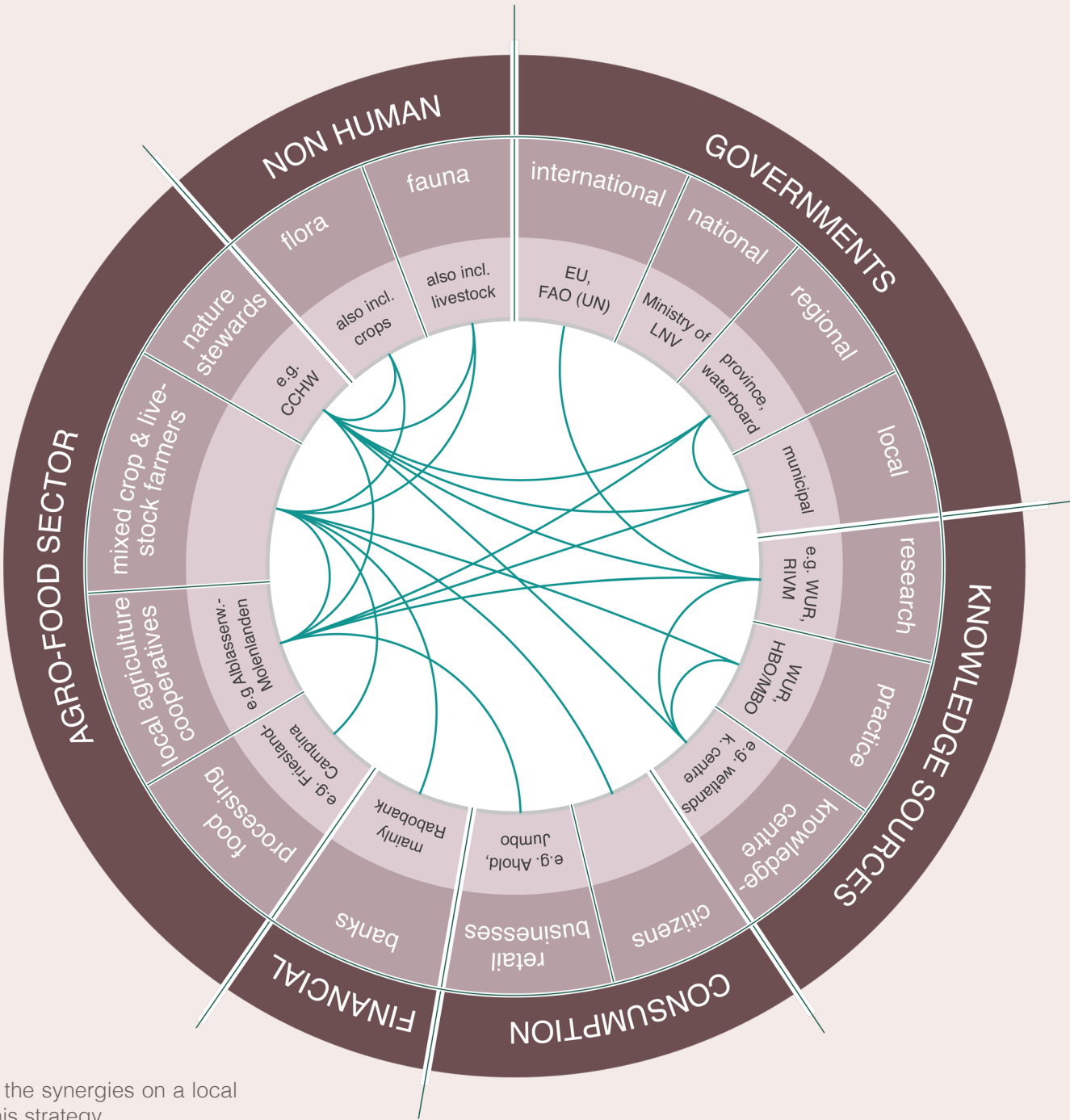
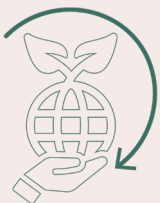


Figure 71: This actor diagram shows the synergies on a local scale, projected to be achieved by this strategy.

Minimise impact on nature



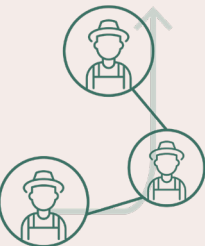
Nature wetlands
Aquaculture wetlands
No-livestock buffers
Mixed crops
City farm buffers

Local agri-food network



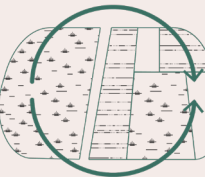
Farmer's markets
Food forest
Forest hubs
Community centres

