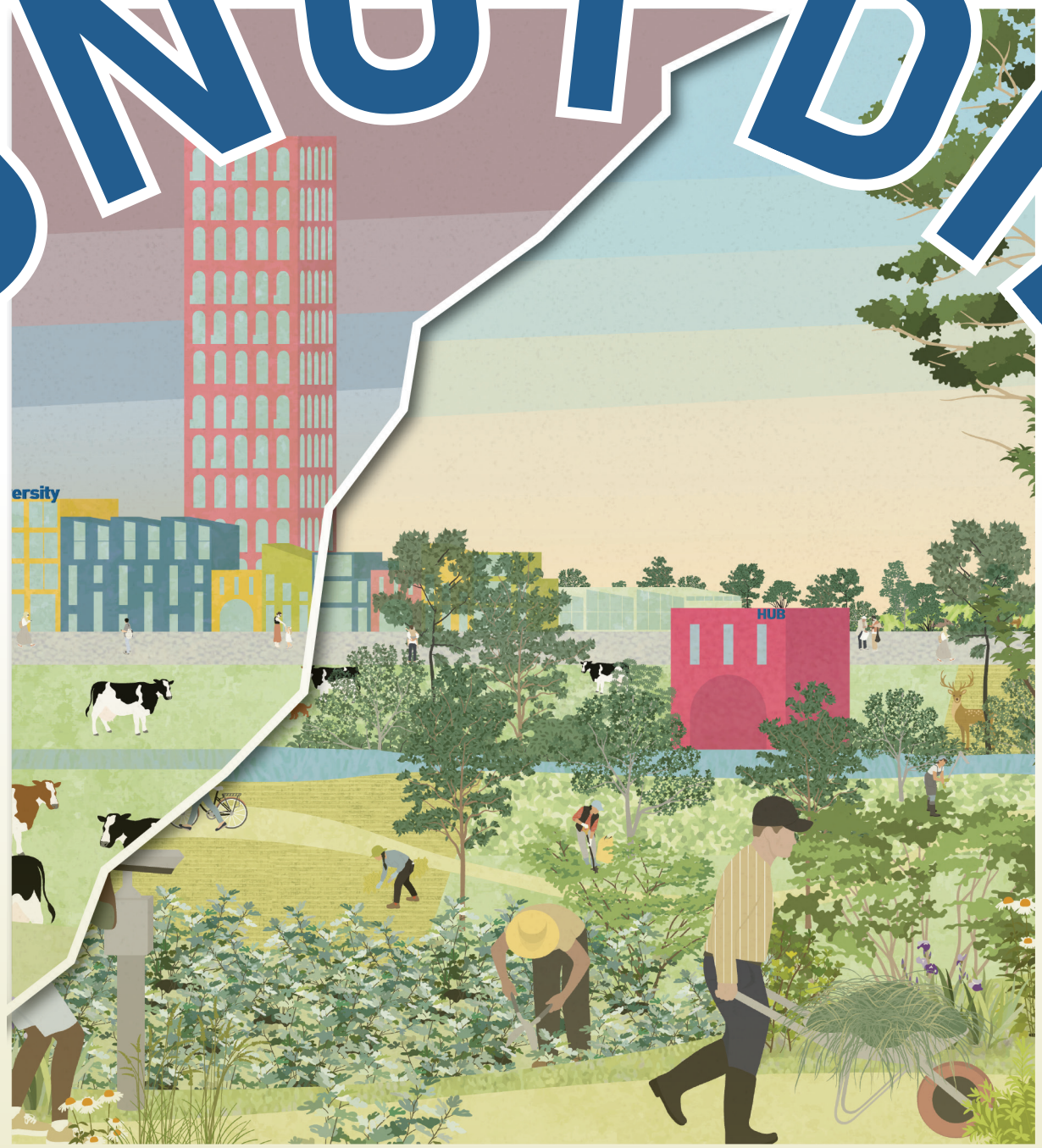
DONUT DIET



A vision and strategy for an agricultural transition towards a circular, collective, and regenerative future.

COLOPHON

DONUT DIET

A vision and strategy for an agricultural transition towards a circular, collective, and regenerative future.

Authors

Vaibhav Bansal
5735904
Thijs de Boer
5893569
JP Boersma
4992970
Jelle Schotanus
4856619
Wiebke Stadtlander
6049249

TU Delft MSc Urbanism
Q3 Academic Year 2023 | 24

Caroline Newton
Verena Balz
Nikos Katsikis

Roberto Rocco
Marcin Dąbrowski

Tutors

Birgit Hausleitner
Alex Wandl

10th April 2024

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ABSTRACT

By 2150, the food system of North-Western Europe will shift from intensive agriculture to regenerative, small-scale, and collective agriculture system with diversified and rotational land use, closing nitrogen cycles thus reducing the strain on the climate and giving soil the space and time to regenerate so nature can thrive. Food and bio-based materials will be produced locally and seasonally, making food and material consumption more transparent and integrated into the daily lives of communities, transforming peri-urban and rural structures and the way we live in them. This regenerative food production system will provide affordable food for all, while being more circular, organic, sustainable and fit for this future world we envision.

We want to achieve this through a multiscalar approach, with collective farming as the foundation. To enable diversified farms, farmers will share facilities, tools and land to enable soil-based crop rotation. This will not only affect the local diet (through the vegetables and fruits that are grown) but also the products produced (through the bio-based materials that are grown). Focusing on local production also means reducing some of our international infrastructure while introducing other collective infrastructures, increasing lcoal and regional flows. By creating knowledge flows between countries we aim to help empower people in the Global South to process and manufacture food locally as well. Finally, at the heart of the strategy is the conservation of nature, which will shape the boundaries of the newly structured peri-urban-rural agricultural landscape. The existing boundaries of the built environment will remain, with the focus on densifying and transforming our current structures rather than expanding them.

KEYWORDS:

- **NITROGEN POLLUTION**
- **COLLECTIVE FARMING**
- **CIRCULAR ECONOMY**
- **REGENERATIVE AGRICULTURE**
- **SEASONAL DIET**
- **LOCAL AGRICULTURE PRODUCTION**

Figure 0.1 Impression of future landscape: a merged urban and peri-urban environment with a regenerative and diversified agriculture system.

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CHAPTER 1
INTRODUCTION

1.1 AN INTRODUCTION TO NITROGEN

Welcome to this report in which we explain the issues North-Western Europe is experiencing with nitrogen in agriculture, and make a proposal on how to go forward to a circular future with a regenerative and collective agriculture system. The topic of nitrogen has been hard to ignore; local, national, and international news outlets have been reporting on it daily, and several policy proposals on limitation of pollution, protection of nature, and agriculture reforms have landed on the table. Before we dive into the details and specifics, let's give a little background.

Nitrogen, the atom N, is one of the basic elements in the universe. You can find it in the atmosphere, soil, and water. In inorganic bounds, it forms a nutrient for plants, and in organic bounds, it forms a nutrient for animals and people. Nitrogen has an important role in photosynthesis and is a crucial element in proteins. Therefore, we need nitrogen to keep our ecosystem running. However, exceeding planetary boundaries and emitting more nitrogen than this natural system can cope with, can lead to wide-spread negative effects, such as eutrophication: accumulation of excess nutrients, such as nitrogen and phosphorous. This in turn leads to loss of biodiversity, as only specific species flourish and dominate, and land degradation, threatening our food production system. The natural nitrogen cycle is visualised in figure 1.1 (De Natuurwetenschappen, 2013; EEA and PBL, 2017).

In some areas in the world including North-Western Europe, planetary boundaries of nitrogen emissions are indeed far exceeded. The excessive use of nitrogen in agriculture – for example in artificial fertiliser and protein-enhanced feed for livestock – are leading to global implications on our environment and ecosystem (Schulte-Uebbing et al., 2022; Huysmans, 2021, Richardson et al., 2023). Schulte-Uebbing et al. (2022) found that while planetary boundaries of nitrogen emissions are being exceeded, some regional boundaries are not. There is potential to feed the world within planetary boundaries by redesigning the food production system to be more local, increasing nitrogen efficiency in the food production sector, and limiting the use of artificial fertiliser and feed (Schulte-Uebbing et al., 2022). In 2013, the average surplus of nitrogen on agricultural land in the EU was 51 kg/ha affecting water, soil and air quality, leading to notable loss of biodiversity. The average nitrogen surplus on agricultural land in the EU has been decreasing since 2000, however, the nitrogen surpluses are largely organised in local and regional hotpots, often located in areas of intensive agriculture and livestock agriculture (EEA and PBL, 2017).

On top of the pollution of nitrogen, agricultural land is dealing with pollution from pesticides. These pesticides, used to repent insects from damaging growing crops, end up in our soil and water due to runoff. Here they cause biodiversity loss. The pesticides that do not wash off, end up on and in the food that we consume, leading to increasing levels of toxins in humans and animals (EEA, 2023b).

Besides paying attention to the use of nitrogen in food production, it is also important to look at the whole system of food production, and follow the nitrogen flow through to the consumer and

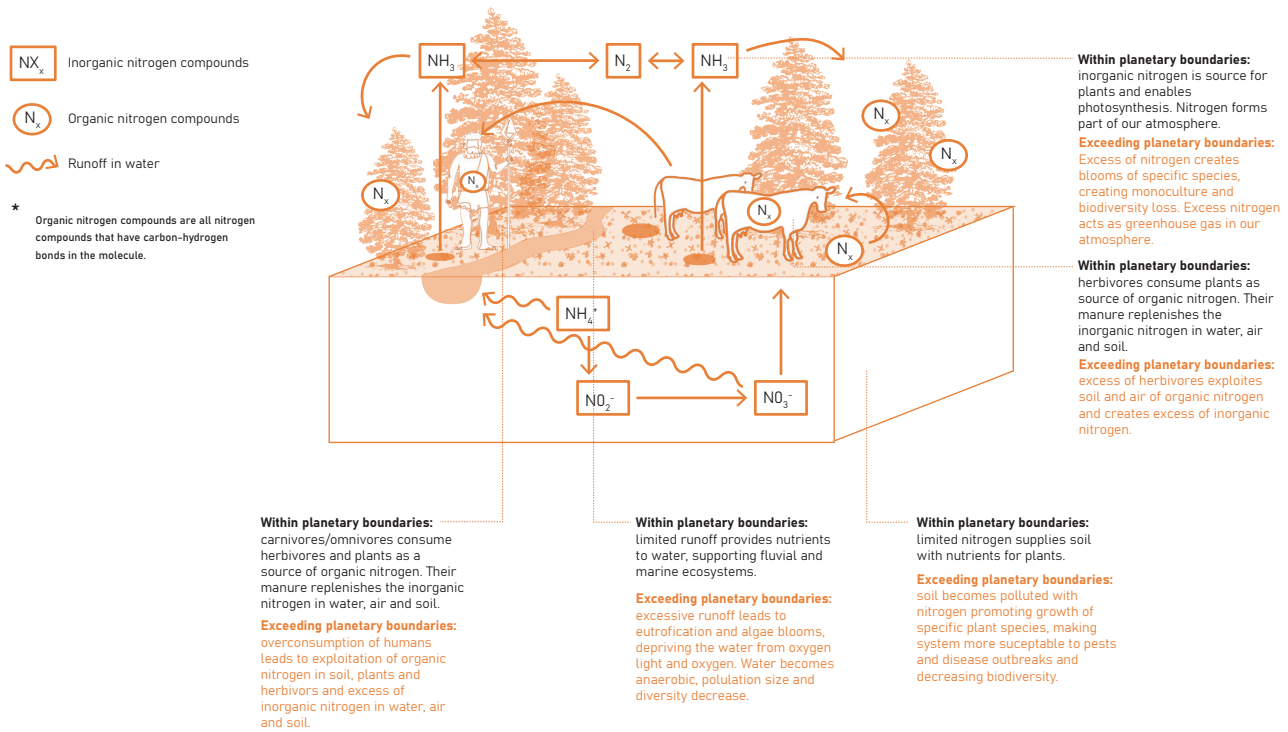


Figure 1.1 The natural nitrogen cycle explained

eventual wasteflows as well. Moreover, within the topic of nitrogen there are multiple human sources of nitrogen emission, only one of which is the agriculture sector. This project, however, will mostly focus on redesigning the food production system in a sustainable way.
The realisation that, amongst other things, the way we produce food is a threat to our climate, environment and our very livelihoods has been clear for a while and slowly, reforms of policies and practices have started popping up. Not without resistance though.

1.2 A TRIP DOWN MEMORY LANE: NITROGEN IN THE EUPOREAN AGRICULTURE SECTOR

For years now, nitrogen has been a 'hot topic' both in international and European politics as well as in the average household. The effects of excess nitrogen in our soil and water and the resulting eutrophication on our ecosystems and climate have been known for decades but the European Green Deal, eventually signed in 2019, spiked a wave of uproar and protests, mostly coming from farmers targetted by new European and national climate measures to reduce the nitrogen emissions (NOS, 2001; CAP at a glance, 2024).

The European Green Deal is an important benchmark in the development towards a more sustainable future. The deal, presented in 2019 and signed in 2020, was a response to research and reports about the state of the Earth and consists of goals for a sustainable Europe in 2030 and 2050. It is most known for its goals addressing energy and CO2 emissions, but there are also goals for biodiversity, nitrogen, and agriculture, such as the Farm2Fork plan (European Green Deal, n.d.). Important to note is that the European Green Deal consists mostly of goals and policies, not of strategies. It is up to the individual member states to create and implement those strategies within the given policies by the EU.

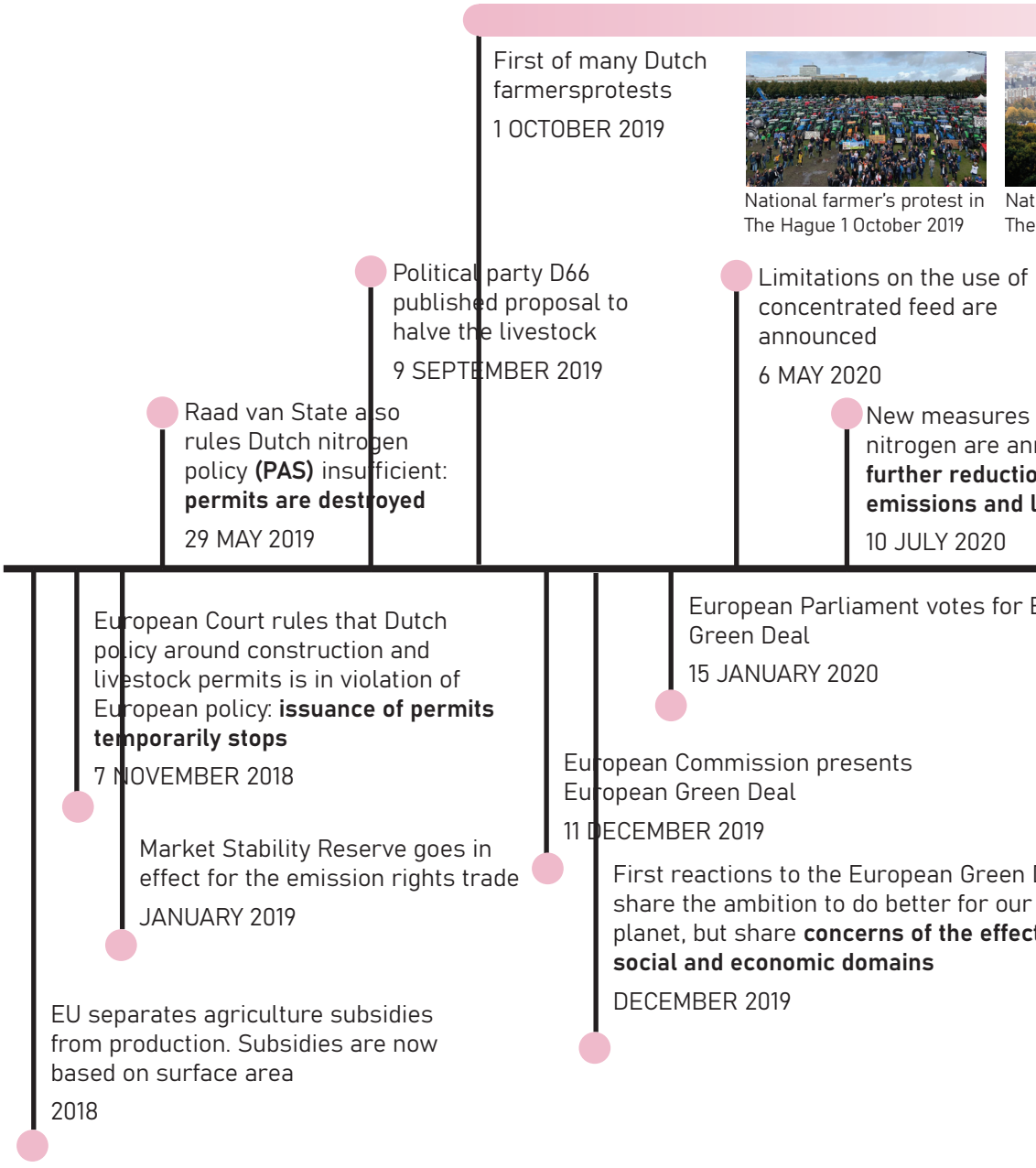
In most EU countries this did indeed lead to various national policies and strategies based upon the Green Deal. In The Netherlands, a country with a proud and traditional group of farmers, this did not land well. As you can see in the timeline in image 1.2, even before the Green Deal was implemented, the Dutch agriculture sector had some conflicts with European rules. Already before the Green Deal was presented, farmers started to protest against agricultural reforms of cutting the number of livestock in half. After the Green Deal, the protests continued after announcements of further downsizing of the livestock, emissions reductions, and limitations on fertiliser and protein-enhanced feed use (NOS, 2001).