Bottom-up organisation

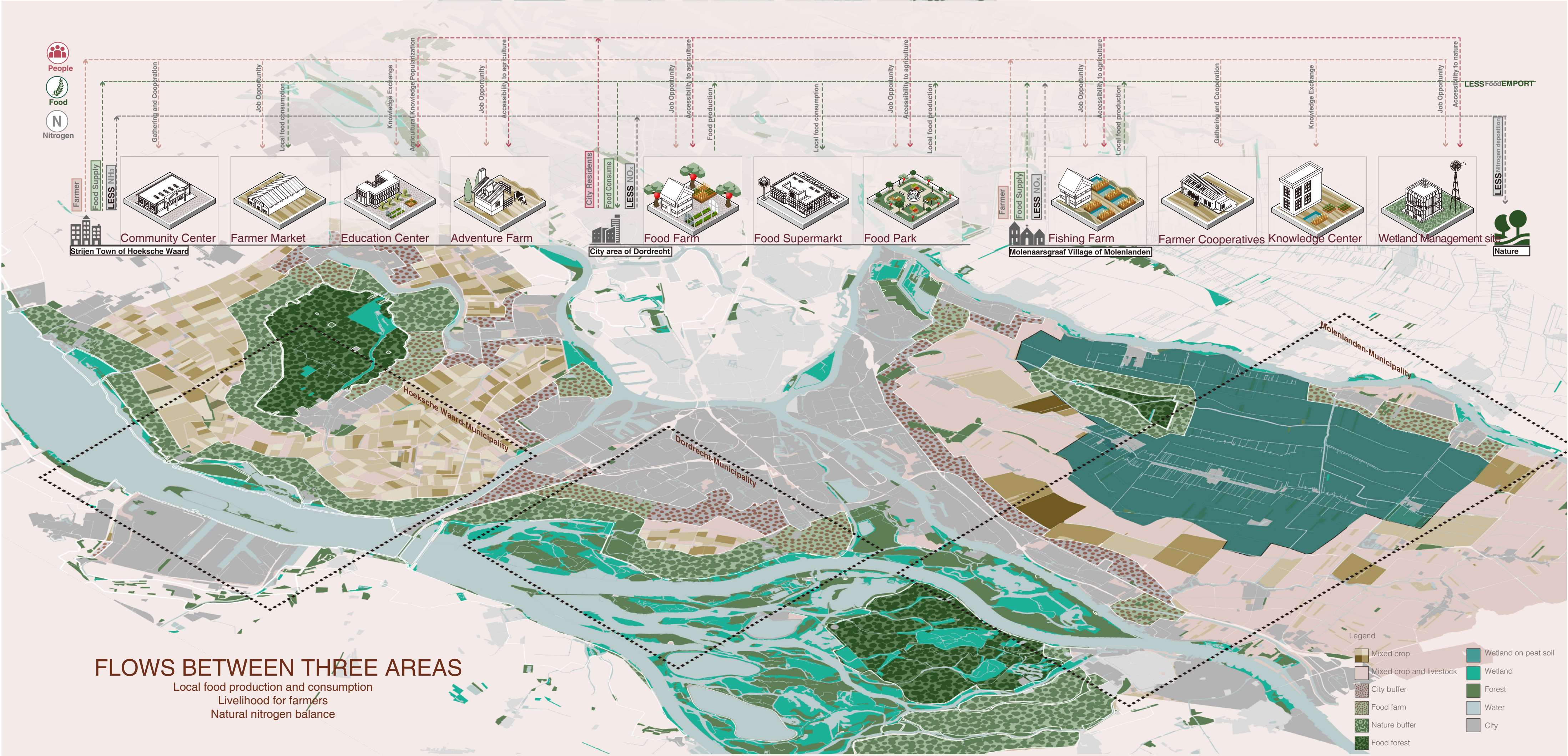


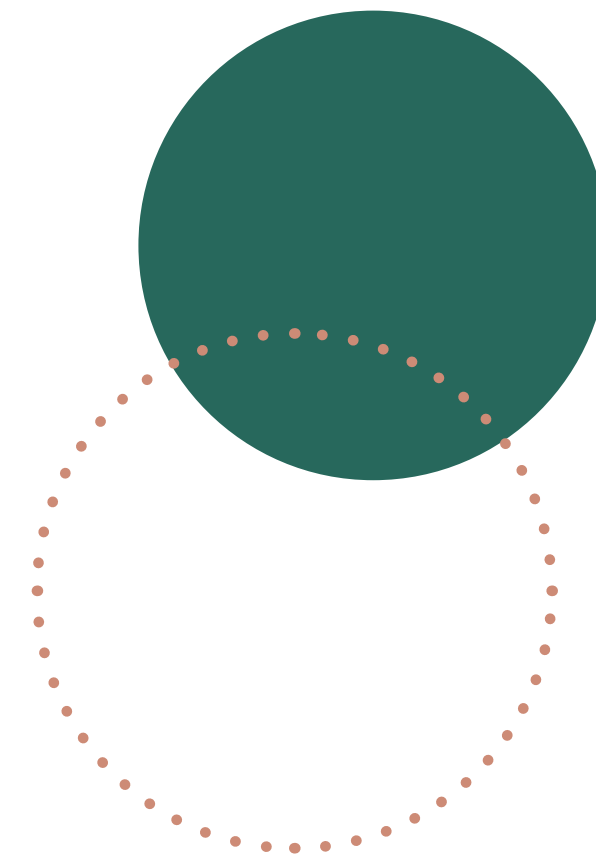
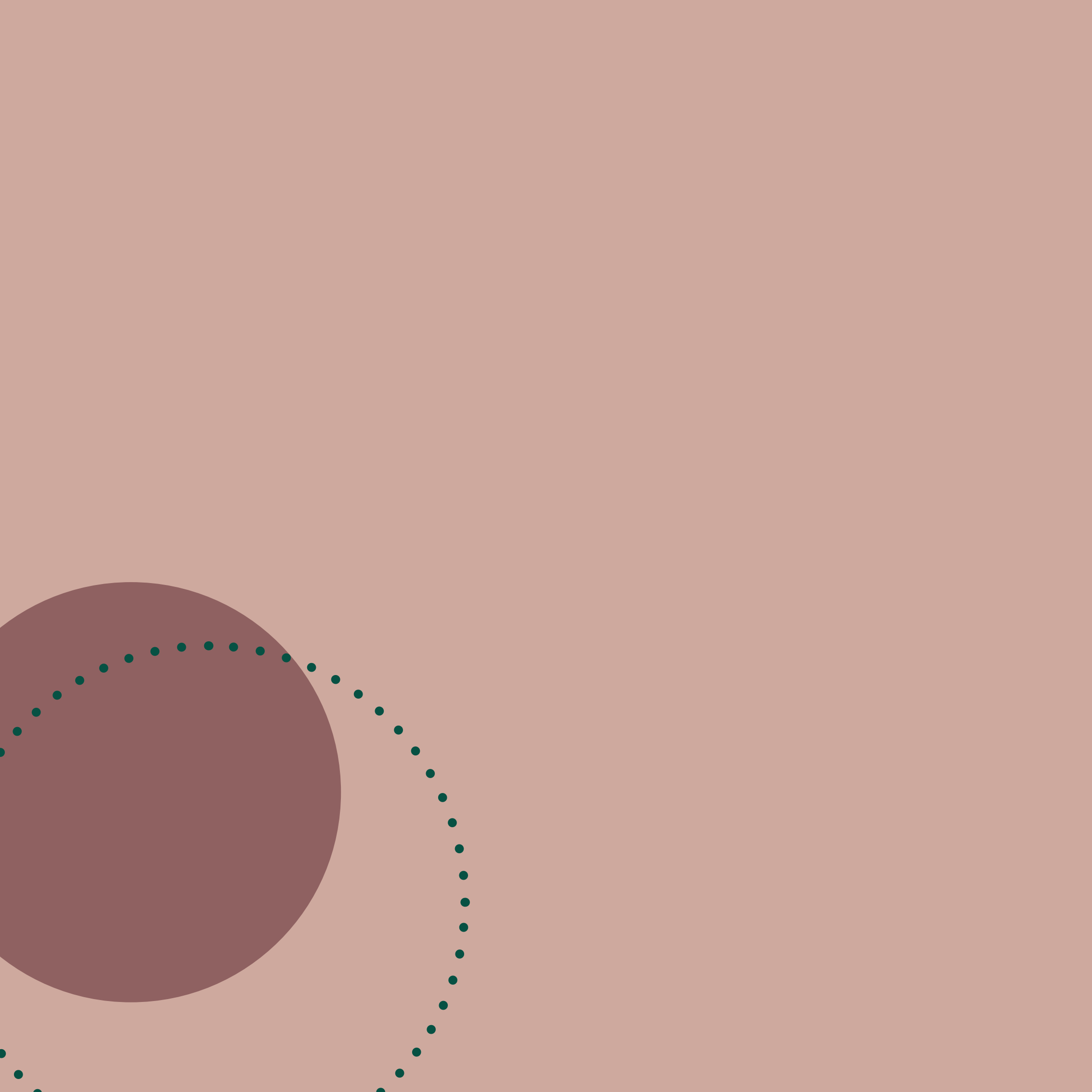
PPP of farmers, municipalities and nature representatives
Community centres

Transition of agriculture



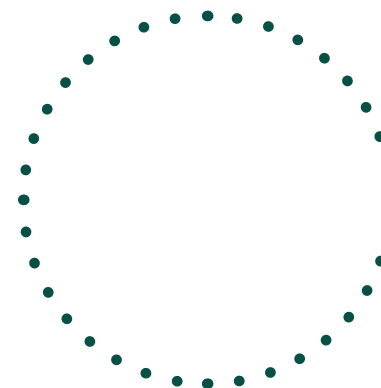
Natural wetlands
Aquaculture wetlands
Mixed crops
No-livestock zones
Buffer zones
Food forest





6. CONCLUSION

Conclusion
Discussion
Personal reflections



CONCLUSION

A transition is needed within the agricultural sector as it is currently one of the main causes of pressure on natural resources, biodiversity levels and the environment (Kay et al., 2019; van Zanten et al., 2018; van Halm, 2022; Bol et al., 2018). To counteract the environmental degradation that is caused by intensive agricultural practices, governments in all levels have introduced several policies over the years. However, it becomes clear that such measures have not succeeded yet. This can, for example, be seen when looking more closely at nitrogen emissions. Such an imbalance in the natural nitrogen cycle is a result of intensive farming which is characterised by intensive livestock and excessive use of fertilisers and pesticides. It becomes clear that this is a problem as livestock represented approximately 40% of the agricultural sector in Europe in 2017 (GreenPeace, 2019).

Besides the unsustainable agricultural practices, the current linear food system can be seen as inefficient. A bottleneck of power can be observed in the Dutch food production chain. Evidently, other parties besides farmers, such as retailers and food manufacturers, also have great influence on the way food is produced and thus on the adverse effects on the environment. These parties have posed a trap of the globalised high input – high output model which offers an increasingly narrow financial-economic perspective for fewer and fewer farmers (Sijmons, 2022). This lock-in situation is not only present for farmers but also in the political arena. The Netherlands finds itself in a socio-technical lock-in situation, where there is a need for a vision guiding the development towards a sustainable alternative for the currently overgrown, oversized bio industry that is quite literally squeezing out the land.

The research question that this research tried to answer is as follows:

How can decentralisation of agriculture aid in a socially just transition towards regenerative farming practices in North West Europe?

To answer this question, we followed a research by design process. This process entails a proposed vision for North West Europe and subsequently a strategy for the Biesbosch area, which is located in South-Holland.

In our vision, we create a framework for transitioning the current land use into one that would mitigate the negative effects of excessive nitrogen levels and ensure that they are on their way down to a natural nitrogen balance. We start off with the scale of North West Europe where we focus on a transition towards

regenerative agriculture and shorter food supply chains. In our vision, we include spatially related principles of mixed crop and diverse crop farming along with mob grazing, agroforestry and nitrogen fixing legume crops as main elements.

A spatial arrangement of buffers and zones suitable for certain future farm uses is proposed based on a guidebook that helps us to determine future spatial arrangements. Here, it should be noted that the guidebook should always be open to additional land-uses and interpretations in order to respect the local context with its ecosystem, community and economy. Using decentralisation as a transition strategy along with international cooperation can facilitate the creation of a decentralised food network with shorter supply chains.

To further concretise how our vision should be implemented on a smaller scale, the region surrounding National Park De Biesbosch was chosen as it is one of the scarce national areas in the Netherlands where also nitrogen concentrations far surpass the maximum value that is set by the European Union (Official Journal of the European Union, 2022). Because of the diverse land uses in the Biesbosch area, it can be seen as an exemplary area for our vision. To be more specific, all land type transformations that are discussed in our vision (see Chapter Vision) are covered in this specific area. For our strategy, two main focus areas or municipalities were chosen: Molenlanden and Hoeksche Waard.

In Molenlanden municipality four strategy interventions are proposed: a fishing farm, farmer cooperatives, knowledge sharing centre, and wetland management site. The future land cover of the chosen research area within the municipality of Molenlanden will mostly consist of new wetlands and aquaculture. In the municipality of Hoeksche Waard also four strategy interventions are proposed: a community centre, farmers market, educational centre, and adventure farm. Instead of having a big concentration of the same crop type and livestock in the area, we propose the cultivation of mixed crops and food forests. The strategy interventions in both zones will not be introduced simultaneously but will be spread out over a longer period of time. When overlaying the two individual strategy timelines, it becomes clear that the governance layer, and more specifically policies, subsidies and PPPs, plays a critical role in the realisation of our vision and strategy. For a more sustainable food system to be achieved, both our vision and strategy have shown that regenerative agricultural practices and the decentralisation of our food system can help us to create a more socially just environment where (long-term) food security is present for all.





DISCUSSION

During the proposal of our vision for North West Europe and strategy for the Biesbosch area, we have tried to take different perspectives into account. However, it is impossible to incorporate every stakeholder and their views and visions on the topic. During this project, this was especially challenging since we did not have the opportunity to meet and have conversations with farmers. Because of this, our vision and strategy are partly based on assumptions. It should be noted that we did research the public discourse and the societal and political divide, for example regarding the current nitrogen crisis in the Netherlands, but this research is only based on news articles. For the further and more in-depth development of our vision and strategy, it is therefore highly recommended that conversations with many different stakeholders are held. Adding onto the perspectives of farmers, our vision also includes food forests and, in relation to this, a different relationship between producers and consumers, and consumers and nature. It should also be looked into whether people are open to such a change.

Furthermore, the economic consequences of the interventions we introduce were not researched in-depth for this proposal. It is

realistic to assume that food prices will increase. Future research will need to determine how much prices for food can rise until consumers are not willing to pay for it anymore. Another economic aspect that should also be considered is what requirements should be put into place for subsidies that are provided by national and international governmental bodies. Currently, 80% of the agricultural subsidies of the European Union go to 20% of the farmers. Thus, there is a huge mismatch here. As social justice is a major aspect in our vision and strategy, more research should be conducted on how these subsidies can be spread out more evenly, including small-scale and family farmers.

Lastly, for the proposal of our vision and strategy, the role of the industry was not taken into account as it lies outside the scope of this research. That is why, for a more complete view on emissions, greenhouse gases as well as nitrogen, industries in North West Europe and the Netherlands should also be analysed. If we want to reduce these emissions even further, perhaps restrictions should also be placed on the industry sector.

PERSONAL REFLECTIONS

PAULA

"What is the role of a vision in the planning and design proposal of your group project and how has it influenced your development strategy?"

A vision is a crucial component of any project. It outlines the primary objectives and goals that need to be achieved to reach the desired future state. By providing direction and purpose for the planning and design process, a vision serves as a guide for decision-making and resource allocation. In our project we wanted to create a fair and sustainable food system that helps both the environment and the people. We imagined a future with decentralised agriculture, with regenerative practices that improve soil health, reduce nitrogen emissions, and enhance biodiversity. Our vision was first stated as a phrase. This holds our main goals and values towards the end, giving us a clear direction of where to go.

I believe that our strategy was strengthened by having a clearly defined vision. While creating the vision we made a methodology to understand our design values. This was crucial for the following steps, once made even more clear what the vision was aiming for. After defining the North-West European vision, we implemented the foundations of it in the South Holland region, to test and refine our approach. We then selected the Biesbosch area, which aligns with our values and presented the

most significant issues, to develop our strategy further. So, here, it was already possible to observe the complete connection between the vision, the planning, and the design proposal.

Then, the development of the strategy, centred around establishing a network of regenerative small-scale farms and food hubs to provide healthy, locally produced food to communities. And having a clear vision and strategy were essential for achieving successful outcomes on the project. The fact that we worked together to achieve the vision, helped us to have a shared understanding of what we were aiming to and provided us with direction. Our strategy ensured that our vision was translated into actions, allowing us to tackle problems more effectively. By analysing the context, we identified the opportunities and challenges of each area and decided on the best course of action to reach our goals. Our focus on regenerative agriculture practices and community engagement was motivated by our vision of a sustainable and equitable food system. For (future) urban planners, a strong vision and development strategy are crucial for achieving successful outcomes in any project.

HANNAH

"In which way is the governance aspect embedded in the planning and design proposal of your group project and what are the reasons for this embedding?"

We came to our vision by firstly recognising that the current food system has several challenges and limitations, which includes the concentration of power and resources in the hands of a few large corporations, but also that there is currently a clear societal divide. In our design process, we tried to find a balance between extreme but realistic interventions as we are aware that farmers might not be as supportive when such large changes in their lives are introduced. We have tried to propose a food system that is environmentally sustainable, socially equitable and economically viable.

The governance aspect is embedded in our planning and design proposal through our very distinct focus and incorporation of the social justice aspect. In our project, local stakeholders are given a prominent role in the decision-making and food production process through the decentralisation of power and the localisation of this very production system. Where small-scale and family farmers are currently often overlooked and have difficulty obtaining subsidies for their production. In our vision, through decentralisation, these farmers are enabled to participate more in the food system. Following our planning and design proposal, we believe that involving local communities and stakeholders, specifically farmers, in the process helps to promote inclusivity and at the same time ensures food security

for all. Our goal was to create a new food production system that involves participatory governance while also focussing on sustainable, regenerative agricultural practices. In our strategy, the participation of local stakeholders is aimed for through, for example, the implementation of knowledge sharing centres and community centres. These initiatives promote collective decision-making and promotes participation, hence governance.

Lastly, the governance aspect is also embedded in the guidebook that we propose in our vision to determine the future land uses. Where the guidebook serves as a powerful base to choose the future land use, we also consider the ecosystem, community and economy in the local context as important factors that should not be generalised over such a large scale as North West Europe.