Simultaneously to the implementation of the Green Deal, a big reform of the Common Agriculture Policy, or CAP, is happening in Europe. CAP is the European agriculture policy used since the reconstruction after the Second World War (Timeline – CAP, n.d.). Initially, it consisted of mostly financial help in the form of a standard price for agriculture products to stimulate production and therefore support the reconstruction. This however lead to vast excesses of milk, butter and even wine: you might be familiar with the Dutch terms 'boterberg' and 'melkplas'. For decades, the EU has been trying to reform CAP, first by giving up the standard pricing and transitioning to a subsidy system based on the surface area of farms. Then the EU tried to make CAP greener and contribute to the sustainability goals and create subsidies for environmentally friendly types of agriculture (Timeline-CAP 2023-27, n.d.; Huysmans, 2021).

The reforms of CAP together with the further implementation of the Green Deal and resulting national strategies and policies are creating large budget cuts for the European agriculture sector. Today, CAP is still indirectly linked to production, as the amount of subsidy is partially based on the surface area of farms (CAP at a glance, 2024; Huysmans, 2021). This is hard to change, as to alter such an old European subsidy, you need unanimity from all member states. However, most member

states benefit greatly from these agriculture subsidies: one-third of the EU's budget is used for CAP (Huysmans, 2021). On top of that, the Dutch farmers protests have spread throughout Europe, and now Belgian, German and French farmers are also protesting budget cuts and 'impossible' strategies and reforms for the agriculture sector (NU, 2023; NU, 2024; Bürmann, 2023).

In the timeline in figure 1.2 you can see all these developments and the setbacks they cause for sustainable development in the European agriculture sector. Whether you agree or not, the amount of protest against current policies and measures is disruptive to our society and is counter-productive for sustainable development. We need a change. We need to allow time for a transition to ensure the livelihoods of farmers. And at the same time we need to make sure a transition happens, to repair our ecosystem and ensure future generations of a flourishing Planet Earth.



ional farmer's protest in
Hague 16 October 2019

National farmer's protest in
The Hague 19 February 2020

Limitations on the use of concentrated feed are lifted due to drought

19 AUGUST 2020

around
nounced:
on of
ivestock

Protecting the environment from nitrogen is laid down binding

13 OCTOBER 2020

Nitrogen legislation starts in practive:
- buy-out programme
- reviewed PAS policy
- transition programme

NOVEMBER 2020

National nitrogen law goes in effect

1 JULY 2021

Final green light for controversial PAS policy

15 JULY 2022

Nitrogen reduction programme, a strategy for the nitrogen legislation, starts. Earlier announced expansion and speeding of the programme are **not** part of the strategy

16 DECEMBER 2022

European

Allowances in MSR from previous years become invalid

1 JANUARY 2023

German farmers start protesting against budget cuts and European measures

18 DECEMBER 2023

German farmer's protest 18 December 2023

German farmer's protest 8 January 2024

Deal

ts on

French farmer's protest 23 January 2024

French farmer's start protesting national strategies following European climate goals

16 JANUARY 2024

Belgian farmers protest in Brussels against climate measures

26 FEBRUARY2024

Belgian farmer's protest in Brussels 26 February 2024

Figure 1.2 Timeline of the nitrogen crisis in Europe
(Source: ANP, 2024; Imago Stock & People GmbH, 2024; NRC, 2022, Reuters, 2023; De Waal, 2019)

1.3 STATEMENT OF URGENCY

When we map all these events, the ones breaking down the current agriculture system and the ones building up a new sustainable alternative, on an x-curve, we come to a painful conclusion: the breakdown process is much further along than the build up. The re-organising and redesigning of our food production system is an urgent matter. It is a transition that needs to happen, and you can see in the x-curve in figure 1.3, it is a transition that needs to happen now to prevent further escalation of the chaos that already exists.

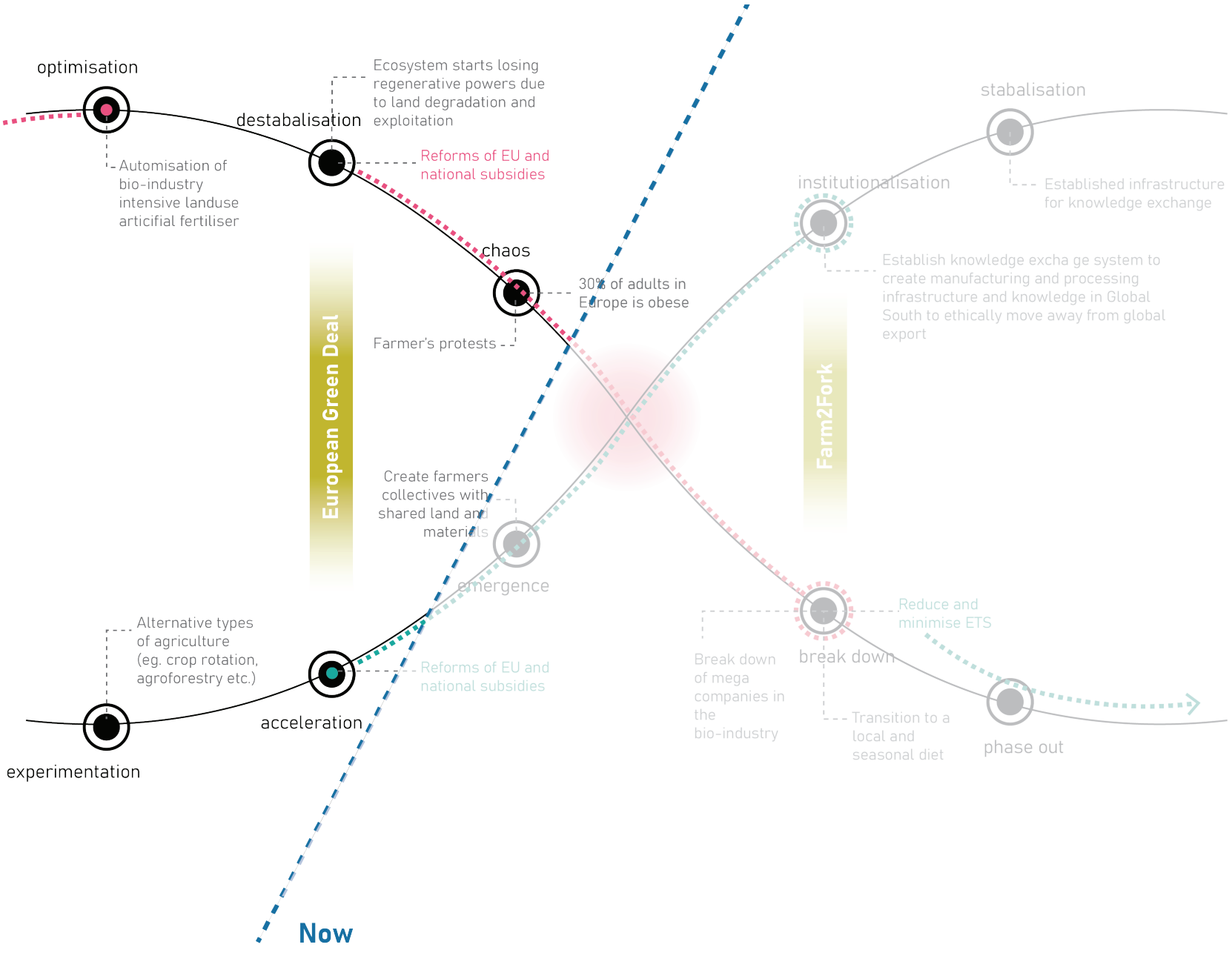


Figure 1.3 Statement of Urgency: the nitrogen crisis and agricultural transition on an x-curve

CHAPTER 2
PROJECT STRUCTURE

2.1 PROBLEM STATEMENT

Northwest Europe is a significant agricultural region, with countries like the Netherlands, Belgium, Germany, France, and the UK being **major producers of crops.**

Especially in densely populated areas with **intensive agriculture, artificial fertilisers** are used excessively, which can lead to **environmental issues such as groundwater pollution, eutrophication of water bodies, and air pollution** (Schulte-Uebbing et al., 2022; EEA and PBL, 2017).

Nitrogen fertilisers contribute to greenhouse gas emissions through processes such as **nitrous oxide (N2O) emissions and ammonia volatilisation**. Mitigating these emissions is essential for addressing climate change (Schulte-Uebbing et al., 2022).

The European Union (EU) has implemented **regulations and policies aimed at reducing nitrogen pollution** and promoting sustainable agriculture (CAP at a glance, 2024), but they are not received well, **nor are they making progress quick enough**.

In reducing the Nitrogen emission in the Netherlands, the government has implemented **measures to reduce nitrogen emissions from agricultural activities**, including promoting more sustainable farming practices, improving nutrient management, and reducing the use of nitrogen fertilisers. **Livestock farming needs to change**.

This includes **stricter regulations** on manure management and agricultural emissions that don't allow a slow transition, **leaving many farmers fear for their future.**

On top of that, **solely looking at livestock is not enough.** In agriculture, greenhouse farming contributes to nitrogen emissions, being the second largest polluter in the production sector.

2.2 CONCEPTUAL FRAMEWORK

From our initial analysis of the nitrogen crisis in Europe and the values that are incorporated into the problem statement, our interpretation of the true crisis, we developed a conceptual framework.

In today's world, we see a lot of extremes. In the agriculture sector, it feels as if the big bio-industry and large-scale farms stand directly opposite to the small-scale civilian initiatives of environmentally friendly farming. There seems to be almost no in-between. In terms of governance, it is always the big corporations, or the top-down, against the people, the bottom-up. We believe, however, that our solution should be a middle ground. We need to make a compromise between the endless growth and profit we seem to have chosen now and caring for our Earth. There is no one answer, the solution will lie within a range in the middle of these appearing opposites, as portrayed in figure 2.1. This is how we wish to position ourselves and this project in the current landscape.

If we then look at our actions, we think the key lies in these three domains: circularity in the food production system, localising food production and consumption, and sustainable landuse: creating a smart way of handling our Earth without exploiting it.
In between these domains we identified processes. To achieve circularity and localisation of production, you should diversify the land, biodiversity, and businessmodel of farms. To achieve localisation and sustainable landuse, you need to form collectives of farms that work together to create a balanced and complete skillset to produce food. To achieve sustainable landuse and circularity you will have to create conscious loops: smaller and closed loops. We need to be conscious about which flows go where, and try to find and create synergies within them. Our triangle of domains and processes, as portrayed in figure 2.2, and our positioning in the current landscape forms the basis of our conceptual framework.

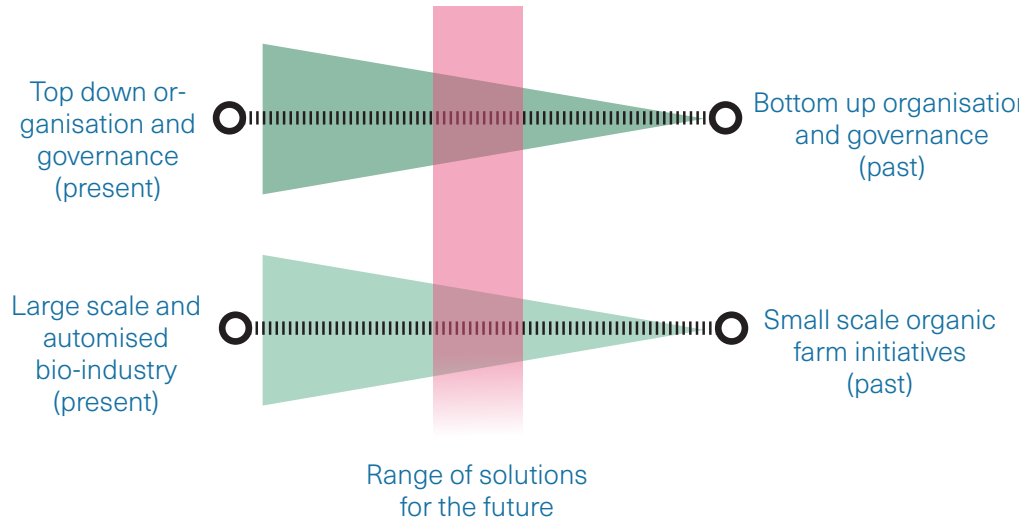


Figure 2.1 Position in the current landscape

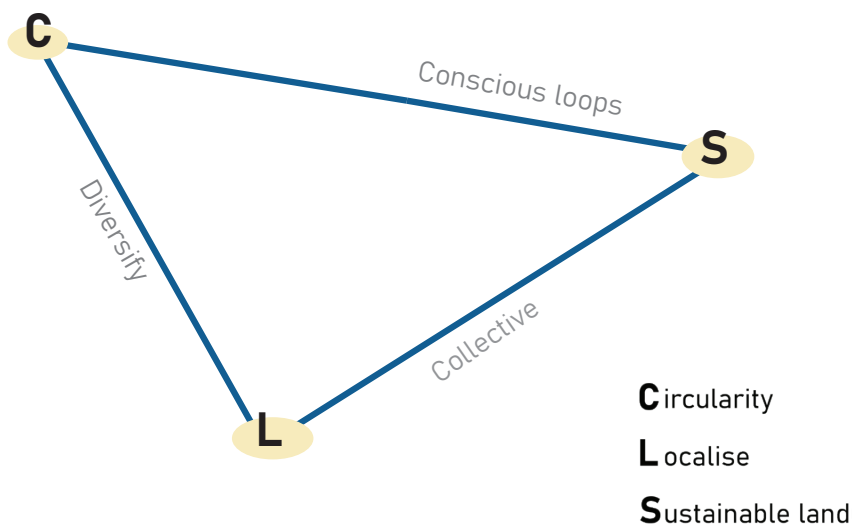


Figure 2.2 Domains and processes

Then, we bring in the concept of the donut; a social and planetary boundary, inspired by Doughnut Economics, by Kate Raworth (2017). All our actions need to happen within the planetary boundary of the finite resources of the Earth and allow for regeneration. For this we use the existing framework of the 5P's from the United Nations (2015): People, Planet, Prosperity, Peace, and Partnership. The social boundary is formed by the existing concept of the Doughnut Economy (Raworth, 2017) visible in figure 2.3, where sustainable development is enabled by taking into account the needs of society and the planet, creating a balance between these often contrasting dimensions.

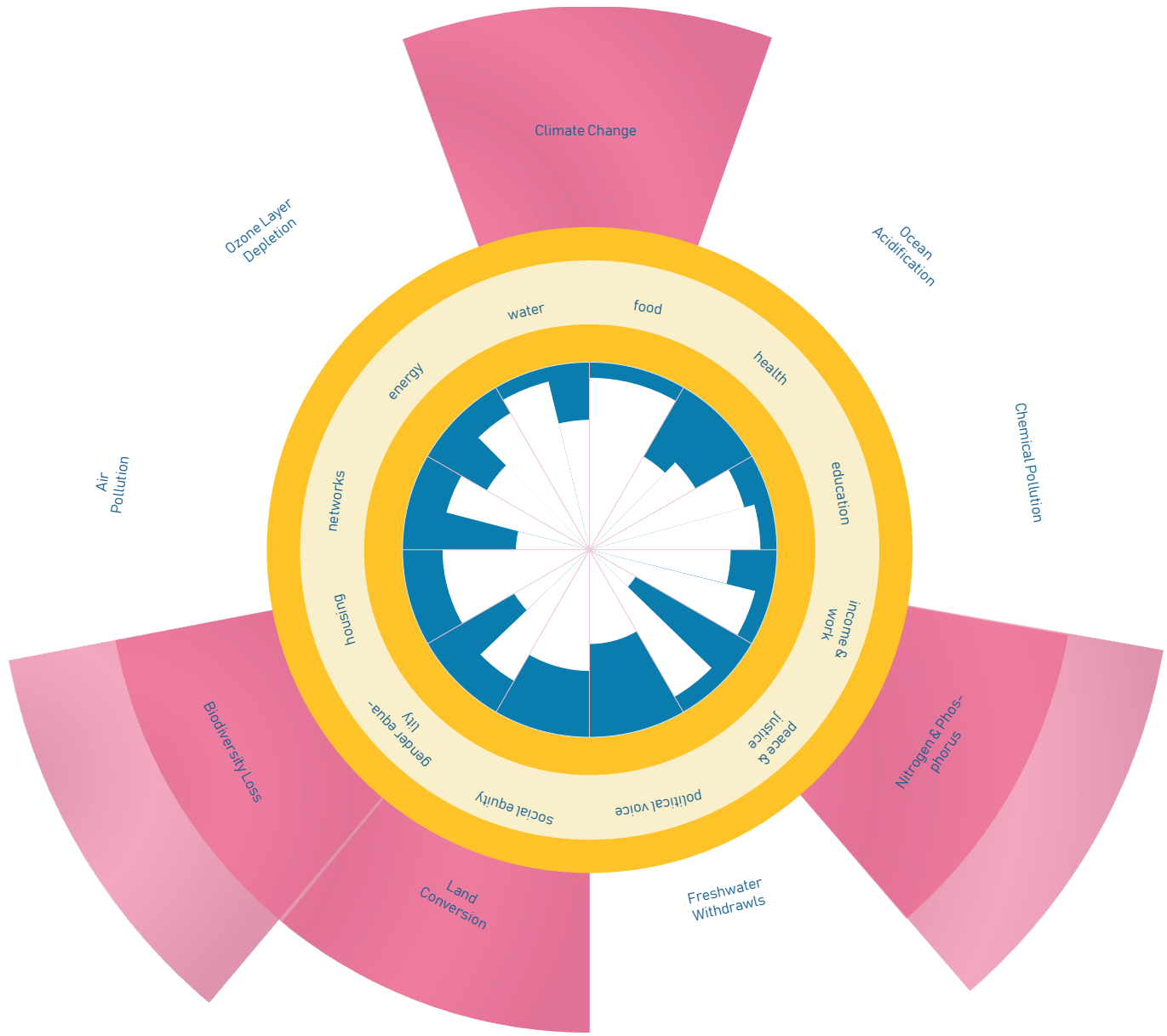


Figure 2.3 The Donut of planetary and social boundaries for society and economy, inspired by Raworth (2017)

The full conceptual framework, as shown in figure 2.4, shows how these different aspects act in different dimensions. Our positioning in the current landscape is within our actions and processes, and all of this together falls within the planetary and social boundaries. This framework reminds us of our important values within this project: to create a just world for the silent stakeholders, the Earth and ecosystem itself and future generations that depend on these ecosystem structures and services; and social needs of the people now, allowing a just transition and maintaining the livelihoods of farmers.