In conclusion, the reasoning for embedding the governance aspect in our proposal is to ensure that the implementation of our vision and strategy is not only environmentally sustainable, but also socially. This can only be achieved by practising and facilitating a good governance approach in which local stakeholders are given a voice.

XINYU

"What is the role of a vision in the planning and design proposal of your group project and how has it influenced your development strategy?"

The vision statement plays a crucial role in guiding the planning and design proposal of our regional planning report. Our vision statement for the report states that by 2070, North West Europe will have transitioned to a decentralised and sustainable food system in a socially just way, where regenerative agriculture provides everyone with a delicious meal. This vision statement sets the tone for our exploration of the research question, which is how the decentralisation of agriculture can aid in a socially just transition towards regenerative farming practices in North West Europe. Our group's initial investigation into the nitrogen issue produced by agriculture, which is the outcome of present unsustainable agricultural practices such as monoculture and concentrated livestock farming, influenced our decision to set a visionary objective of sustainable food systems. We highlighted regenerative agricultural transition and agricultural production decentralisation as critical aspects in accomplishing this goal and realise that a vast number of stakeholders are involved in the transition from present unsustainable agriculture techniques to sustainable, regenerative practices. As a result, it is critical to carry out this transition in a socially just manner, while also balancing the interests of all stakeholders participating in the process. We consistently refer to these three perspectives in our planning and design suggestions, recognizing that regenerative agriculture offers the initiative, decentralisation gives farmers

greater authority, and social justice focuses on giving farmers with a visible future. We redesigned and visualised the future use of diverse land types in our proposal's sustainable agriculture section, understanding that different stakeholders have an equal stake in the land use transformation process. This method enables us to translate structural interventions at multiple scales for the region, from the greatest to the smallest. We developed a paradigm that persuades multiple audiences to support the growth of renewable agriculture by placing different audiences, particularly farmers, in future scenarios. We always considered the power of farmers as the most affected stakeholders as we suggested measures, giving them a voice in the transformation through power decentering actions. We constantly guaranteed them future career prospects and a clear picture of the future, assuring that they would not be left behind during the transition process. In conclusion, Our vision statement guided us to explore the research question and provided us with a framework to always consider the three dimensions of regenerative agriculture, decentralisation, and social justice in our proposals. Through our proposals, we ensured that the transition to sustainable, regenerative agriculture is accomplished in a socially just manner, balancing the interests of all stakeholders involved.

OLEG

"What is the relationship between research and design in your group project?"

Research and design was a new concept to me. Previously, when studying architecture I did not dive too deep into the scientific method. This does not mean that no analysis was done- it was, but using the approach of observing and creating spatial and systemic concepts from, mainly, first-hand impressions. In this studio, we combined the two approaches to understanding the world. We started off by doing extensive analysis, using statistics, GIS data and literature on topics related to regenerative agriculture. The process itself inspired us for a certain research direction. As we learned more about agricultural practices, nitrogen flows and the crisis around it, we knew that this was an interesting area to focus on. It is not easy to translate raw facts and data into an educated research question, even more into a working spatial concept: it took us several days of brainstorming to determine what we want to do conceptually and spatially, what main factors lie behind our conceptual framework and how do they translate into a vision. A big challenge was to switch from one scale to another, NW Europe has different spatial structures and arrangements than the Netherlands, South Holland or Biesbosch. We needed to revise our approach every time to understand what really makes

sense on each individual level. While design added a great freedom to the way we approach the research question, the structure of the report made sure that we stay within our main frameworks and focus on the interplay between them rather than expanding outside of the conceptual vision. Even though we performed lots of prior analysis, the report does not seem to be a serious scientific paper: it is highly speculative on an array of questions, especially when it comes to the plausibility of proposed regenerative transitions. On the other hand, it is far more scientific than the majority of design proposals which more often are based on personal experience, site visits and anecdotal evidence. I come to the conclusion that research by design is a way to bridge the two disciplines, however researchers and designers undergoing it must understand that is also a double amount of work. Uniting the two sides in a coherent way is no easy task yet the results can be worth the effort. The learnings we obtain through this method of studying our planet and its people are closer to reality and arguably much more valuable to society and nature.

BRAM

"In which way is the governance aspect embedded in the planning and design proposal of your group project and what are the reasons for this embedding?"

A hot topic

Working on a project that at current date is extremely topical and highly relevant has been an intriguing experience. A large share of the news and opinion articles I have read during the project course have been related to the topic of the nitrogen crisis and the discussion about the agricultural future for the Netherlands and the EU. This has been both motivating and insightful. The urgency stressed by the news and public discourse about what the (production-)landscape of the Netherlands will look like in the close future has been motivating in trying to formulate the vision and strategy in a way that is encompassing and socially just. It has been insightful for me that I find the inevitable political dimension of designing on this large scale very interesting – politics have interested me for quite some time – but also often terribly complicated or doubtful. The political dimension of regional design and strategy making was therefore made very clear to me the last quarter. I am still reflecting on whether this is the scale I would like to work on later. The relevance of the topic was intriguing, but the uncertainty of planning for the long term and large scale also went against my intuition and experience as a designer, keeping in mind the (more absolute) experience I have in civil engineering and architecture. This is definitely something to digest and reflect upon further in the coming months.

Governance integration

The course gave insight into the fact that a spatial issue like this is to be addressed in a truly integrated way, especially including governance. And besides that, it became clear to me that from the spatial discipline there is an enormous competence in designing integrated spatial solutions for the problems

the Netherlands as an agricultural powerhouse is facing (a selection: Het Verukkelijk Landschap, IABR-2020 Down-to-Earth, Rerooting the Dutch Food System). These initiatives often involved close cooperation with local stakeholders: the farmers. This is also what we tried to simulate from the start, using for example the synergies and conflicts-diagram to position the vision and strategy within that landscape of actor relations. I believe that for creating broadly supported spatial plans, an integrated approach is key. By coupling regional initiatives of farmers and citizens to knowledge institutes and designers, broadly supported visions and implementation strategies can be developed and integrated into a nationwide landscape of solutions. The collective organization and knowledge sharing needed for this can be fostered by the national government providing a strong case for this bottom-up approach. This might be seen as naïve. Perhaps, but the alternative is stumbling from crisis to crisis. Besides nitrogen, there are more potential crises on the way; think phosphate, pesticides, drought. The end result of such an incremental approach is, I fear, a bricolage landscape of half-solutions and investment ruins of a bankrupt agricultural system. Spatial planners and designers cannot - out of some sort of dreamed professional neutrality - remain on the sidelines. We need to reclaim the landscape from the privatised agricultural business areas into which it has been transformed and turn it back into a healthy public good, reflecting our social values. Within the governance system of planning and landscape architecture, I think a more activist role is needed from spatial enthusiasts to professionals to state advisers to convince our elected representatives of the landscape's importance in this overheated debate. Not as being a new constraint on farmers, but as a liberating connection between the many interests.

REFERENCES

LITERATURE

Aan De Burg, M., Van Gameren, E., Stavast, E. & Hoogendijk, T. (2022). De Stikstofcrisis Uitgelegd. NRC. Retrieved from <https://www.nrc.nl/nieuws/2022/11/18/de-stikstofcrisis-uitgelegd-a4148169>

Amelung, W., Bossio, D., de Vries, W., Kögel-Knabner, I., Lehmann, J., Amundson, R., ... & Chabbi, A. (2020). Towards a global-scale soil climate mitigation strategy. *Nature Communications*, 11(1), 5427.

Anderegg, W. R., Trugman, A. T., Badgley, G., Anderson, C. M., Bartuska, A., Ciais, P., ... & Randerson, J. T. (2020). Climate-driven risks to the climate mitigation potential of forests. *Science*, 368(6497).

Antwi-Boasiako, K. B. (2010). Public administration: Local government and decentralization in Ghana. *Journal of African Studies and development*, 2(7), 166

Aragao, A., Jacobs, S., & Cliquet, A. (2016). What's law got to do with it? Why environmental justice is essential to ecosystem service valuation. *Ecosystem Services*, 22, 221-227.

Azadi, H., Moghaddam, S. M., Burkart, S., Mahmoudi, H., Van Passel, S., Kurban, A., & Lopez-Carr, D. (2021). Rethinking resilient agriculture: From climate-smart agriculture to vulnerable-smart agriculture. *Journal of Cleaner Production*, 319, 128602.

Baayen, R. P., Berkhout, P., Candel, J. J. L., van Doorn, A. M., Eweg, A. Y., Jager, J. H., Jellema, A., & Jongeneel, R. A. (2021). Naar een doeltreffend en doelmatig Nationaal Strategisch Plan: Effectenanalyse van beleidsvarianten voor de Nederlandse invulling van het nieuwe GLB. (Rapport / Wageningen Environmental Research; No. 3102). Wageningen Environmental Research. <https://doi.org/10.18174/552685>

Bajželj, B., Richards, K. S., Allwood, J. M., Smith, P., Dennis, J. S., Curmi, E., & Gilligan, C. A. (2014). Importance of food-demand management for climate mitigation. *Nature Climate Change*, 4(10), 924-929.

Bavel, M. van, Frouws, J. & Driessen, P. (2004). Nederland en de Nitraatrichtlijn: Struisvogel of Strateeg? Retrieved on 10 March 2023 from <https://www.rivm.nl/bibliotheek/digitaaldepot/NederlandendeNitraatrichtlijn.pdf>

Beleef De Biesbosch (n.d.). Nationaal Park de Biesbosch. Beleef de Biesbosch Regio. Retrieved from <https://www.beleefdebiesbosch.nl/de-biesbosch/nationaal-park-de-biesbosch>

Bennett, N. J., Blythe, J., Cisneros-Montemayor, A. M., Singh, G. G., & Sumaila, U. R. (2019). Just Transformations to Sustainability. *Sustainability*, 11(14), 3881. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/su11143881>

Bergh, S. (2004). Democratic decentralisation and local participation: a review of recent research. *Development in Practice*, 14(6), 780-790.

Berkhout, P. (2021). Boeren zonder (kunst)mest, kan dat? Wageningen University &

Research. Retrieved from <https://www.wur.nl/nl/show-longread/boeren-zonder-kunstmest-kan-dat.htm>

Blattner, C. (2020). Just transition for agriculture? A critical step in tackling climate change. *Journal of Agriculture, Food Systems, and Community Development*, 9(3), 53-58.

Bobbink, R., D. Bal, H.F. van Dobben, A.J.M. Jansen, M. Nijssen, H. Siepel, J.H.J. Schaminee, N.A.C. Smits & W. de Vries. (2012). The effects of nitrogen deposition on the structure and functioning of ecosystems. European Commission. Retrieved from https://ec.europa.eu/environment/nature/natura2000/platform/documents/part-i-chapter_2_nov-2012_2013-09-10_en.pdf

Bodó, B., Brekke, J. K., & Hoepman, J. H. (2021). Decentralisation: A multidisciplinary perspective. *Internet Policy Review*, 10(2), 1-21.

Bol, R., Gruau, G., Mellander, P. E., Dupas, R., Bechmann, M., Skarbøvik, E., ... & Gascuel-Odoux, C. (2018). Challenges of reducing phosphorus based water eutrophication in the agricultural landscapes of Northwest Europe. *Frontiers in Marine Science*, 5, 276.

Brandt, K. M. F., Romeijn, P., Hazelhorst, S. B., Stolwijk, G. J. C., Marra, W. A. (2022). Dataset Stikstofdepositie Herkomst (DASH). RIVM. Retrieved from <https://data.rivm.nl/data/stikstof/DASH/2022/>

Britannica, T. Editors of Encyclopaedia (2023, March 30). Nitrogen cycle. Encyclopedia Britannica. Retrieved from <https://www.britannica.com/science/nitrogen-cycle>

Carney, D. (1995). Management and Supply in Agriculture and Natural Resources: Is decentralisation the answer? (Vol. 4). Overseas Development Institute.

CBS (2020). Landbouw; gewassen, dieren en grondgebruik naar gemeente. Centraal Bureau voor de Statistiek. Retrieved from <https://opendata.cbs.nl/#/CBS/nl/dataset/80781ned/table?dl=45B70>

CBS (2021, 23 June). The Netherlands is the EU's largest meat exporter. Statistics Netherlands; Centraal Bureau voor de Statistiek. Retrieved from <https://www.cbs.nl/en-gb/news/2021/25/the-netherlands-is-the-eu-s-largest-meat-exporter#:~:text=Meat%20exports%20account%20for%2060,billion%20euros%20through%20domestic%20sales>

CBS (2021). Stikstofemissies naar lucht. Centraal Bureau voor de Statistiek. Retrieved from <https://www.cbs.nl/nl-nl/dossier/dossier-stikstof/stikstofemissies-naar-lucht>

CBS (2021a). Longread: Hoeveel landbouwdieren telt ons land? Centraal Bureau voor de Statistiek. Retrieved from <https://longreads.cbs.nl/nederland-in-cijfers-2021/hoeveel-landbouwdieren-telt-ons-land/>

CBS (2022, 7 July). The Netherlands largest EU importer of Brazilian agricultural goods. Centraal Bureau voor de Statistiek. Retrieved from <https://www.cbs.nl/en-gb/news/2022/27/the-netherlands-largest-eu-importer-of-brazilian-agricultural-goods>

CBS (2022a). Inwoners per gemeente. Centraal Bureau voor de Statistiek. Retrieved from <https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/regionaal/inwoners>

CCHW. (2019). INTERREG project FABulous Farmers is van start. Retrieved from <https://cchw.eu/media/interreg-project-fabulous-farmers-is-van-start/>