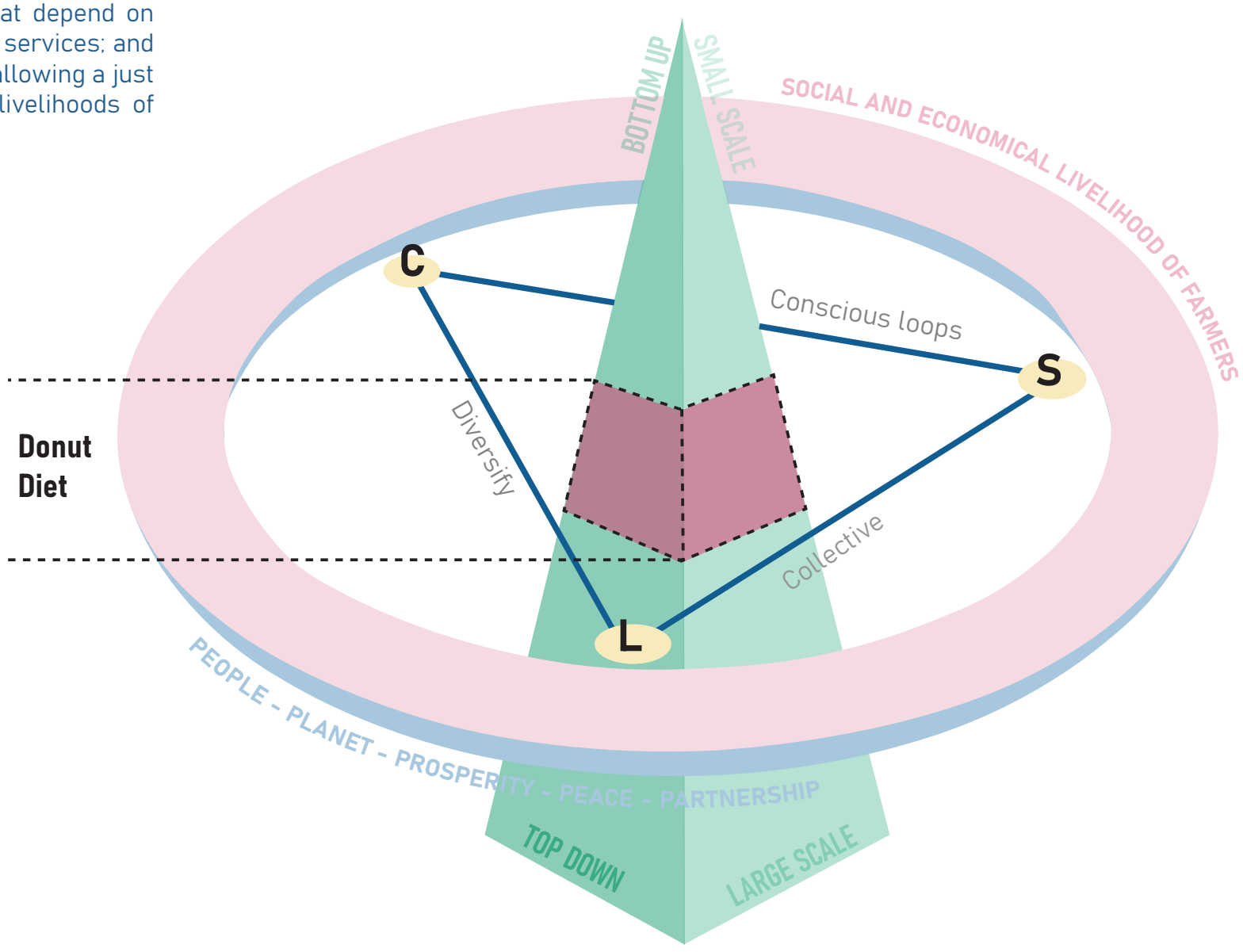


Figure 2.4 Conceptual framework

2.3 RESEARCH QUESTIONS

The problem statement and conceptual framework bring us to the following main research question:

How can we transform the agricultural sector into a more circular and environmentally friendly farming system, that helps feed the growing world population while staying within both social and planetary boundaries and enabling a just transition for farmers?

This main research question is essentially built up of multiple subquestions that we try to analyse, research and answer throughout the report. The first one is: 'How do we define an environmentally friendly farming system?'

With this question we create more insight into the available agriculture types and techniques there are, and try to find out which types might be a viable and sustainable option for the future.

The second subquestion is: 'How can we stay within social boundaries?'

For this question we analyse the role of the Netherlands in international food trade and research the dependencies in the world in terms of agriculture export. Can we indeed localise our food production, or does this just shift the problem to other parts of the world? Part of this question is also the social aspects for farmers in The Netherlands. We need to test our project and make sure it is a transition people can follow and eventually benefit from. We also realise a societal and behavioural shift will be essential to make our transition happen. How far can we push these changes and to what extend are they already happening?

The third subquestion is 'How can we stay within planetary boundaries?'

Overlapping with both of the previous subquestions, this hits the core of our project. We ananlyse the system and flows of nitrogen, and see how we can optimise and reorganise these flows to make closed and smaller loops.

In image 2.5, you can see how these research questions relate directly to the conceptual framework and form the basis of this project.

How can we transform the **agricultural sector** into a more circular and **environmentally friendly farming system,** that helps **feed the growing world population** while staying **within both social and planetary boundaries** and enabling a just transition for farmers?

How do we define an **environmentally friendly farming** system?

How can we stay within **social boundaries**?

How can we stay within **planetary boundaries**?

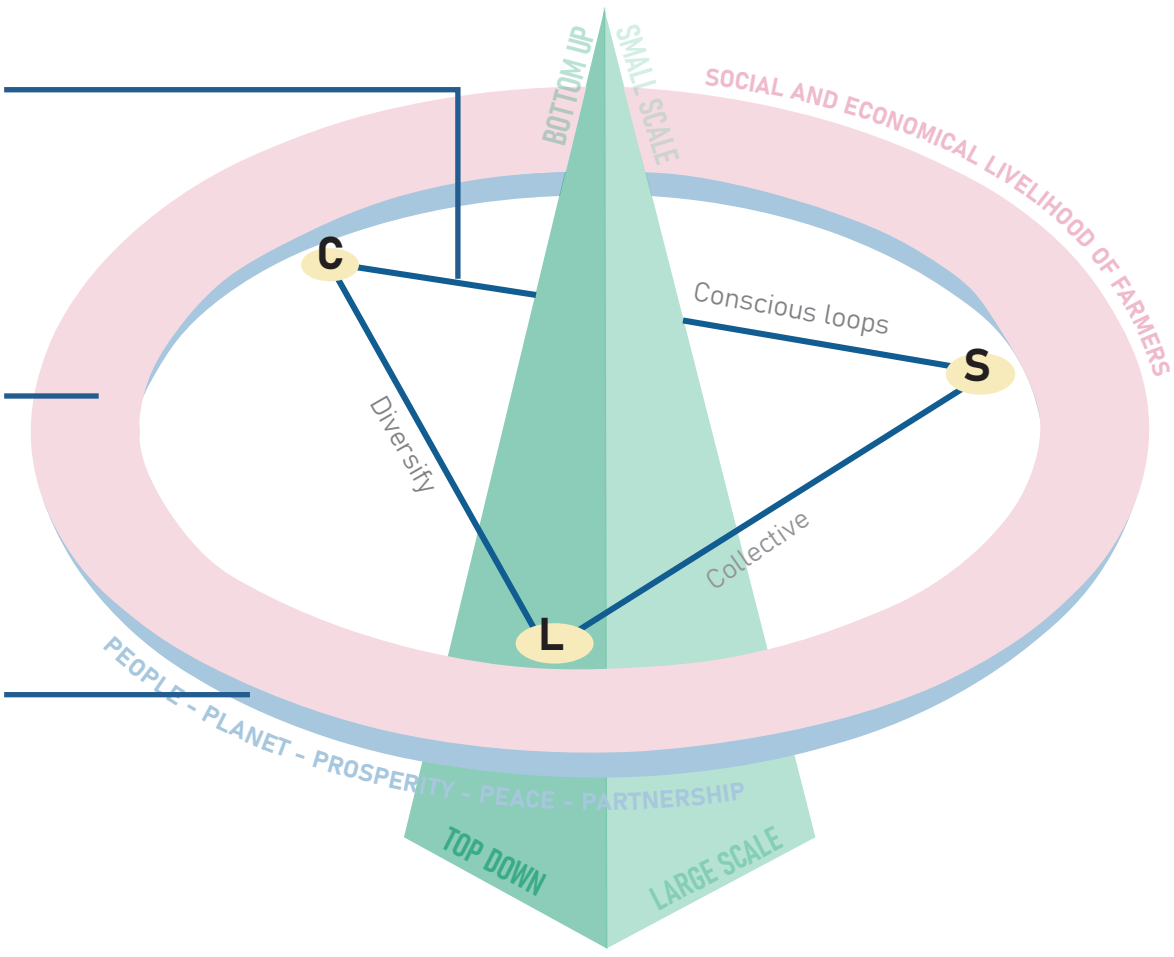
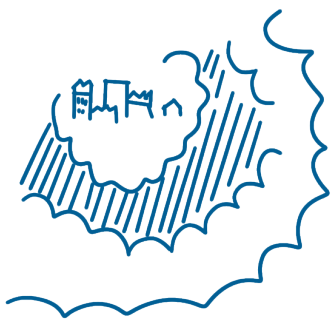


Figure 2.5 Research question and their relation to the conceptual framework

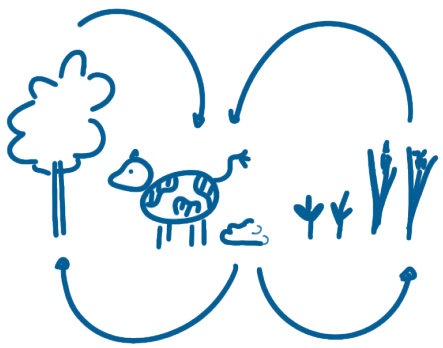
2.4 THEORETICAL FRAMEWORK

This project is largely based on our own analysis and broad literature review. However, some bodies of research are more central to our project and form the basis of our eventual vision and strategy. These we briefly introduce in this chapter, before we delve deeper into detail.



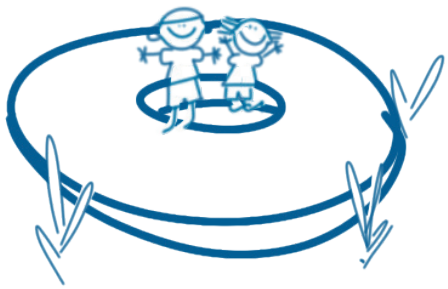
Urban, Peri-Urban, and Rural relationships

Peri-urban areas serve as transitional zones where agricultural activities intermingle with residential and industrial development. They typically face challenges of infrastructure strain and environmental degradation, and are therefore of particular interest. In contrast to bustling urban centres, rural areas are characterised by sparse populations, agricultural dominance and close-knit communities (Wandl et al., 2014).



Circular Economy

A circular economy focuses on creating closed-loop systems that aim to reduce the amount of necessary resources. Only when this is not possible, products and materials are reused, repaired or recycled at the end of their lifecycle. This model emphasises sustainable production and consumption practices, resulting in reduced environmental impact, increased resource efficiency, and long-term economic resilience (Wandl, 2024).



Doughnut Economics

The Doughnut Economy, introduced by economist Kate Raworth (2017), is a framework that aims to create a regenerative and inclusive economy that works for both people and the planet. It aims to ensure that everyone's basic needs are met without exceeding the Earth's ecological limits by promoting an equitable distribution of resources, encouraging sustainable practices and prioritising well-being over relentless growth (Raworth, 2017).

Regenerative agriculture practices

By mimicking natural processes, regenerative agriculture aims to restore soil health, increase biodiversity, and improve farmers' livelihoods. In doing so, it builds resilience to climate change and reduces dependence on external inputs such as artificial fertilisers and pesticides, which are part of the problem in the nitrogen crisis. Common techniques include minimising soil disturbance and diversifying agriculture through practices such as crop rotation and agroforestry.

Agroforestry:
The integration of trees and shrubs with agricultural landscapes in order to improve soil fertility, water retention, biodiversity and both livestock and crop productivity.

Crop rotation:
Involves the systematic rotation of different crops in the same field over time to improve soil health, control pests and diseases, and increase overall agricultural productivity.

(Bertrand & Roberts, 2022; Basics of Agroforestry, 2021).

2.5 POLITICS, POLICIES AND SUBSIDIES

On EU level there are many policies and regulations already in place that impact the agricultural sector in the Netherlands.

The **Sustainable Development Goals** (SDG's)are a set of 17 global goals adopted by the United Nations to address a range of social, economic and environmental challenges and achieve a more sustainable and equitable future by 2030 (United Nations, 2023).

The **European Green Deal** is a comprehensive European Union initiative that aims to transform the region into a climate-neutral, sustainable and inclusive economy, addressing issues such as climate change, environmental degradation and social inequality through a range of policies and investments in green technologies, innovation and infrastructure (European Comission, 2021).

The **Leipzig Charter**, a European policy document, provides guidance for policy makers, urban planners, local authorities and stakeholders involved in urban development, setting out principles for sustainable and inclusive approaches to address urban challenges and promote social cohesion, economic prosperity and environmental sustainability (Bmwsb , 2024)

The **Paris Agreement** is an international treaty that aims to limit global warming to well below 2 degrees Celsius above pre-industrial levels, while promoting adaptation to the impacts of climate change and climate-resilient development pathways (United Nations, 2016).

The **National Ecological Network** (NEN) is a system of interconnected natural areas within a country designed to conserve biodiversity, protect ecosystems and promote sustainable land management practices to ensure the long-term health of the environment and the species that inhabit it. It includes among others "agricultural land under nature-friendly management" (Government of the Netherlands, 2024).

Natura 2000 is a network within the NEN. It consists of protected areas across the European Union designed to conserve Europe's most valuable and threatened species and habitats and to promote biodiversity conservation and sustainable land use. However, agricultural practices cannot be included in the Natura 2000 network, but in the NEN (European Environment Agency, 2023a).

Common Agriculture Policy (CAP) is, as the name suggests, the common policy that is used in Europe to regulate agriculture since 1962. It was first introduced to help with the reconstruction after World War II, and focused on a standard price for agricultural products, such as milk, butter and wine. Since then, the policy has been reformed multiple times. It now forms the guidelines for European agriculture subsidies, currently based on agriculture surface area with available bonuses for environmentally friendly farming initiatives (Timeline-CAP 2023-27, n.d.; CAP at a glance, 2024).

Emission Trading rights System (ETS) is the system used for emission rights of CO2, but also nitrogen by involved companies. The concept is that there are a limited amount of rights per year. These get divided over countries and companies and the rest are for sale. Companies themselves can also choose to sell their rights and emit less than they are 'permitted'. Rights that are unused at the end of the year can be transferred to the next calander year (Nederlandse Emissieautoriteit, 2023).

Challenges in politics

In this project, we will build upon the above mentioned policies. While most of them already form a good step forward, towards sustainable development of both the agriculture sector as the built environment, there are also big challenges to be tackled, especially concerning CAP. Subsidies for agriculture are still (indirectly) linked to prodcution, as they are now linked with surface area dedicated to agriculture. There have been efforts to change this, however, Europe voted against these changes. Because the CAP is so old, it needs unanimity on any decision to change it. However, some of the member states of the EU earn a lot of money through those subsidies and are therefore inclined to vote against abolising these subsidies, even though they limit sustainable development (Huysmans, 2021). On top of this, the political lobby of the agriculture sector is very active and powerful. Some big bio-industry companies have longstanding ties to politics. These organisations tend to vote against sustainable development for the long term, as their first priority is growth and profit (Huysmans, 2021).

Recently, the ETS has been increasingly critised as well. Emission rights are often not all used, leaving the rights themselves at a value too low to promote sustainable development over purchasing more rights. Each year the number of available rights decreases, but according to some, not fast enough to induce the necessary change in, for example, the energy and agriculture sector (Mast & De Ploeg, 2021).