Chaichi, M. R., Saravi, M. M., & Malekian, A. R. A. S. H. (2005). Effects of livestock trampling on soil physical properties and vegetation cover (case study: Lar Rangeland, Iran). <i>Int. J. Agric. Biol.</i> 7, 904-908.	livestock-2020-10-14_en	Groot Koerkamp, P. W. G., Schouten, W. J., Schreefel, L., Wojtynia, N., Beldman, A. C. G., de Boer, I. J. M., de Boer, M., Bos, A. P., Derks, M., van Dijk, J., Grin, J., Heideveld, A., Hekkert, M., Korthals, G. W., Lesschen, J. P., Schrijver, A., Rossing, W. A. H., Schulte, R. P. O., Smit, A. B., & van Zanten, H. H. E. (2021). A Regenerative Agricultural System at Scale: an Outline of Required Outcomes for the Netherlands. In <i>Proceedings of the European Conference on Agricultural Engineering AgEng 2021</i> (pp. 476-483) https://edepot.wur.nl/585240	Khoroshev, A. (2023). Ландшафтно-экологическое планирование. Учебник для вузов. Московский Государственный Университет им. Ломоносова.
Chamberlain, J. L., Mitchell, D., Brigham, T., Hobby, T., Zabek, L., & Davis, J. (2009). Forest farming practices. <i>North American agroforestry: An integrated science and practice</i> , 219-255.	European Commission. (2023). Enhancing agricultural biodiversity. <i>Agriculture and Rural Development</i> . Retrieved from https://agriculture.ec.europa.eu/sustainability/environmental-sustainability/biodiversity_en	Healey, P. (1996). The communicative turn in planning theory and its implications for spatial strategy formation. <i>Environment and Planning B: Planning and design</i> , 23(2), 217-234.	Köning, E. (2022). Stikstofbeleid in de provincies: 'Den Haag zet de handtekening, wij moeten met het slagersmes rond'. Retrieved from https://www.nrc.nl/nieuws/2022/06/08/stikstofbeleid-in-de-provincies-den-haag-zet-de-handtekening-wij-moeten-met-het-slagersmes-rond-a4132777
Chapman, M., Walker, W. S., Cook-Patton, S. C., Ellis, P. W., Farina, M., Griscom, B. W., & Baccini, A. (2020). Large climate mitigation potential from adding trees to agricultural lands. <i>Global Change Biology</i> , 26(8), 4357-4365.	European Union. (2021, July 14). A European Green Deal. European Commission. Retrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en	Het Kontakt (2023). Hoog bezoek vanuit de EU aan pilot Donkse Laagten in Brandwijk. Retrieved from https://www.hetkontakt.nl/alblasserwaard/341470/hoog-bezoek-vanuit-de-eu-aan-pilot-donkse-laagten-in-brandwijk	Larson, A. M., & Ribot, J. C. (2004). Democratic decentralisation through a natural resource lens: an introduction. <i>The European Journal of Development Research</i> , 16, 1-25.
CLO. (2021). Herkomst stikstofdepositie, 2021. Retrieved from https://www.clo.nl/indicatoren/nl0507-herkomst-stikstofdepositie	Eurostat. (2023). Animal populations by NUTS 2 regions. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/AGR_R_ANIMAL/default/table?lang=en	Hoekschewaard Duurzaam. (2023). Prof. Jan Rotmans: “Hoeksche Waard heeft duurzame impuls nodig”. Retrieved from https://www.hoekschewaardduurzaam.nl/prof-jan-rotmans-hoeksche-waard-heeft-duurzame-impuls-nodig/	Lockwood, B. (2015). The political economy of decentralization. <i>Handbook of multilevel finance</i> , 37-65.
CLO. (2022). Land- en tuinbouw: ruimtelijke spreiding, grondgebruik en aantal bedrijven, 1980-2021. Retrieved from https://www.clo.nl/indicatoren/nl2119-agrarisch-grondgebruik-	FAO. (2008). An Introduction to the Basic Concepts of Food Security.	Ibáñez Martín, R., & Smits, F. (2022). The material politics of living in close proximity to our wastewaters: A case of decentralisation in the Netherlands. <i>Environment and Planning E: Nature and Space</i> , 25148486221131191.	Muilwijk, H.; Westhoek, H.; De Krom, M. (2018), Voedsel in Nederland: verduurzaming bewerkstelligen in een veelvormig systeem, Den Haag: PBL. Retrieved from https://www.pbl.nl/sites/default/files/downloads/pbl-2018-notitie-voedsel-in-nederland-3239.pdf
CLO. (2023a). Stroomschema voor stikstof en fosfor in de landbouw, 2021. Retrieved from https://www.clo.nl/indicatoren/nl0094-stroomschema-stikstof-en-fosfor?ond=20885	FAO. (2020a). Trade of Agricultural Commodities 2000-2020. FAOSTAT ANALYTICAL BRIEF 44. Retrieved from https://www.fao.org/3/cb9928en/cb9928en.pdf	IPCC (2018). Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.	Mulder, M. (2014). De storm Sicco Mansholt en het Nederlandse boerenlandschap. Archined. Retrieved from https://www.archined.nl/2014/02/de-storm-sicco-mansholt-en-het-nederlandse-boerenlandschap/
CLO. (2023b). Fauna van open natuurgebieden. Retrieved from https://www.clo.nl/indicatoren/nl1586-trend-fauna-open-natuurgebieden?ond=20877	FAO. (n.d.). Management of sandy soils. https://www.fao.org/soils-portal/soil-management/management-of-some-problem-soils/sandy-soils/en/	Jenks, George F. (1967). The Data Model Concept in Statistical Mapping. <i>International Yearbook of Cartography</i> 7: 186–190.	Nair, P.K.R. (2005). Agroforestry. <i>Encyclopedia of Soils in the Environment</i> , 35-44.
CLO. (2023c). Fauna van het agrarisch gebied. Retrieved from https://www.clo.nl/indicatoren/nl1580-trend-fauna-agrarisch?ond=20877	Fowler, D., Coyle, Mhairi, Skiba, Ute, Sutton, Mark A., Cape, J. Neil, Reis, Stefan, Sheppard, Lucy J., Jenkins, Alan, Grizzetti, Bruna, Galloway, J.N., Vitousek, P., Leach, A., Bouwman, AF., Butterbach-Bahl, K., Dentener, F., Stevenson, D., Amann, M., Voss, M. (5 July 2013). “The global nitrogen cycle in the twenty-first century”. <i>Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences</i> . 368 (1621). Retrieved from https://doi.org/10.1098%2Frstb.2013.0164	Johnson, C. (2001). Local democracy, democratic decentralisation and rural development: theories, challenges and options for policy. <i>Development policy review</i> , 19(4), 521-532.	Nair, P.K.R., Gordon, A.M. & Mosquera-Losada, M.R. (2008). Agroforestry. <i>Encyclopedia of Ecology</i> , 101-110.
Cook-Patton, S. C., Drever, C. R., Griscom, B. W., Hamrick, K., Hardman, H., Kroeger, T., ... & Ellis, P. W. (2021). Protect, manage and then restore lands for climate mitigation. <i>Nature Climate Change</i> , 11(12), 1027-1034.	Fujimori, S., Hasegawa, T., Krey, V., Riahi, K., Bertram, C., Bodirsky, B. L., ... & van Vuuren, D. (2019). A multi-model assessment of food security implications of climate change mitigation. <i>Nature Sustainability</i> , 2(5), 386-396.	Jukema, G., Ramaekers, P., & Berkhout, P. (2023). De Nederlandse agrarische sector in internationaal verband: Editie 2023. Rapport / Wageningen Economic Research; No. 2023-004. Wageningen Economic Research. Retrieved from https://doi.org/10.18174/584222	Nationaal Park De Biesbosch (n.d.). Welkom in Nationaal Park De Biesbosch. Nationaal Park De Biesbosch. Retrieved from https://np-debiesbosch.nl/
Copernicus. (2018). Corine Land Cover (CLC), Version 2020_20u1.	Gamage, D., & Zajda, J. (2005). Decentralisation, delegation and devolution: Towards self-governing schools. <i>Political Crossroads</i> , 12(3), 29-57.	Kadaster. (2023). Kwartaalbericht agrarische grondmarkt, 2022 - 4e kwartaal. Retrieved from https://www.kadaster.nl/-/kwartaalbericht-agrarische-grondmarkt-2022-4e-kwartaal?redirect=%2Fzakelijk%2Fvastgoedinformatie%2Fkwartaalberichten-agrarische-grondmarkt	Newell, P., & Mulvaney, D. (2013). The political economy of the 'just transition'. <i>The geographical journal</i> , 179(2), 132-140.
Dietz, T., Ostrom, E., & Stern, P. C. (2003). The struggle to govern the commons. <i>science</i> , 302(5652), 1907-1912.	Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. <i>Research policy</i> , 31(8-9), 1257-1274.	Kay, S., Rega, C., Moreno, G., den Herder, M., Palma, J. H., Borek, R., ... & Herzog, F. (2019). Agroforestry creates carbon sinks whilst enhancing the environment in agricultural landscapes in Europe. <i>Land use policy</i> , 83, 581-593.	Ngatia, L., Grace III, J. M., Moriasi, D., & Taylor, R. (2019). Nitrogen and phosphorus eutrophication in marine ecosystems. <i>Monitoring of marine pollution</i> , 1, 1-17.
Dolan, P., Edlin, R., Tsuchiya, A., & Wailoo, A. (2007). It ain't what you do, it's the way that you do it: Characteristics of procedural justice and their importance in social decision-making. <i>Journal of Economic Behavior & Organization</i> , 64(1), 157-170.	Geels, F. W. (2019). Socio-technical transitions to sustainability: A review of criticisms and elaborations of the Multi-Level Perspective. <i>Current opinion in environmental sustainability</i> , 39, 187-201.	Khemani, S. (2020). Delegation and Decentralization: Reform Ideas for Bihar's Economic Transformation. <i>Journal of Asian Development Research</i> , 1(1), 53-77	NOS. (2023). 'Stikstofonzekerheid remt verduurzaming bij boeren'. NOS. Retrieved from https://nos.nl/collectie/13901/artikel/2470598-stikstofonzekerheid-remt-verduurzaming-bij-boeren
Dovey K. (2012). Informal urbanism and complex adaptive assemblage. <i>International Development Planning Review</i> 34(3), 371-390	Giller, K. E., Hijbeek, R., Andersson, J. A., & Sumberg, J. (2021). Regenerative agriculture: an agronomic perspective. <i>Outlook on agriculture</i> , 50(1), 13-25.		PBL. (2014). The Netherlands in 21 infographics. Retrieved from https://www.pbl.nl/en/publications/the-netherlands-in-21-infographics
EEA. (2018). Agricultural land: Nitrogen balance. Retrieved from https://www.eea.europa.eu/airs/2018/natural-capital/agricultural-land-nitrogen-balance	Glotsbach, S., & Baumgartner, S. (2012). The relationship between intragenerational and intergenerational ecological justice. <i>Environmental Values</i> , 21(3), 331-355.		PBL. (2016). English Summary and Findings of the Dutch report 'Dalende bodems, stijgende kosten. Mogelijke maatregelen tegen veenbodemdaling in het landelijk en stedelijk gebied', PBL publication number: 1064. Retrieved from https://www.pbl.nl/sites/default/files/downloads/Subsiding_soils_rising_costs_Findings.pdf
EEA. (2020). Latest evaluation shows Europe's nature in serious, continuing decline. Retrieved from https://www.eea.europa.eu/highlights/latest-evaluation-shows-europes-nature	GreenPeace (2019). Feeding the Problem: the dangerous intensification of animal farming in Europe. Retrieved from https://www.greenpeace.org/eu-unit/issues/nature-food/1803/feeding-problem-dangerous-intensification-animal-farming/		PBL. (2016). Subsidence of peatlands leads to high costs. PBL Planbureau Voor de Leefomgeving. Retrieved from https://www.pbl.nl/en/news/2016/subsidence-of-peatlands-leads-to-high-costs
EEA. (2022). Exceedance of atmospheric nitrogen deposition above critical loads for eutrophication in Europe in 2020. Retrieved from https://www.eea.europa.eu/data-and-maps/figures/exceedance-of-atmospheric-nitrogen-deposition			Quarles, W. (2018). Regenerative agriculture can reduce global warming. <i>IPM Practitioner</i> , 36(1/2), 1-8.
ESDAC. (2006). The European Soil Database distribution version 2.0, European Commission and the European Soil Bureau Network.			Rawls, J. (2020). A theory of justice: Revised edition. Harvard University Press.
European Commission (2022, 24 February). Factsheet – a greener and fairer CAP.			Redactie Hoeksch Nieuws. (2022). Hoeksche Zuivel opent seizoen als Foodlab locatie. https://www.hoekschnieuws.nl/2022/04/06/hoeksche-zuivel-opent-seizoen-als-foodlab-locatie/
European commission. (2020). Commission publishes external study on future of EU livestock. <i>Agriculture and Rural Development</i> . Retrieved from https://agriculture.ec.europa.eu/news/commission-publishes-external-study-future-eu-			Rhodes, C. J. (2017). The imperative for regenerative agriculture. <i>Science progress</i> ,

100(1), 80-129.	The Economist. (2023). Charlemagne: The cucumber Saudis: how the Dutch got too good at farming. Retrieved from https://www.economist.com/europe/2023/03/23/the-cucumber-saudis-how-the-dutch-got-too-good-at-farming	worldbank.org/en/topic/communitydrivendevelopment/brief/Decentralization
Rijksoverheid (2022a, 10 June). Startnotitie Nationaal Programma Landelijk Gebied.		WUR. (2022). De bodem, daar is toch iets mee? Wageningen University & Research. Retrieved from https://www.wur.nl/nl/show-longread/de-bodem-daar-is-toch-iets-mee.htm
Rijksoverheid (2022b, 24 February). Nederlands Nationaal Strategisch Plan GLB 2023-2027.	Tollefson, J. (2010). Intensive farming may ease climate change. Nature, 465(7300), 853-854.	WWF (2023). Living Planet Report Nederland. Kiezen voor natuurherstel. WWF-NL, Zeist. Retrieved from https://www.wwf.nl/globalassets/pdf/lpr/lpr-nl-2023-kiezen-voor-natuurherstel.pdf
Rijksoverheid. (2019). Startnotitie Nationaal Programma Landelijk Gebied. Rijksoverheid voor Ondernemend Nederland.	Tore Helsether, S. & Reid, G.F. (2023, 11 January). 5 benefits of regenerative agriculture – and 5 ways to scale it. World Economic Forum. Retrieved from https://www.weforum.org/agenda/2023/01/5-ways-to-scale-regenerative-agriculture-davos23/	Yaka, Ö. (2019). Rethinking justice: Struggles for environmental commons and the notion of socio-ecological justice. Antipode, 51(1), 353-372.
RIVM. (2020). Programma Aanpak Stikstof. Rijksinstituut voor Volksgezondheid en Milieu.	Tribaldos, T., & Kortetmäki, T. (2022). Just transition principles and criteria for food systems and beyond. Environmental innovation and societal transitions, 43, 244-256.	Yenneti, K., & Day, R. (2016). Distributional justice in solar energy implementation in India: the case of Charanka solar park. Journal of rural studies, 46, 35-46.
Rodale, R. (1983). Breaking new ground: The search for a sustainable agriculture. Futurist, 17(1), 15-20.	Turnhout, S., Drenthen, D. (2023). Natuurherstel moet ook gaan over herstel van de relatie tussen mens en natuur. Nature Today, Soorten NL & Radboud Healthy Landscape. Retrieved from https://www.naturetoday.com/intl/nl/nature-reports/message/?msg=30604	Zhang, Y. & Ayyub, B.M. (2021). Chapter 2 – Temperature extremes in a changing climate. Climate Change and Extreme Events, 9-23.
Royal FloraHolland. (2023). Column: Kijk uit met insleep van quarantaineziekten en -plagen, ze zijn gevaarlijker dan je denkt. [Image] https://www.royalfloraholland.com/nieuws-2023/week-10/column-fytosanitair-expert-kijk-uit-met-insleep-van-quarantaineziekten-en-plagen-ze-zijn-gevaarlijker-dan-je-denkt	United Nations (n.d.). Goal 2: Zero Hunger. Sustainable Development Goals. Retrieved from https://www.un.org/sustainabledevelopment/hunger/	
Sabato, S., & Fronteddu, B. (2020). A socially just transition through the European Green Deal?. ETUI Research Paper-Working Paper.	United Nations. (2015). THE 17 GOALS Sustainable Development. Un.org. Retrieved from https://sdgs.un.org/goals	
Salvia, M., Reckien, D., Pietrapertosa, F., Eckersley, P., Spyridaki, N. A., Krook-Riekkola, A., ... & Heidrich, O. (2021). Will climate mitigation ambitions lead to carbon neutrality? An analysis of the local-level plans of 327 cities in the EU. Renewable and Sustainable Energy Reviews, 135, 110253.	Van Den Braak, B. (2020). Toen en nu: onverenigbare doelen in de mestwetgeving. Parlement.com. Retrieved from https://www.parlement.com/id/vlatcnvs1lve/toen_en_nu_onverenigbare_doelen_in_de	
Santagati, M. E., Baraldi, S. B., & Zan, L. (2020). Understanding decentralization: deconcentration and devolution processes in the French and Italian cultural sectors. International Journal of Public Sector Management, 33(4), 435-460.	Van Dooren, N., Oosterhof, G., Stobbelaar, K. & Van Dorp, D. (2018). The emerging practice of food forest-a promise for a sustainable urban food system? In European Agroforestry Conference-Agroforestry as Sustainable Land Use, 4th. EURAF.	
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.	Van Halm, I. (2022, 16 August). The Dutch nitrogen crisis shows what happens when policymakers fail to step up. Energy Monitor. Retrieved from https://www.energymonitor.ai/policy/the-dutch-nitrogen-crisis-shows-what-happens-when-policymakers-fail-to-step-up/	
Shrestha, S., & Dhakal, S. (2019). An assessment of potential synergies and trade-offs between climate mitigation and adaptation policies of Nepal. Journal of environmental management, 235, 535-545.	Van Zanten, H. H., Herrero, M., Van Hal, O., Rööß, E., Muller, A., Garnett, T., ... & De Boer, I. J. (2018). Defining a land boundary for sustainable livestock consumption. Global Change Biology, 24(9), 4185-4194.	
Sijmons, D. (2023). Nederland worstelt met zijn agrarische verleden terwijl de toekomst voor ons ligt. Archined. Retrieved from https://www.archined.nl/2022/08/nederland-worstelt-met-zijn-agrarische-verleden-terwijl-de-toekomst-voor-ons-ligt/	Vermunt, D. A., Wojtynia, N., Hekkert, M. P., Van Dijk, J., Verburg, R., Verweij, P. A., Wassen, M., & Runhaar, H. (2022). Five mechanisms blocking the transition towards 'nature-inclusive' agriculture: A systemic analysis of Dutch dairy farming. Agricultural Systems, 195, [103280]. Retrieved from https://doi.org/10.1016/j.agsy.2021.103280	
Sikkema, A. (2019). De stikstofproblematiek in vijf vragen. WUR Resource Online. Retrieved from https://www.resource-online.nl/index.php/2019/09/25/de-stikstofproblematiek-in-vijf-vragen/	Von der Leyen, U. (2019). A Union that strives for more: My agenda for Europe.	
Sinclair, F.L. (2004). Agroforestry. Encyclopedia of Forest Sciences, 27-32.	Wang, C., Li, Z., Wang, T., Xu, X., Zhang, X., & Li, D. (2021). Intelligent fish farm—The future of aquaculture. Aquaculture International, 1-31.	
Smit, M. in Kleis, R. (2018). Landbouw in 2040: meer mens, minder machine. Wageningen University & Research Resource Online. Retrieved from https://www.resource-online.nl/index.php/2018/09/14/landbouw-in-2040-meer-mens-minder-machine/	Wikipedia (2023, 12 January). Molenlanden. Wikipedia. Retrieved from https://nl.wikipedia.org/wiki/Molenlanden	
Soil Heroes Foundation. (2020). Guidebook for Regenerative Farming. Retrieved from https://www.soilheroesfoundation.com/wp-content/uploads/2022/12/Guidebook-for-regenerative-farming.pdf	World Bank (2020). Agricultural Land (% of Land Area) - Netherlands Data. Retrieved from https:// data.worldbank.org/indicator/AG.LND.AGRI.ZS?locations=NL	
Sustainable Markets Initiative Agribusiness Task Force (n.d.). Scaling Regenerative Farming: An Action Plan. Retrieved from https://a.storyblok.com/f/109506/x/7b102e6831/agribusiness-task-force-white-paper.pdf	World Bank. (2013). Community driven development brief. Retrieved from https://www.	