Figure 2.6 Current policies that address the nitrogen crisis

2.6 METHODOLOGY

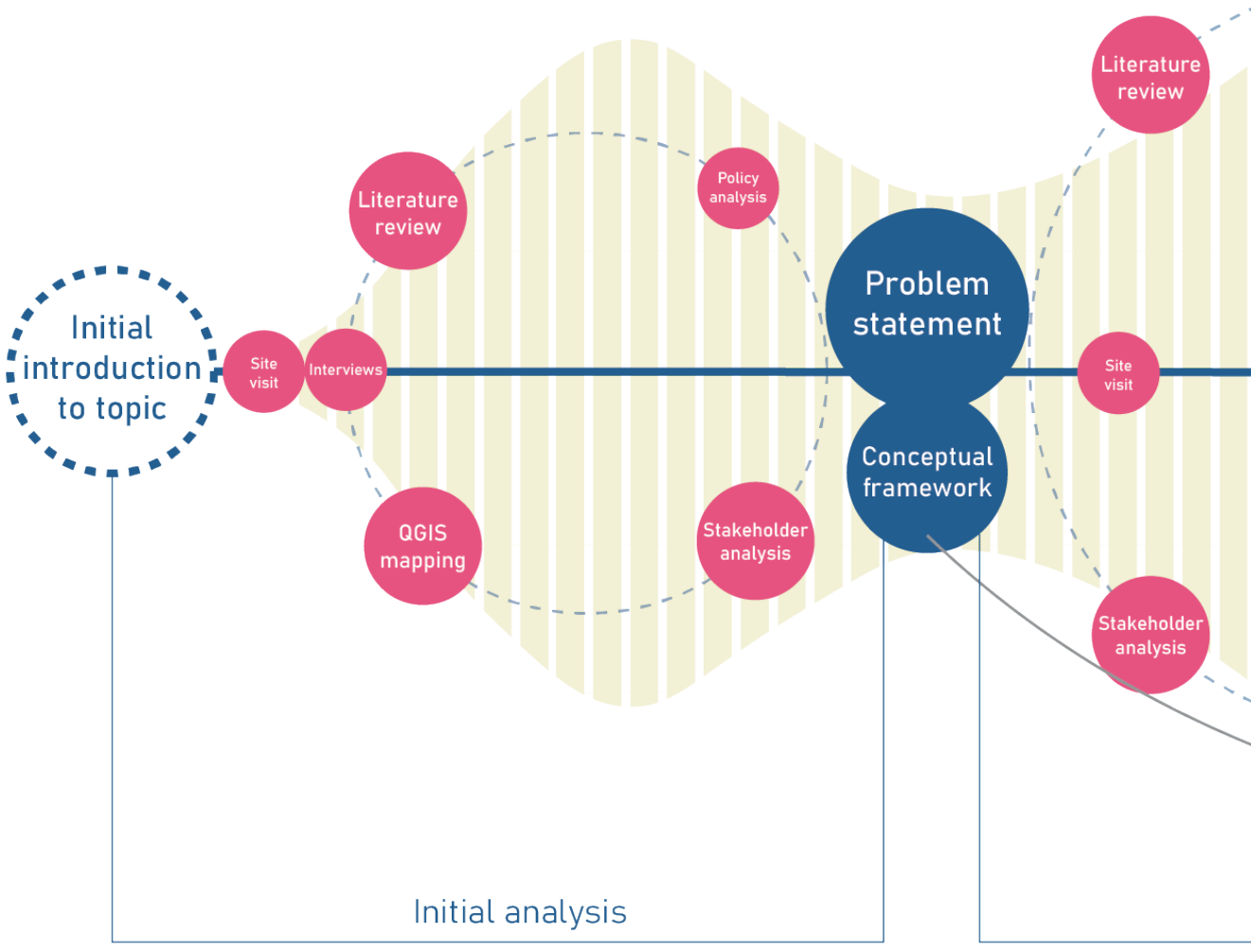
In the process of this project, we used many different methods and tools. In figure 2.6 you can see these methods, with a short explanation on how we used them and what they entail. Throughout the process, we used these methods multiple times, and in combination with each other, as iteration is key in urbanism.

Figure 2.6 also shows the key products and milestones in the project process. These milestones are used as placeholders in the methodology flowchart of figure 2.7 (on the next page) as they shaped the process of diverging and converging.

Figure 2.7 Legend of methodology flowchart: used methods with explanations and project milestones and products

As you can see in figure 2.7, some methods were used in only one part of the process, such as MCA and Pattern language, both specific to the strategy building. Other methods, however, are used multiple times, as they can bring useful insights into different phases of the project. Examples are the site visits and stakeholder analysis. Naturally, mapping in QGIS, data-analysis, and literature review are prominent in the first part of the process. Most methods are used in iteration and in combination with each other. This is why they are portrayed on a circle around the phase of the project. The site visits, however, are more of an acupunctural method that inspired us, without being a method that was applied throughout a longer period of time. This is why they are positioned on the timeline.

The green figure in the background of the flowchart shows the process of diverging and converging along the timeline of project milestones.



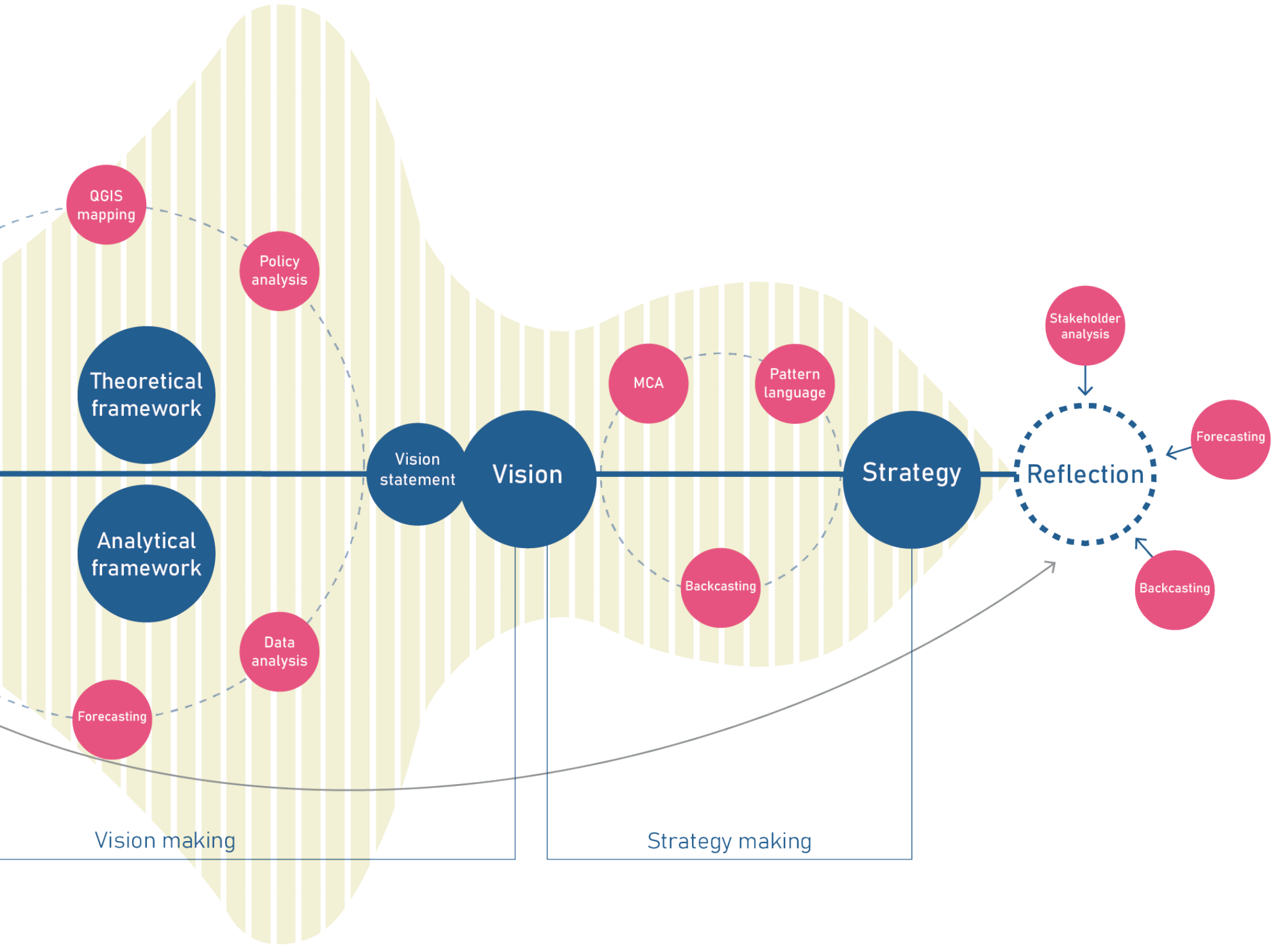


Figure 2.8 Methodology flowchart of the project process*

*The method of portraying the methodology flowchart is inspired by the 'From Pasture to Pathway' group of Q3 '22-'23.

3. ANALYSIS

3.1 NITROGEN POLLUTION SPATIALISED

Spatialising the Nitrogen problem will help us close in on areas that require the most attention. North-Western Europe is predominantly being used for agriculture, and the Netherlands percentage even goes up to 66%. The map on the right clearly shows different agricultural patterns between countries. Different forms of agriculture emit different nitrogen emissions on different levels.

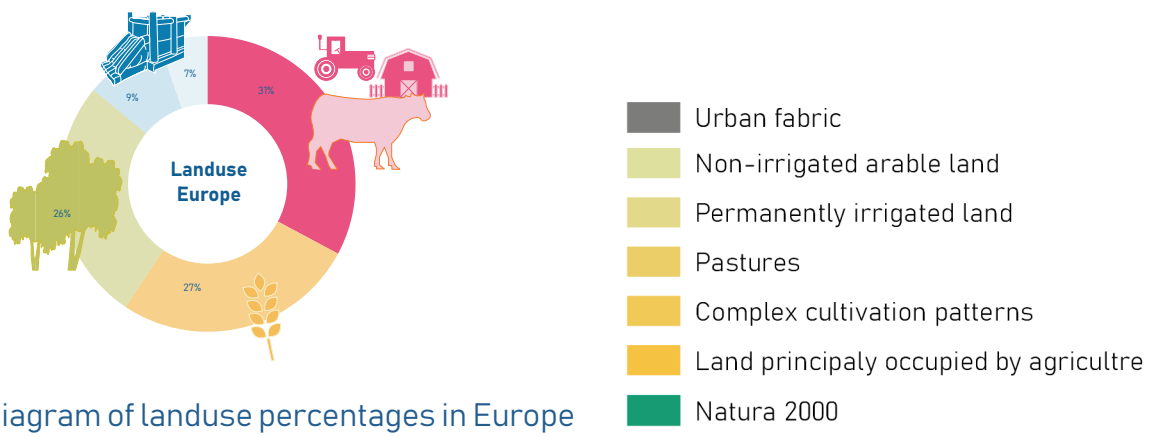


Figure 3.1 Diagram of landuse percentages in Europe

NITROGEN POLLUTION

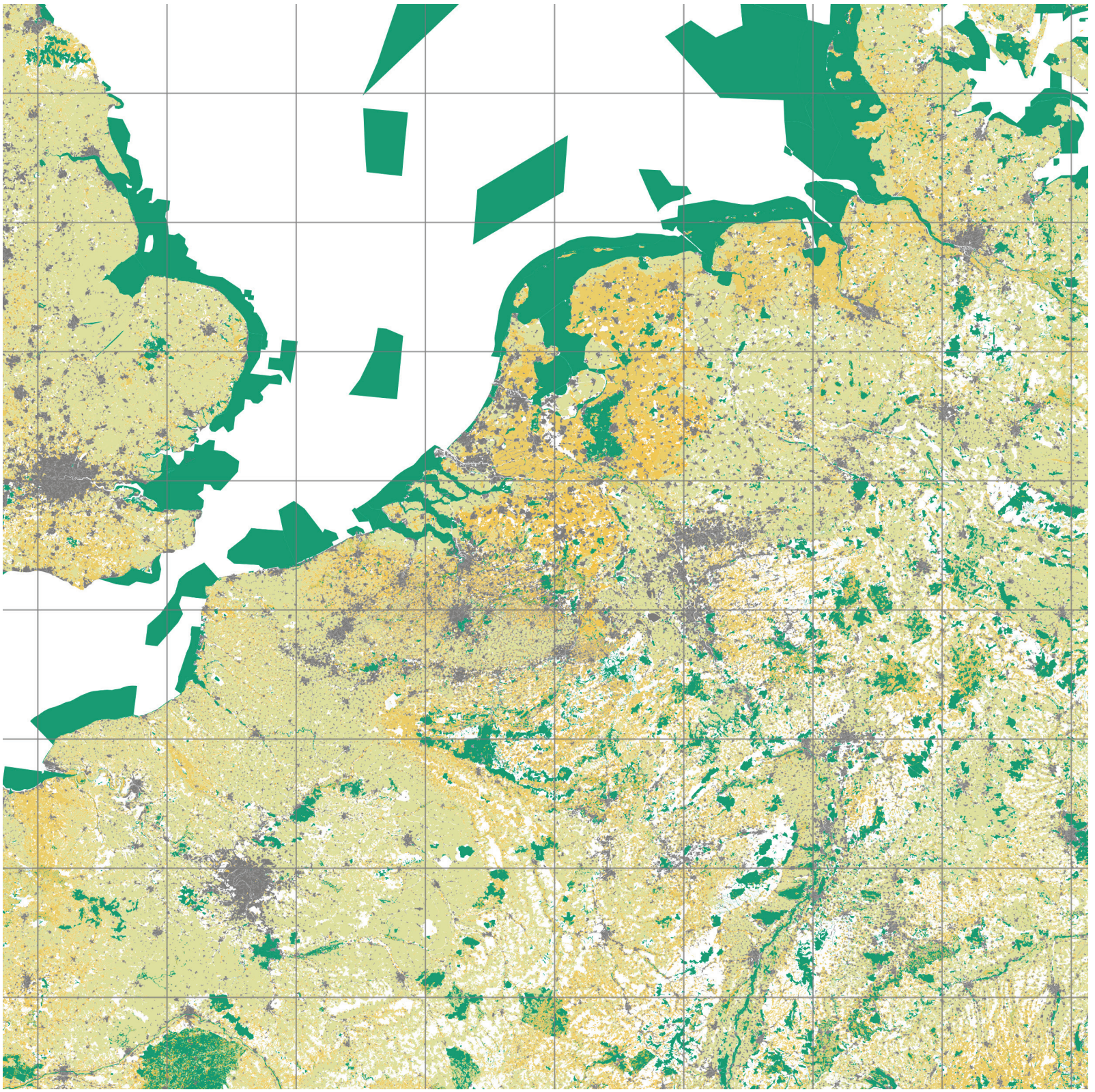


Figure 3.2 Nitrogen pollution in North-Western Europe

0 75 150 km

By looking at the amount of NOx and NH3 in the air clusters of excess emissions that are hurting neighbouring natura 2000 areas can be identified. The total emissions of NOx are clustered around cities, as only 19% of all NOx emissions comes from agriculture as shown in figure 3.3 and 3.6. However if we look at specific Nitrogen oxides like NO3, they stem almost solely from the agricultural sector.

By looking at the NOx and NH3 aerial emissions of just livestock agriculture three main hotspots can be identified that emit an excessive amount of nitrogen and ammonia. From western Germany, across the middle and Southern part of the Netherlands towards the Belgian coast a large line of excess agricultural emissions can be identified.