COLLAGE & ICONS SOURCES

Icons creators in order of appearance: Pariphat Sinma, Gan Khoon Lay, Irman Firmansyah, ferdizzimo, Made x Made, Eucalyp, IconTrack, ohyeahicon, Grégory Montigny, Gan Khoon Lay, Jonathan Wong, Firza Alamsyah, Abdulloh Fauzan, @w@n !cons, Alena Artemova, Luis Prado, Orin zuu, Insticon, KonKapp, supalerk laipawat, Jessigue, shashank singh, Cahya Kurniawan, Soni Sokell, Adrien Coquet, Akshar Pathak, Candy Design, Laurent Génèreux, Solid Icon Co, fausan mayeh, Mada Creative, ANTON icon, Danil Polshin, iconfield, Made, Cono Studio Milano, KP Arts, tezar tantular, DinosoftLab, P Thanga Vignesh, Eucalyp, Tippawan Sookruay, SBTS, Chanut is Industrie, Berkah Icon, sam maulidna, Andrejs Kirma, ProSymbols, pictohaven, monkik, Ariyanto Deni, ic2icon, Adrien Coquet, Josh Sorosky, Design Circle, Colourcreatype, IQON, Kamin Ginkaewt, Chaiwat Ginkaew, WEBTECHOPS LLP, Oliver Walton

Figure 14: NOS. (2022). Hoe nederland een landbouw grootmacht werd. YouTube. Pinterest. (s.d.). Melkinrichting St Martinus mastbosstraat begin jaren 30. D'Adamo, P. (2011). Hongerwinter. , Misset in Welink, M. (2021). 1950: Eindeloos zakken vullen met kunstmest, Canon van Nederland. (s.d.). Ruilverkaveling Veghel-Erp, Presser, S. in Het Nieuwe Instituut. (1950). Sicco Mansholt in Wieringermeer, 1950. Courtesy of Maria Austria Institute., European Union (EU). (2013). Edgard Pisani, French Minister for Agriculture, on the left, Walter Hallstein, President of the Commission of the EEC, and Louis-Georges Rabot, Director General of DG VI Agriculture of the Commission of the EC, NRC. (1990). Topambtenaren verzwegen groei mestoverschot, Hadders, R. (2015). Afschaffing melkquotum, het einde van een tijdperk, European Environment Agency. (2020). Natura2000: Birds and Habitats Directives, Aanpak Stikstof (Rijksoverheid). (s.d.). Foto Natuur. Berkhout, 2021; Bobbink, 2012; Mulder, 2014; EEA, 2018; Van Den Braak, 2020. Images in order of appearance: NOS, 2022; Pinterest, s.d.; D'Adamo, 2011; Canon van Nederland, s.d.; Presser, 1950; EU, 2013; NRC, 1990; EEA, 2020; Aanpak Stikstof, s.d.

Figure 24: Collage sources - © Sergey Uryadnikov / WWF – Korhoen, © Dian-Mary Stofmeel - Blauwe kiekendief, © Josef Hlasek - Hipparchia statilinus, © R. Willemsen - Levendbarende hagedis, © Natura2000 – Kemphaan – On Unsplash

Figure 28: © ANP – NOS; © NOS; © ANP – NOS; © ANP / Laurens van Putten – RTL Nieuws; © WWETV Network - Website Design & Algorithm By AuroIN Digital Marketing Agency - World Wide; © ANP – Metro Nieuws; © Nieuwsuur – NOS; © ANP – EenVandaag; © Shutterstock – Bio Wetenschap Maatschappij; © ANP – HLN; © Maarten Hartman – Trouw; © 11.11.11; © Shayne Robinson / Greenpeace – Medium

Figure 30: ©Twitter/@GretaThunberg; ©FABRICE COFFRINI/AFP; © LandBouwLeven/ Jan Cees Bron; © Elsevier Weekblad/Jelte Wiersma.

Figure 35: © Bürkler, R-Pexels, © Sayles, B-Pexels, © Henrotte, G-Unsplash, © Boguslawska, A – Unsplash, © Park, J – Unsplash, © Tibodi, F – Pexels, © Zilka, S – Unsplash, © Poncet, C – Pexels, © Fring, G – Pexels, © Gonullu, M – Pexels, © John - Flickr

Figure 55: © Adams, S – Unsplash, © Baddley, T – Flickr, © Cafnr, M – Flickr, © Chung, Z – Pexels, © Delzio, M – Flickr, © The hero - Wikimedia Commons, © Jim, T. P – Flickr, © Jones, E – Pexels, © Kemper, M - Flickr., © Krimifreundin – Pixabay, © NatalieMaynor – Flickr, © Pixabay – Pexels, © Renaissance_Flick – Flickr, © Schwoaze – Pixabay, © Стаменов, М – Flickr