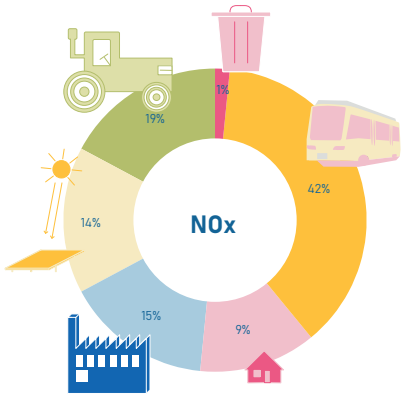


Figure 3.3 NOx emissions between sectors

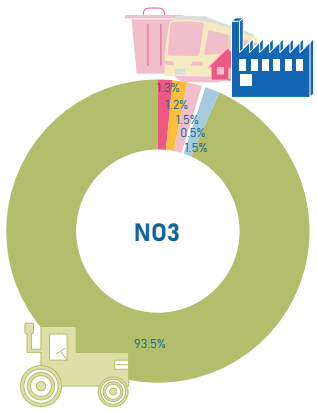


Figure 3.4 NO3 emissions between sectors

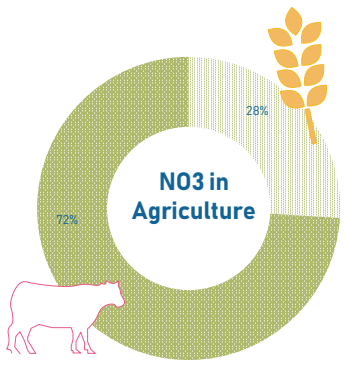


Figure 3.5 NO3 emissions in agriculture

Total NOx emissions in mg 2023
- 0 - 30
- 30 - 100
- 100 - 400
- 400 - 1000
- 1000 - 5000

Total NH3 emissions in mg 2023
- 0 - 312
- 312 - 623
- 623 - 935
- 935 - 1246

Livestock NH3 emissions in mg 2023
- 0 - 277
- 277 - 554
- 554 - 831
- 831 - 1107

Livestock NOx emissions in mg 2023
- 0 - 3,4
- 3,4 - 12
- 12 - 28
- 28 - 44
- 44 - 60
- Urban fabric
- Agriculture

NITROGEN POLLUTION LIVESTOCK

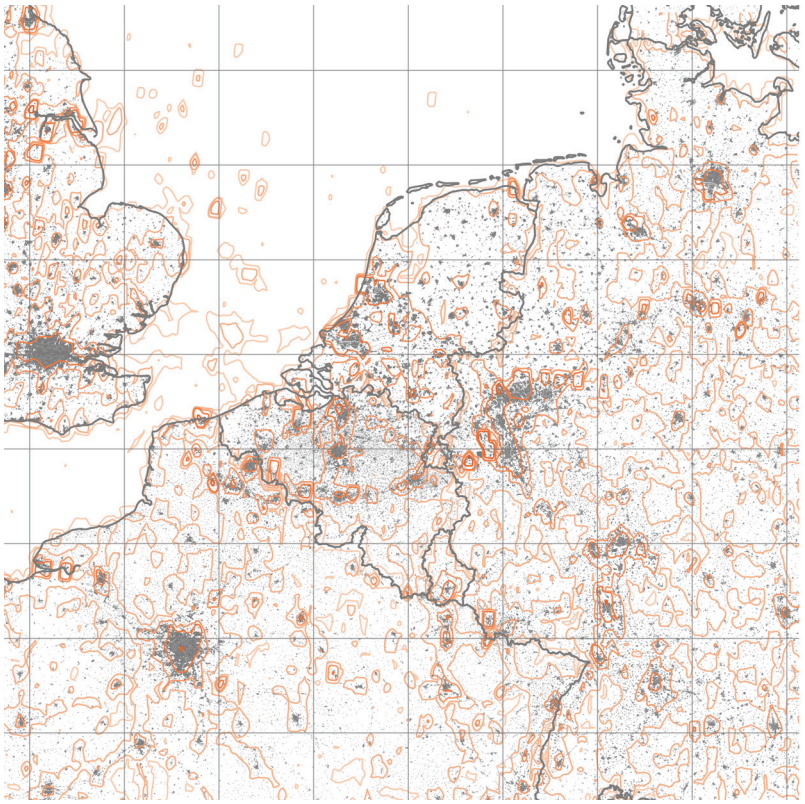


Figure 3.7 NH3 emissions and proximity to urban areas

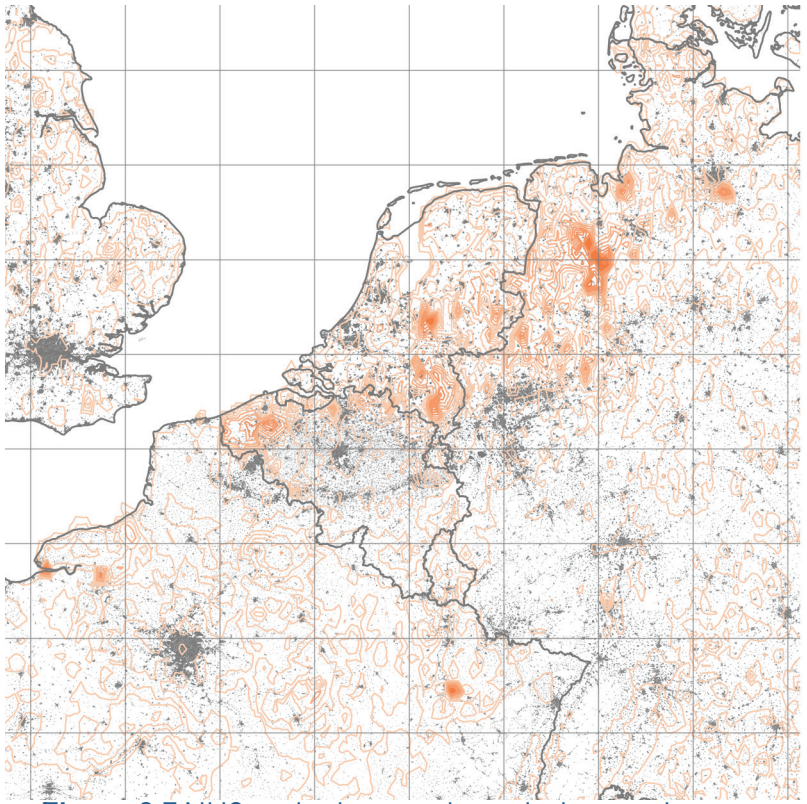


Figure 3.9 NOx emissions and proximity of agriculture

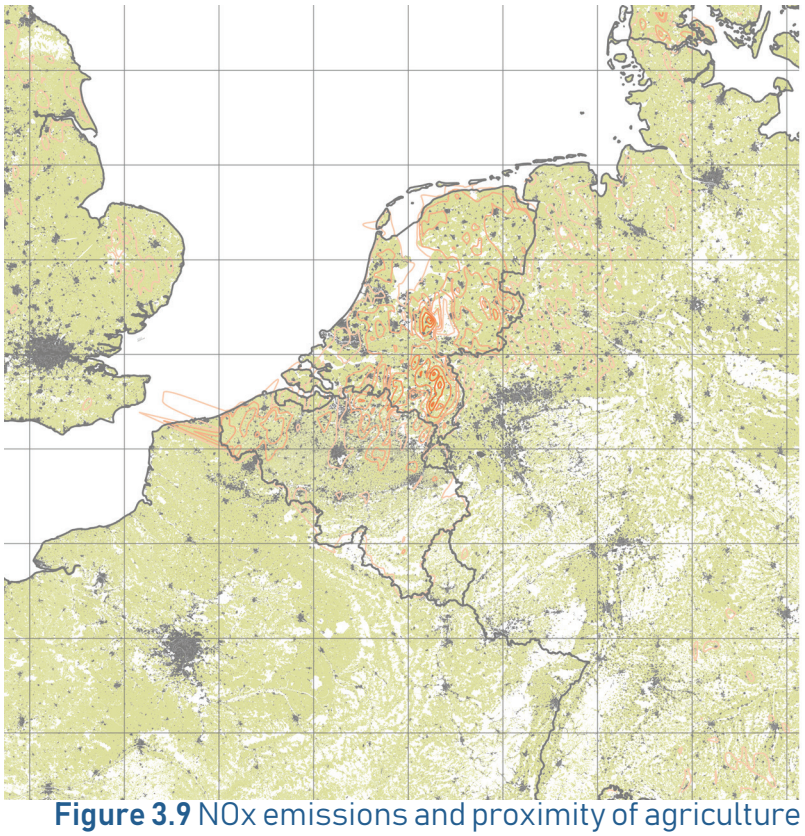


Figure 3.9 NH3 emissions and proximity of agriculture

When we compare the livestock emissions with NOx emissions of the crop sector within agriculture, the areas that produce excess emissions are more spread out, not singling out on one specific location.

NOx emissions from crops result in nearly half of total NOx emissions from agriculture with the amount of emissions going up to 100 mg in the air compared to the 60 of livestock farming.

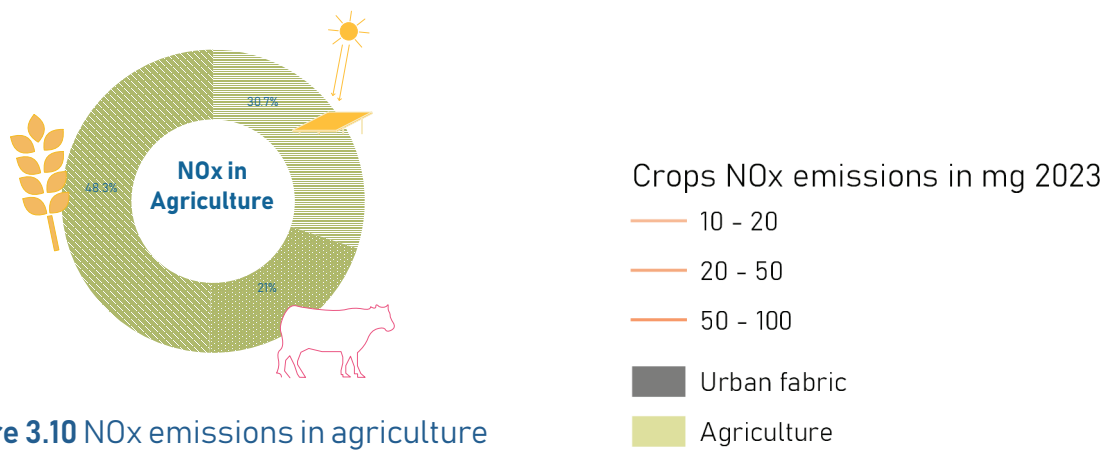


Figure 3.10 NOx emissions in agriculture

NITROGEN POLLUTION CROPS

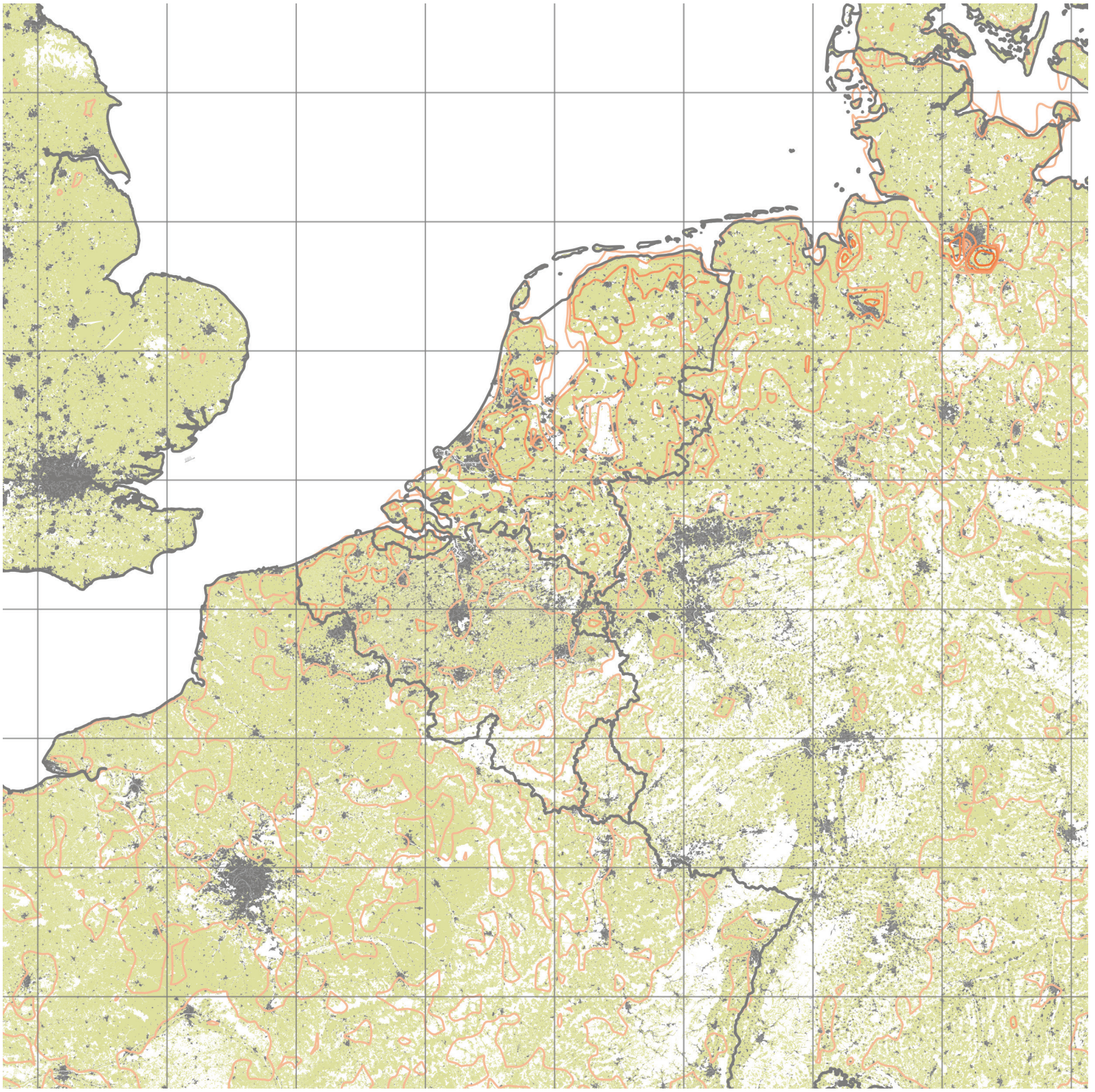


Figure 3.11 Nitrogen pollution from crop cultivation in North Western Europe

Excess emissions lead to eutrophication and biodiversity loss, thus being a threat to nature. With eutrophication and biodiversity loss, these emissions are risking the survivability of nature. Agricultural practices are not allow within Natura 2000 areas, but instead they are still harmed by them due to their closeness to agricultural areas.

The big factor behind this is wind. The wind, that generally blows from the south-Western direction, blows large parts of these emissions to adjacent natura 2000 areas where these air pollutants land on the ground.

Another factor is air pollutants landing in water, which are then taken away to other areas by runoff, leading to the beforementioned problems.

Concluding, the total area and land that suffers form direct and indirect consequences of the excess emissions of Nitrogen by the agricultural sector in North-Westen Europe is way larger than just the zones that the Nitrogen is being emitted in

Livestock NOx emissions in mg 2023

- 0 - 3,4
- 3,4 - 12
- 12 - 28
- 28 - 44
- 44 - 60

Livestock NH3 emissions in mg 2023

- 0 - 277
- 277 - 554
- 554 - 831
- 831 - 1107

- Agriculture
- Natura 2000

NITROGEN POLLUTION NATURE

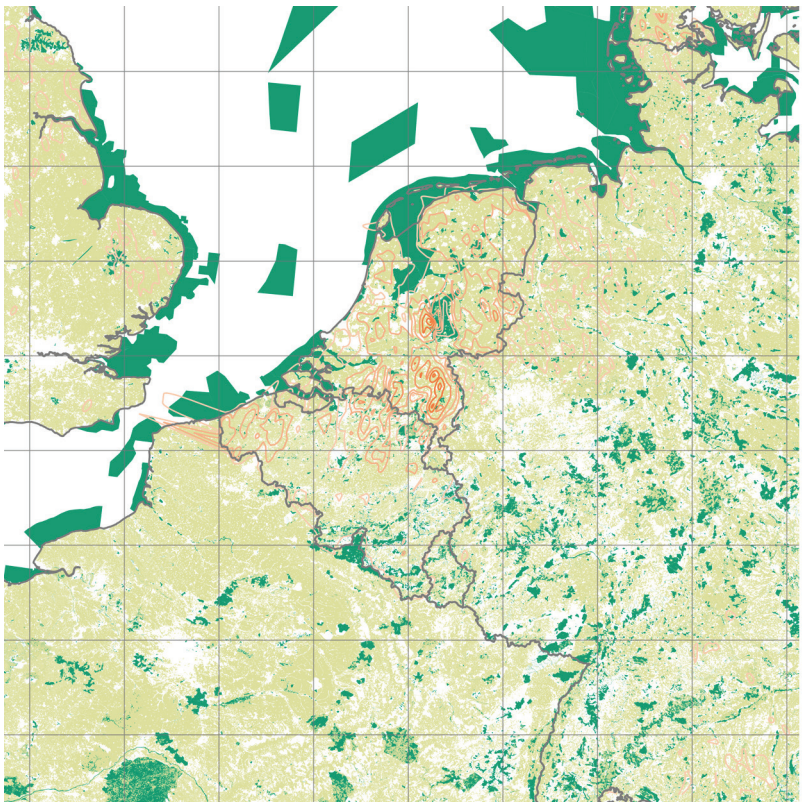


Figure 3.12 N0x emissions and proximity to protected natural areas

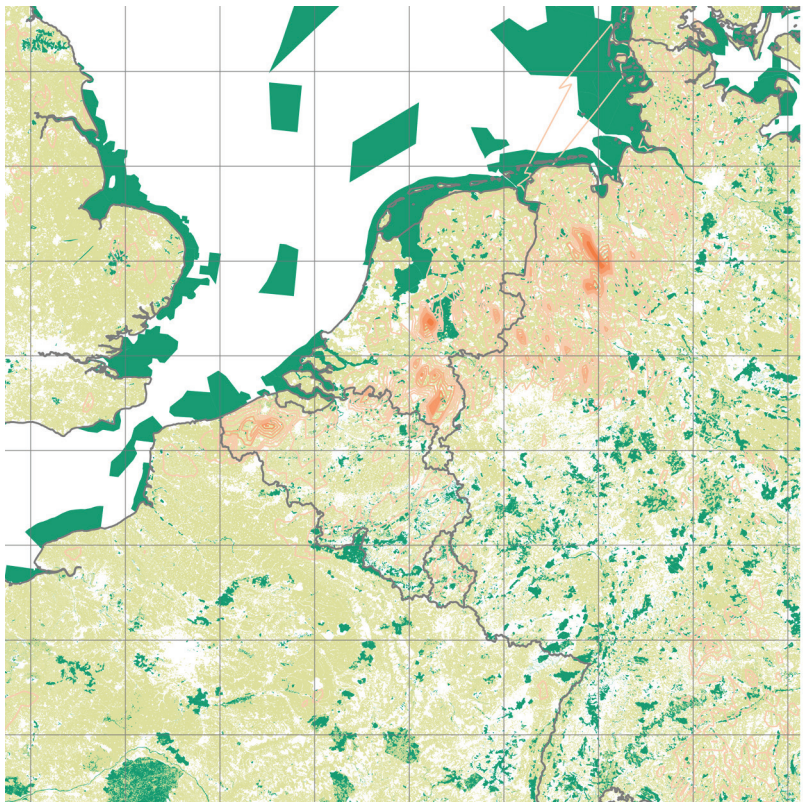


Figure 3.13 NH3 emissions and proximity to protected natural areas

3.2 AGRICULTURAL FLOWS

Intensive farming aims to maximise yields and profits by producing large quantitites on a small amount of land. If this is applied to both livestock and arable farming and leads to overuse of nitrogen.

Livestock farming is the main source of nitrogen emission in the agricultural sector. In the Netherlands, both dairy (figure 3.14) and meat (figure 3.15) production typically operate as separate sectors, each with its own characteristics and practices. Despite this separation, both intensive dairy farming and meat production have common features, such as the confinement of animals in high-density facilities where they are fed high-energy diets to increase milk yield or rapid meat growth.

The main source of nitrogen in agriculture is the protein-rich feed consumed by livestock. This nitrogen is mainly excreted in urine and faeces. When these excreta are applied to agricultural land as manure, they contribute to the overload of nitrogen in the environment (European Environment Agency. 2021; EFSA. 2020).

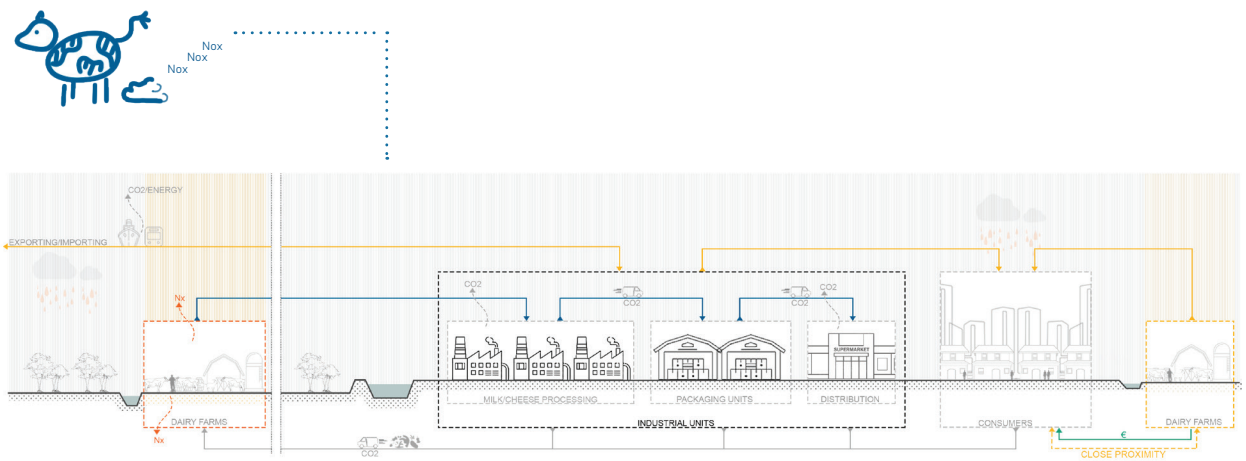


Figure 3.14 Systemic section showing the current dairy farming flows

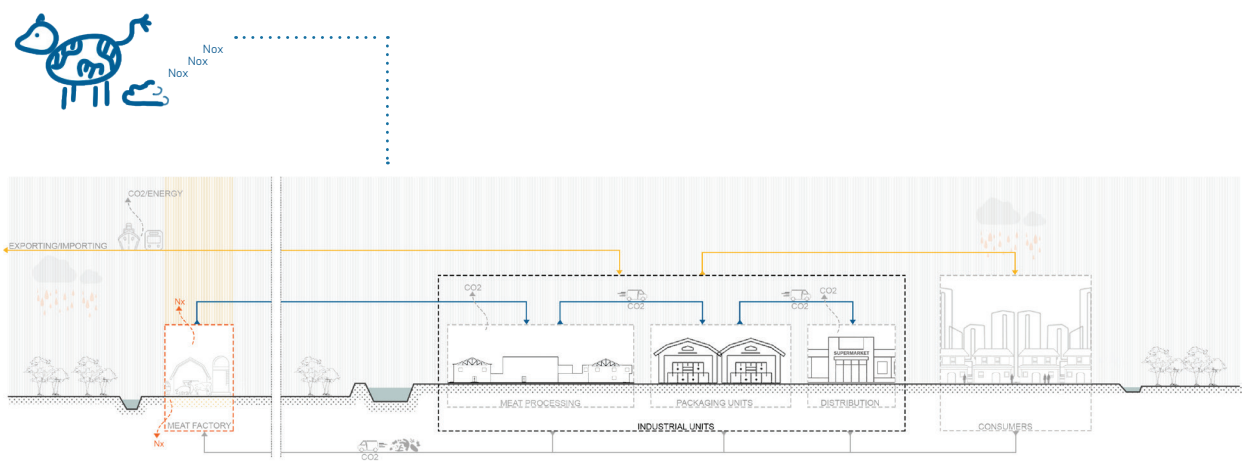


Figure 3.15 Systemic section showing the current meat farming flows

In greenhouse agriculture in particular, as shown in figure 3.16, nitrogen overuse is a major concern because of its role in achieving high crop yields under controlled conditions (Schieland en de Krimpenerwaard, 2022).

But even high yields on a field of specialised crops, as showed in figure 3.17, require the use of synthetic fertilisers to keep the soil fertile after planting the same crops over and over again, reducing the natural nutrients in the soil. In addition, pesticides are used more excessively to combat the increased susceptibility to pests associated with mono-functional farming.

While intensification brings short-term gains, the nitrate NH3 emitted from fertilisers in particular is a burden on the environment, leading in particular to soil degradation, water pollution and loss of biodiversity. Nitrous oxides, on the other hand, cause air pollution and exacerbate climate change concerns (European Environment Agency. 2023).

However, the environmental impact goes beyond nitrogen alone. Transporting agricultural products to processing units, followed by washing, packaging and distribution, generates significant CO2 emissions, further exacerbating environmental degradation. A holistic approach to sustainable agriculture is therefore essential, addressing not only nitrogen management but also the entire supply chain to minimise carbon footprints and promote environmental stewardship.

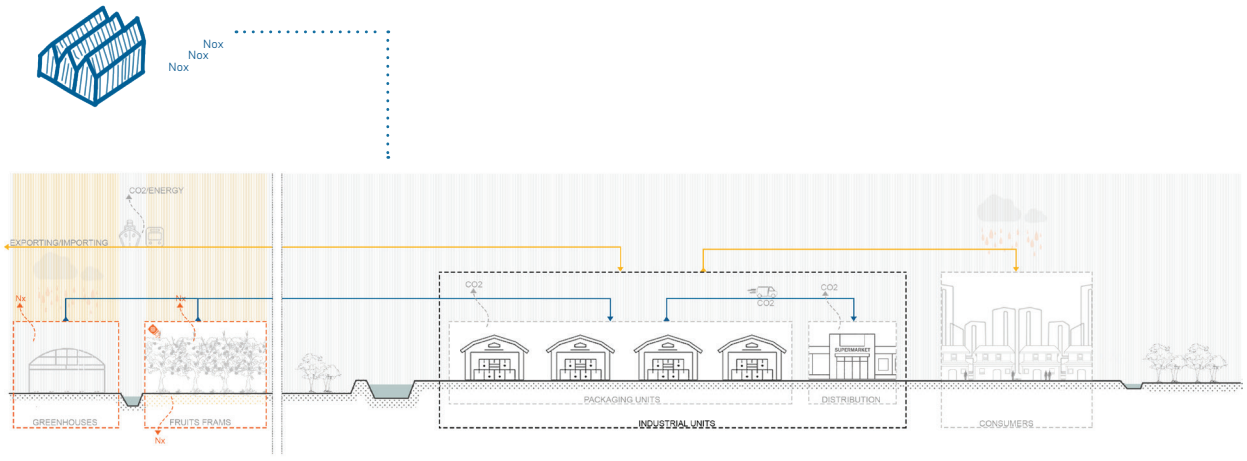


Figure 3.16 Systemic section showing the current dairy farming flows

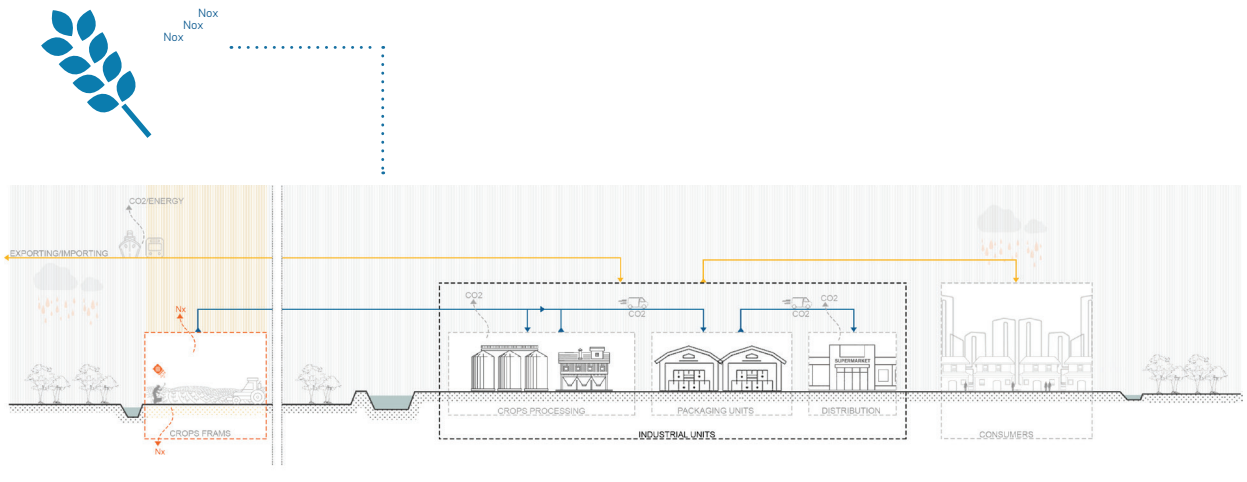


Figure 3.17 Systemic section showing the current meat farming flows

3.3 IMPORT AND EXPORT RELATIONS IN AGRICULTURE

The Netherlands is known as an important agriculture country; they are the second biggest exporter of agricultural products in the world. Even though this may be true, it is also a misleading statement. Merely 1,5-2% of the Dutch GDP consists of agriculture (World Bank, 2023). While still an important chunck, you can understand how the 1,5-2 percent might be much less significant to the Dutch economy than the statement 'the second biggest exporter in the world,' might make it seem to be.

Another misconception is that 'The Netherlands feeds the world'. Let's look at that a bit closer. In 2021, The Netherlands exported 124B dollars worth of agriculture products to all over the world (Harvard Kennedy School & Domingo, 2022). However, when taking a closer look at where these products are exported to and what exactly is exported, not everything is of equal necessity.

To assess the necessity of the Dutch agriculture export, we analysed the exported products and classified them as (1) basic needs and raw foods, (2) medium grade products, and (3) luxury products. Only 12,60% of the Dutch agriculture export classified as basic needs and raw foods. This 12,60% means that only 15,6B dollars of the 124B dollars of total agricultural products classify as 'basic needs and raw foods' (Harvard Kennedy School & Domingo, 2022).

The Netherlands mostly exports within Europe, countries that generally have a similar climate and knowledge system to create their own food. The same goes for North America. We looked closer into continents that fall under the Global South, as these are the countries that might be considered 'dependent' on Dutch food production. Again, we filtered the imports with the same classification of basic needs and raw foods, medium grade products, and luxury products and only looked at the basic needs and raw foods.

In 2021, the products under the category basic needs and raw foods exported to Africa, Asia, South America and Central America respectively consist of merely 0,54%, 0,86%, 0,03%, and 0,11% of the total Dutch agriculture export that year (Harvard Kennedy School & Domingo, 2022).

These percentages are obviously quite small from the perspective of The Netherlands. This does not mean, we do not recognise the importance these products might have in areas in need. We do, however, trust that slowly phasing international export out and replacing it with knowledge exchange to replace these product flows will be a sufficient approach, without leading to shortages of food. An important product in the basic needs and raw foods category is 'seeds used for sowing'. This product will probably have to remain part of international export for a longer time, and can be incorporated in the future knowledge exchange flows.

The full export analysis can be found in the appendix 8.2.

more regional
and seasonal production

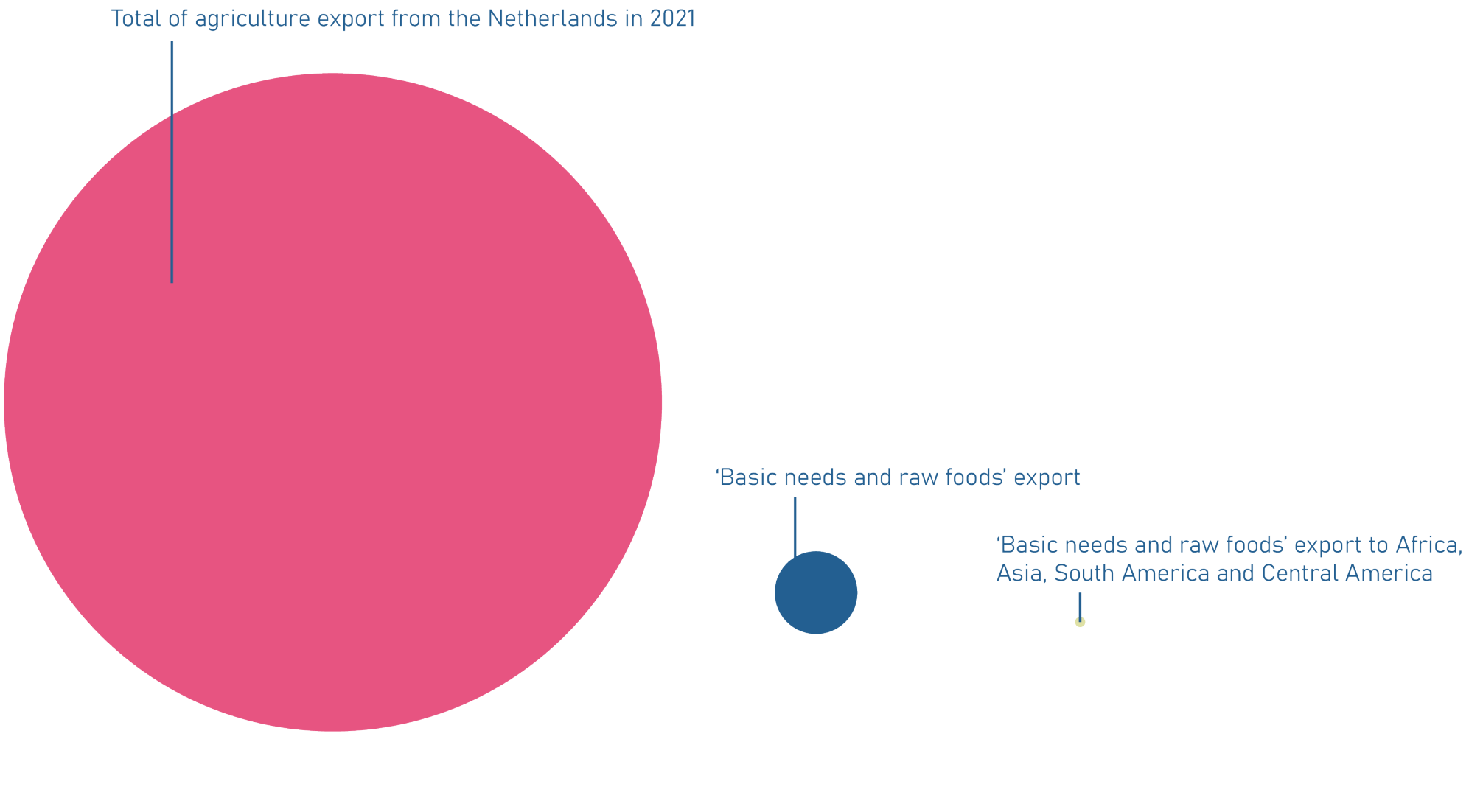


Figure 3.18 Shares of agriculture export from The Netherlands

3.4 STAKEHOLDER ANALYSIS AND ETHICAL CONSIDERATIONS

A complex and broad issue like the nitrogen crisis and changing a complete system such as our agriculture system knows a lot of stakeholders. Throughout multiple workshops and sessions, we have gathered these stakeholders and placed them in a power/interest diagram as shown in figure 3.19 and 3.20.

As you can see the types of stakeholders varies wildly. We are dealing with both national municipalities and powerful economic institutions like the port of Rotterdam, while also dealing with the needs of individual citizens. To give a little more structure to these stakeholders, we categorised some of them based on motive: a financial motive with power, a financial motive without direct power, and a personal motive. Putting a glance on the power/interest diagram, most stakeholders with a financial motive and power, have little interest in a sustainability transition for the agriculture sector. The people whose livelihood depends on it, however, citizens and farmers, the stakeholders with personal motives, have little power.

In figure 3.20 you can see which shifts in the power/interest diagram we hope to achieve by applying our vision and strategy to the agriculture sector. We want to give agency back to farmers themselves and disperse the power of large bio-industry companies and the agriculture lobby.

This relates directly to our values, described earlier in the conceptual framework (chapter 2.2). We allow for a just transition, with sufficient support and time for farmers, so that they can turn their very livelihoods into a sustainable model also. Part of this is to give them agency in this transition. A large part of the work will come from them, but so will the returns.

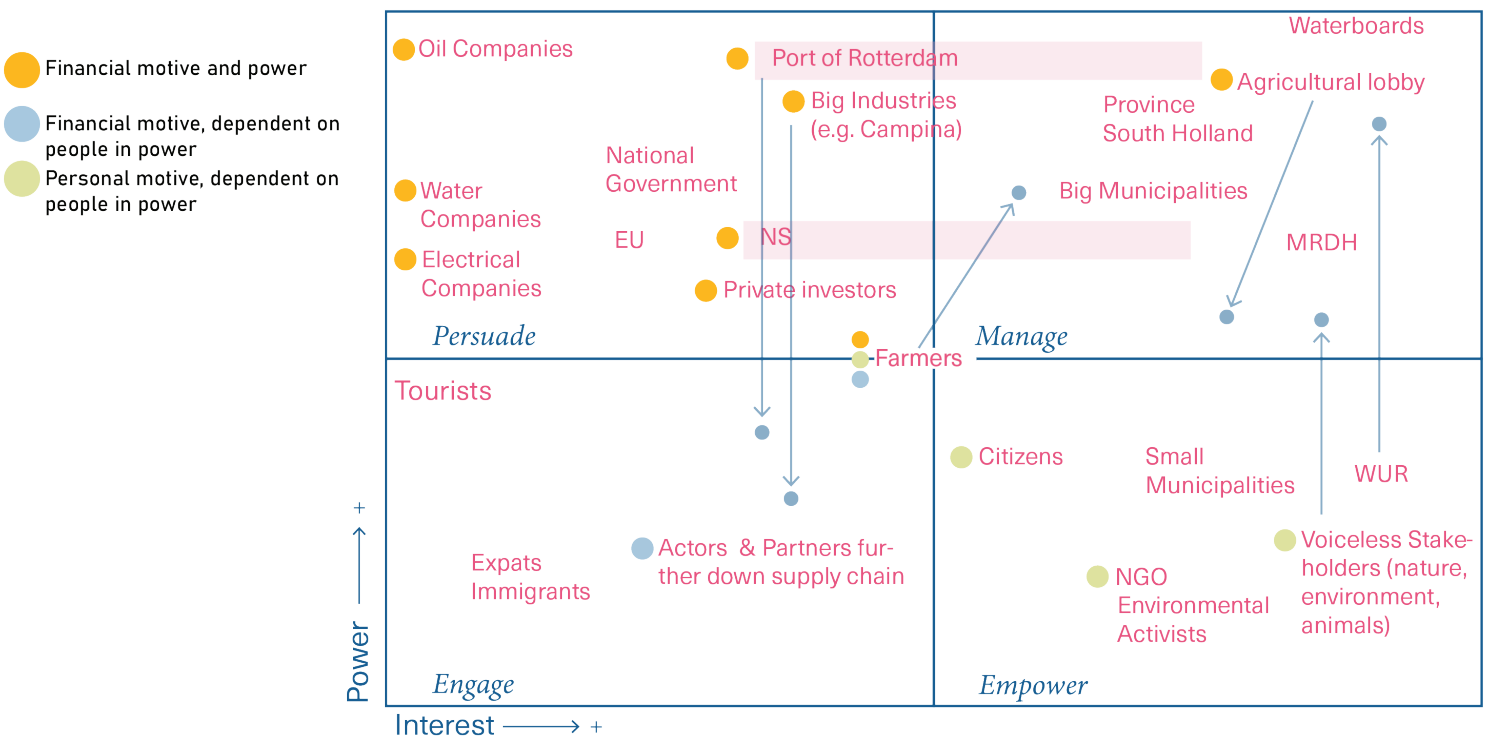


Figure 3.19 Stakeholders in Power/Interest diagram

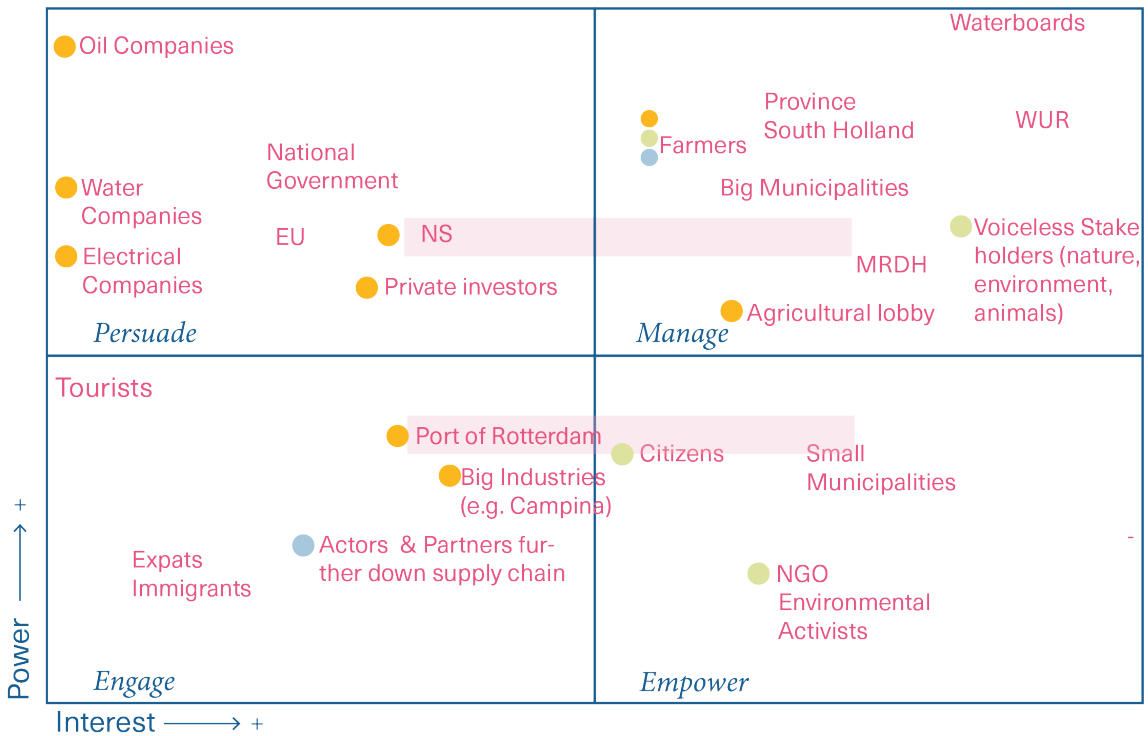
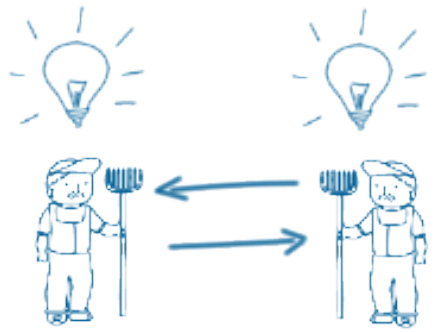


Figure 3.20 Stakeholders in Power/Interest diagram with desired shifts

CHAPTER 4
OUR VISION
FOR A CIRCULAR, COLLECTIVE AND REGENERATIVE FUTURE

4.1 VALUES: CORE VALUES

Based on our analysis, we have defined specific core values that we believe can help us move from an agricultural system that exploits both nature and communities to a more holistic approach that will lead us to a future we want to be a part of.



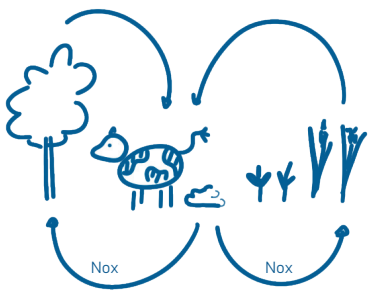
Collective farming and Knowledgs Exchange

By making farmers part of a collective, they are able to share knowledge, tools and land with each other, empowering them and making them less vulnerable for risks related to events such as extreme weather. Farmers will also play a bigger role of building up knowledge in the region about food and materials, by hosting workshops such as cooking or planting in return for a diversification of their business model.

Change Import and Export

Currently, the Global South is exploited for the benefit of the Global North. The prices we pay for our food are not fair, and we maintain this by keeping a lot of knowledge for ourselves. By strengthening knowledge flows between the Global North and South, farmers in the Global South are able to empower themselves and in the long term making them less dependent on the Global North, making local food production possible in both parts of the world.

With an increasingly globalised world, the import of food from all over the world became the norm. Having bananas in the supermarket is a luxury that very few people realise they have, and something that should not be taken lightly. This way of living has a huge impact on the climate because of the logistics that are necessary to maintain this lifestyle. If everyone would shift to eating more regional and seasonal food, these impactful logistic flows could be taken away and replaced by a local one, resulting in less pollution.



Conscious Loops

A lot of people are not aware of the imbalance of flows that currently occur in the agricultural sector. By making production, processing and other processes related to food and materials locally visible, people are made aware of the flows that are happening and thus become more conscious about them.

Increase Biodiversity

The current form of agriculture produces too much nitrogen, putting too much pressure on nature, eventually leading to the degradation of it. To restore the quality of nature and biodiversity the emission of nitrogen has to reduce significantly, for which a dramatic shift in the agricultural sector can not be avoided.

RELATION TO SDG'S

The Sustainable Development Goals (SDGs) are a set of 17 interconnected global goals adopted by all United Nations Member States in 2015, as part of the 2030 Agenda for Sustainable Development. These goals aim to address a range of social, economic and environmental challenges the world is facing today, with the overarching goal of achieving sustainable development by 2030.

Each goal is accompanied by specific targets and indicators to measure progress. The SDGs provide a universal framework for governments, planners, businesses, civil society and individuals to work together towards a more sustainable and equitable future for all. (United Nations, 2023)

We are aware of the importance of the SDGs in our role as planners. However, due to the short time frame, it is not possible to create a holistic project that addresses all SDGs in the same way. Therefore, we present the most relevant ones related to our vision and strategy for a new, circular and sustainable agricultural system in the Eurodelta. In this chapter, we will give a brief explanation of the importance and connection of each of the selected goals, as well as a link to the targets we are addressing in relation to our project.

Figure 4.1 Donut Diet related SDGs, sized according to relevance in this project (source: United Nations, 2023)

Zero Hunger

aims to end hunger, achieve food security, improve nutrition and promote sustainable agriculture by 2030

By creating a more equitable agricultural system, we are improving access to food. Rather than processing imported food, we believe that sharing knowledge is a key intervention in moving towards a more equitable distribution of resources. By considering both social and global boundaries, we hope to contribute to a more resilient future.
Target 2.3, 2.4, 2.5, 2.a, 2.b, 2.c

Clean Water and Sanitation

aims to ensure availability and sustainable management of water and sanitation for all, striving to achieve universal access to clean water and

adequate sanitation to improve health and well-being by 2030.

By closing water loops in agriculture through methods such as aquaponics and the ability to grow algae in wastewater, we are reducing some of the amount of water used in agriculture.
By further limiting the use of artificial fertilisers and enhanced feeds, we continue to contribute to less pollution and cleaner water, soil and air.
Target 6.3, 6.4, 6.6

Industry Innovation and Infrastructure

seeks to build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation by 2030

By revolutionising the technology and infrastructure associated with the agricultural sector, SDG 9 is one of the central objectives of our project.
Target 9.1, 9.3, 9.4, 9.5, 9.a, 9.b, 9.c

Life on Land

aims to protect, restore and promote sustainable use of terrestrial ecosystems, halt biodiversity loss and combat desertification and land degradation by 2030

One of the key drivers of this project is climate change. By redesigning our food production system and operating within planetary boundaries, we aim to restore the regenerative capacity of our ecosystem, halt the loss of biodiversity and restore a clean environment for people, plants and animals.
Target 15.1, 15.2, 15.5, 15.6, 15.8, 15.9, 15.a

Reduce Inequalities

focuses on reducing inequality within and among countries, striving to ensure equal opportunities and outcomes for all individuals regardless of their background, by 2030.

In our analysis and problem statement, we recognise that with the current policies and plans, farmers, especially in the north of the Netherlands, are burdened with solving a large part of the nitrogen crisis without the proper resources or time. We propose a new plan for a transition to a sustainable future where we address this inequality by providing the appropriate resources and time frame to make a sustainable transition. Of course, the inequalities in the Netherlands are relatively low if you look at them in context. That is why we say that we are indirectly contributing to this goal.
Target 10.2, 10.4, 10.6, 10.b

Sustainable Cities and Communities

aims to make cities and human settlements inclusive, safe, resilient, and sustainable by promoting urban planning, infrastructure development, and access to basic services for all by 2030

Our new approach to food production changes the relationship between the urban and the peri-urban. We are creating a more connected and equitable urban fabric and community. The peri-urban no longer carries the burdens of the city, it is the heart of production and therefore of amenity. Consumption flows will now flow directly into the production areas. In addition, the urban will share some of the burden of food production in the future.
Target 11.3, 11.4, 11.6, 11.7, 11.a, 11.c

Responsible Comsumption and Production

promotes sustainable consumption and production patterns, encouraging responsible resource use, waste reduction, and efficient management of natural resources to minimize environmental impact by 2030.

By designing a new agricultural system that operates within planetary boundaries, we are creating a system of responsible food production. This will be complemented by societal changes, such as a transition to a more local, seasonal and plant-based diet to create awareness for a more responsible consumption of food. SDG 12 is a key target in our plan, however we only touch on the responsible consumption and production of food and natural nutrients such as nitrogen, not other areas such as energy, heavy metals, plastics, etc.
Target 12.1, 12.2, 12.3, 12.4, 12.6, 12.8, 12.a

No Poverty

seeks to eradicate poverty in all its forms worldwide, ensuring that all people have access to basic needs such as food, shelter, healthcare, and education by 2030

By sharing knowledge with other parts of the world, we hope to contribute to education on sustainable and resilient food production in times of climate change. Rather than exploiting cheap resources, we hope to empower developing countries and break their dependence on the Global North. This way, we want to build resilience in the food production system and economy, and create jobs, which will indirectly lead to less poverty.
Target 1.5, 1.a

Climate Action

seeks urgent action to combat climate change and its impacts by mobilizing efforts to mitigate greenhouse gas emissions and enhance resilience to climate-related disasters and changes.

We raise awareness of the need for social change in how we produce and consume food through educational programmes and international knowledge sharing. Our strategy also refers to existing national and international policies and proposes new additions to achieve our vision.
Target 13.2, 13.3

4.2 VISION STATEMENT

By 2150, the food system of North-Western Europe will be completely transformed. Reducing nitrogen emissions at all stages of the food chain, and thereby decreasing the strain on the climate, will give low-income countries the space to consume materials equitably to meet the needs of their populations (Circularity Gap Report).

A **regenerative and sustainable food production sector** leads to healthy food while ensuring clean water and air by **moving away from intensive agriculture and closing nitrogen cycles**. Transitioning from intensive agriculture to **small-scale, collective farming**, with a fair distribution of profits, resources and risks among farmers, will lead
to future-conscious citizens and equitably distributed employment opportunities. Ultimately, it will **transform peri-urban and rural structures, and the way we live in them.**

Collective farms have diversified and apply rotational land-use, providing most of the needed food local and seasonal. This allows the soil to regenerate over time and provides space for nature to thrive. Conscientious citizens are educated about the impact of different types of food production on both planetary and social boundaries, so **food is integrated into daily community life**.

Policies are introduced at different scales to ensure that food is affordable and balanced with the livelihoods of farmers.

This all comes together in a **regenerative food production system** that is able to provide affordable food for all, while being more circular, organic, sustainable and fit for this future world.

Figure 4.2 Vision image

4.3 A REGIONAL VISION FOR NORTH-WESTERN EUROPE

To implement our vision on the North-Western European scale we overlay the peri-urban analysis, watersystems, the natura 2000 areas ,and the soil to identify example areas, with diverse qualities to show the different layers of our vision.

Based on these factors, we can identify four different example regions with mainly one soil-type, all different from each other, rivers, natura 2000 areas and different scales of urban and peri-urban structures. Each of these areas will have a different variety of crops that would support the local diet.

In the South we have a large clay area with the Moezel river that is connected to the Rhine and a large urban structure in Nancy. A mono cultural area that faces challenges in the ability to support a sufficiently diverse diet.

Further downstream in the Rhine, we identified an example region beneath the Ruhr area with a silt-loam soil type and large Natura 2000 structures.

In the North of Limburg we identified a sandy border area with peri-urban and Natura 2000 structures that brings interesting challenges with the relations between three countries and the large excess emissions.

Finally, we identified the heart of the Netherlands from the Green Heart region towards the beginning of the Veluwe with the Food Valley inbetween. This area, in contrast to the other three, has a diverse soil typing on a small scale. A varying form of urban and peri-urban structures in between a rural landscape, fully developed for agriculture. It borders a major agricultural emissions zone in the Foodvalley between a natural area and a Natura 2000 area. These combing factors make this region the perfect opportunity to showcase the different interventions through the scales, providing strong examples as a showcase to the rest of North-Western Europe.

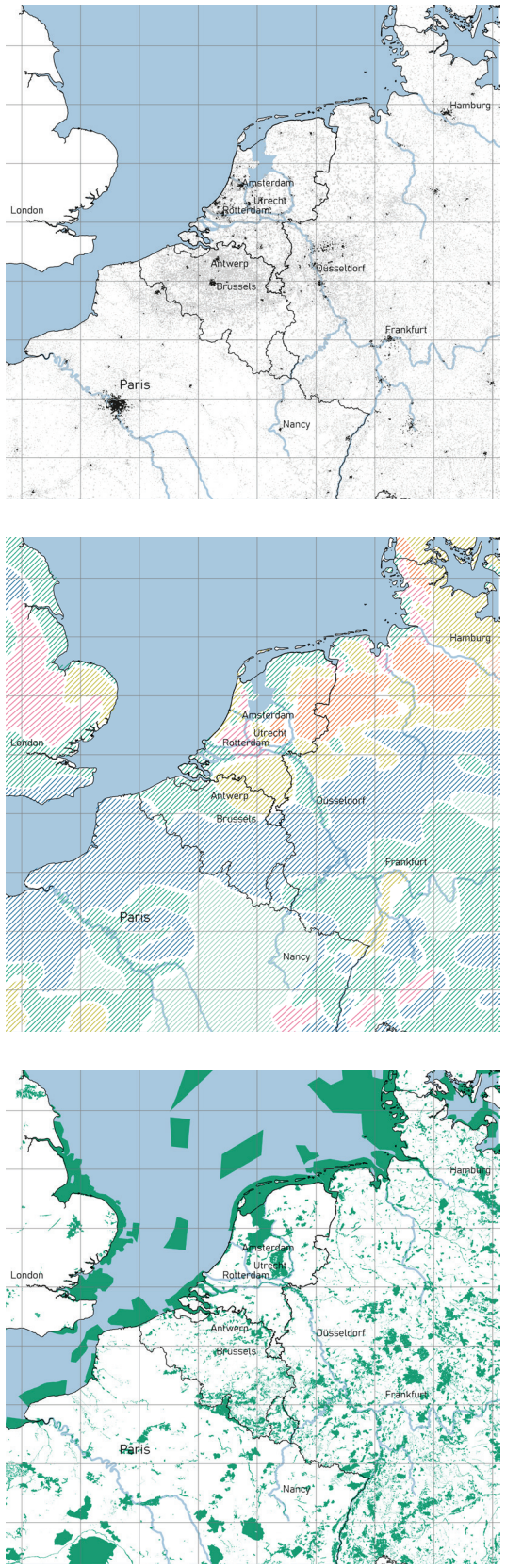


Figure 4.3-5 Layers of urban settlements, soil types, and protected natural areas of the regional vision map (figure 4.6)

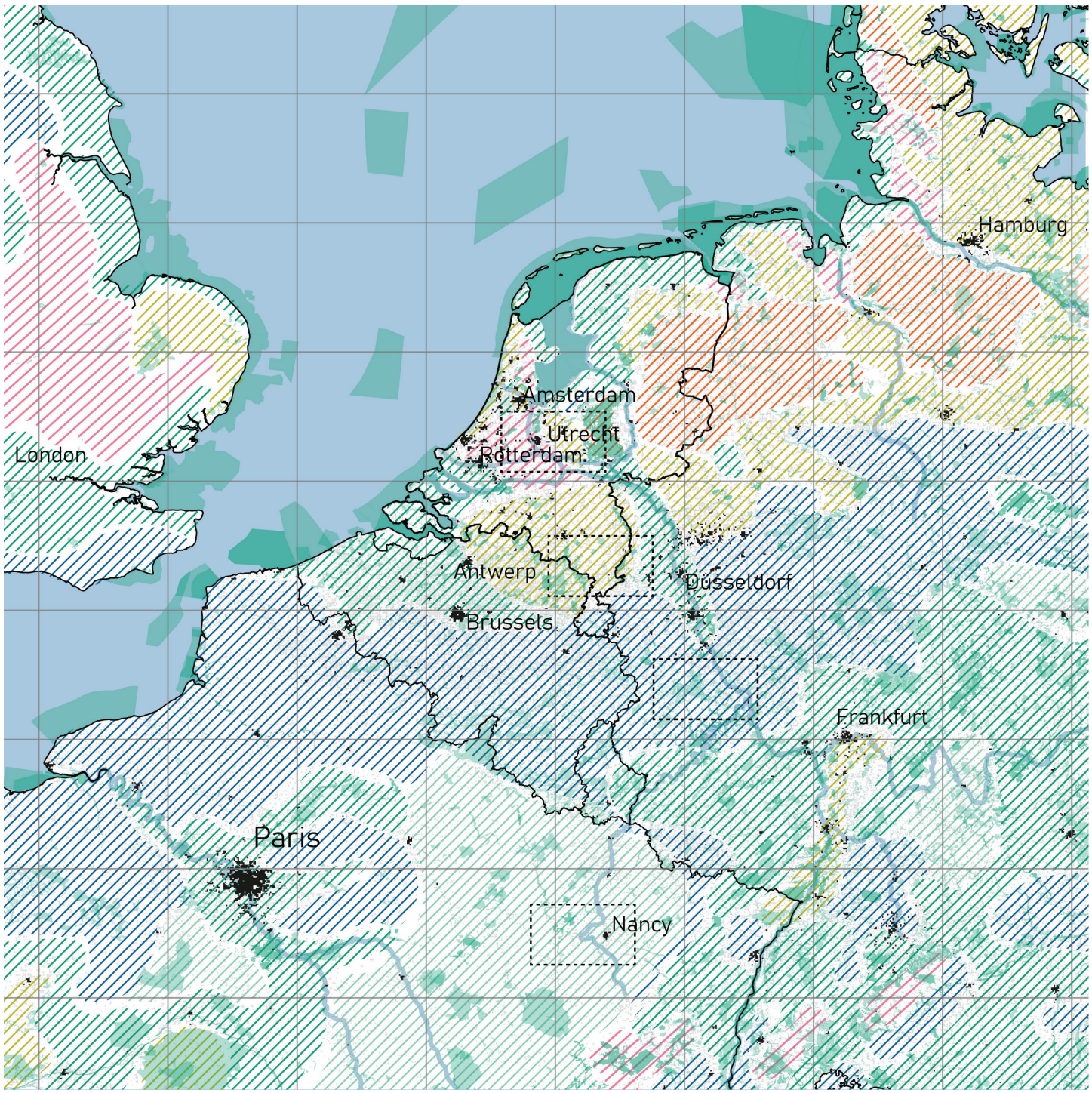


Figure 4.6 Regional vision map of North Western Europe

4.5 THE VISION ZOOMED IN: DUTCH CENTRAL FOOD REGION

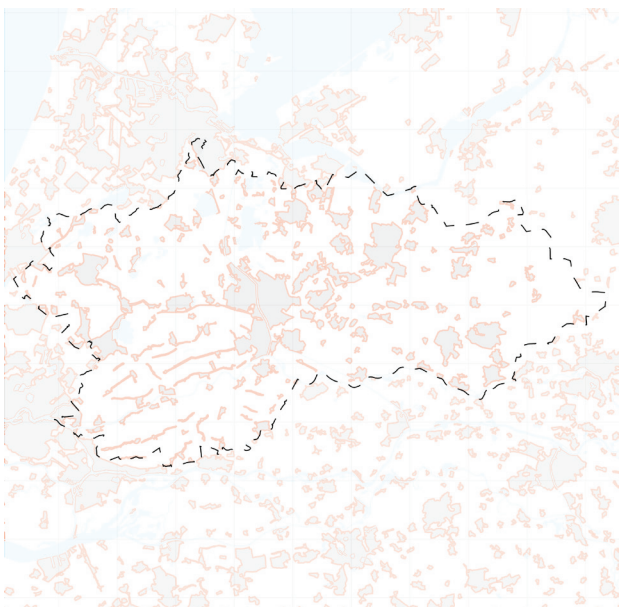


Figure 4.7 Urban boundary layer for vision

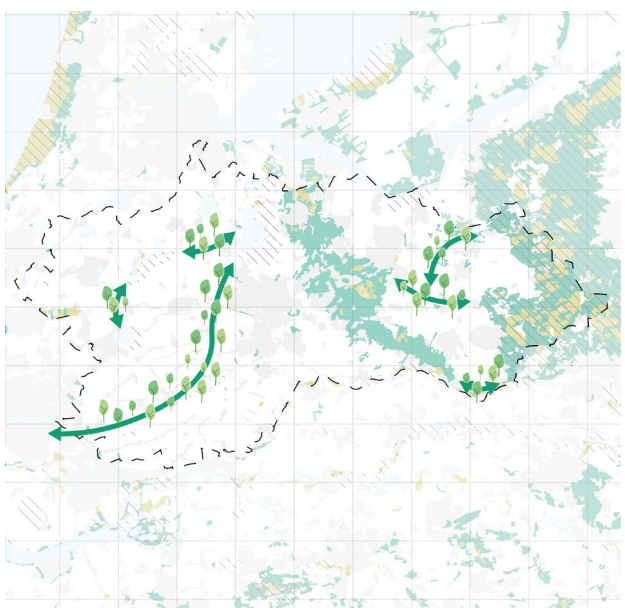


Figure 4.8 Green corridor layer for vision

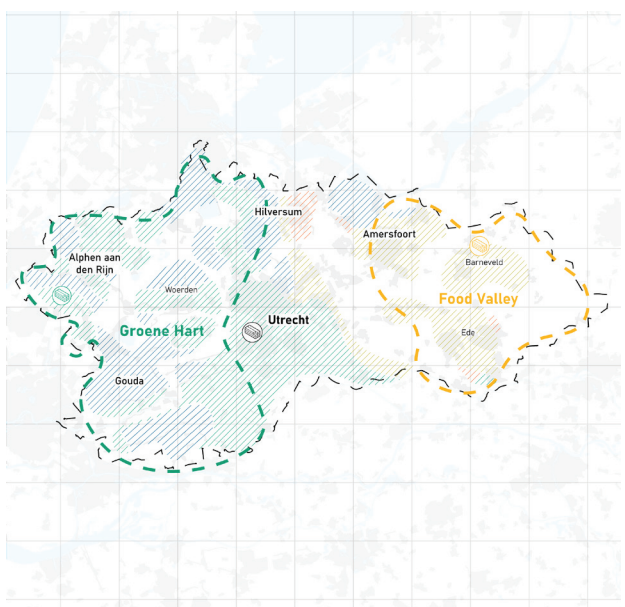


Figure 4.9 Production areas and soil layer for vision

Forest
Shrub and/or harbecous vegetation
Open space with little or no vegetation
Natura 2000

Peat
Clay
Sand
Sand (upland)
Material hub

NO URBAN EXPANSION

The existing urban boundaries will be maintained, and no more land will be taken from nature or the agricultural sector in favour of new urban areas.

GREEN CORRIDORS

The example region is unique because of the big natural structures that run through it. Towards the east the Veluwe, in the middle the Utrechtse Heuvelrug and in the west the big peat lakes. To improve the natural connectivity of these areas, benefiting wildlife, green corridors are proposed between them. They will form the planetary boundaries of our vision.

SOIL

It is important to look at the soil of the production region to see what kind of crops could grow where. Towards the east between the Veluwe and the Utrechtse Heuvelrug, a sandy soil is dominant, whereas in the western part of the example region clay and peat make up the most part of the soil.

PRODUCTION REGIONS

Around the main cities in the example regions, thet production regions are drawn up. The boundaries of these production regions are defined by existing nature and the green corridors.

EXAMPLERY REGIONS

There are three different examplery regions that can be distinguished within the example region: the Groene Hart, the Food Valley and the agglomeration Utrecht. The Groene Hart and Food Valley have very distinct soil types, and therefore can grow only specific biobased materials. That is why they will each get their own material hub so that they are able to specialise in the processing of their local materials. These materials can then be exchanged with other examplery regions.

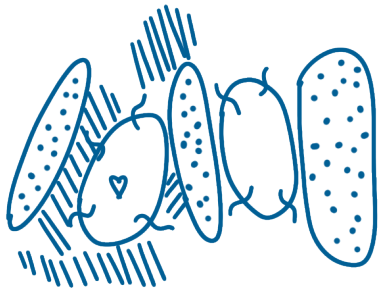


Figure 4.13 Examplary Region, created by Authors

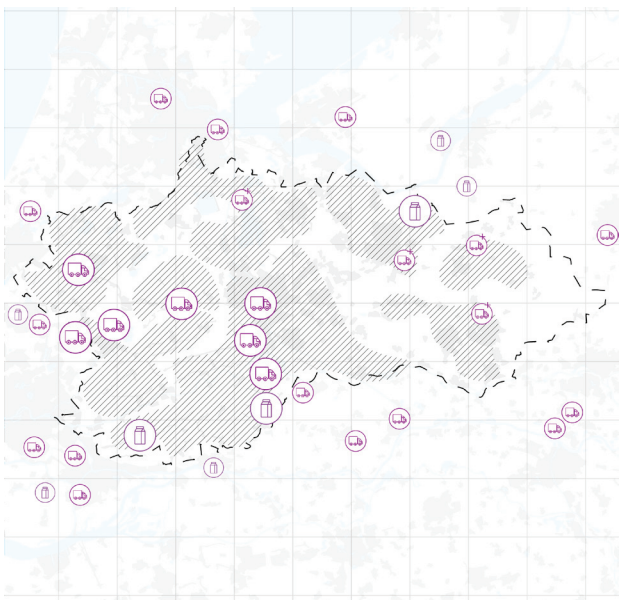


Figure 4.10 Central points layer for vision

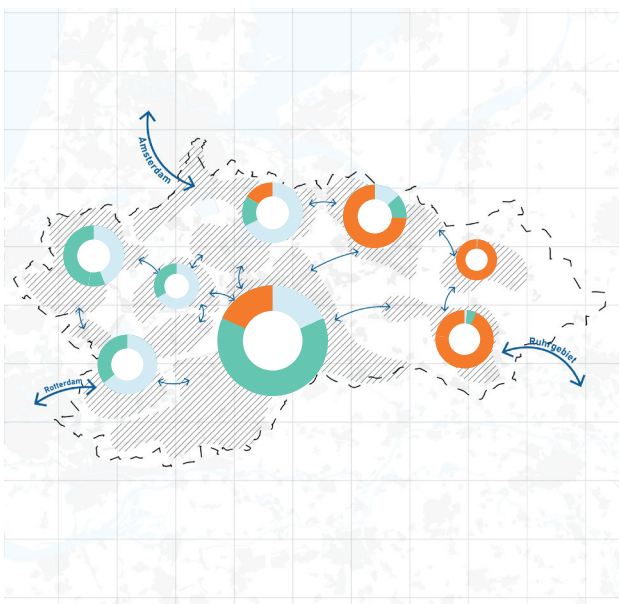


Figure 4.11 Flows and production layer for vision

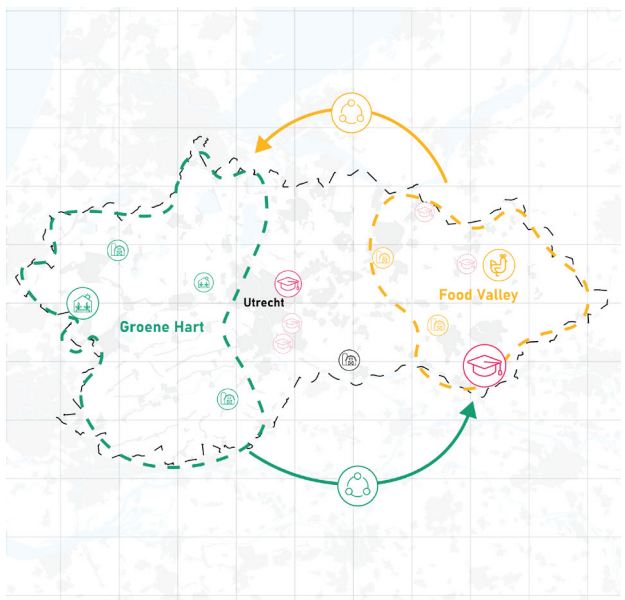


Figure 4.12 Knowledge exchange layer for vision

CENTRAL POINTS

On EU level there are many policies and A lot of distribution centres are located in the western part of the example region, which makes sense as this is the most dense part of the Netherlands. Milk processing units are scattered around the region, with three being within the example region's boundary.

FLOWS

The production regions should be able to produce enough food for their own inhabitants, and if that is not possible on their own agricultural land, then it should be produced within city boundaries. It will still be possible for different production regions to exchange food and materials with each other to create a more diverse diet (e.g. some crops can grow only on sandy soil).

KNOWLEDGE

The sharing of knowledge is important to work towards the shift that we are proposing. This includes not only big educational institutes such as the University of Wageningen or the University of Utrecht, but also practical schools scattered across the example region. Educational institutes are not the only bodies carrying knowledge, but the farmers themselves do as well. Large clusters of agriculture such as the greenport of Boskoop or the chicken farms in Barneveld could also play a big role in the creation and sharing of knowledge for the shift we propose.

With all layers combined the vision map will look like this. The most important part of it being that the planetary boundaries form the boundaries of the agricultural system as well. The production regions created from these boundaries must try to sustain their own food and material production, but are able to exchange with other production regions within the example region. Knowledge sharing plays an important role in empowering farmers to make the transition possible.

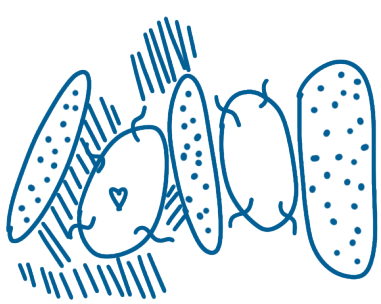


Figure 4.13 Examplary Region, created by Authors

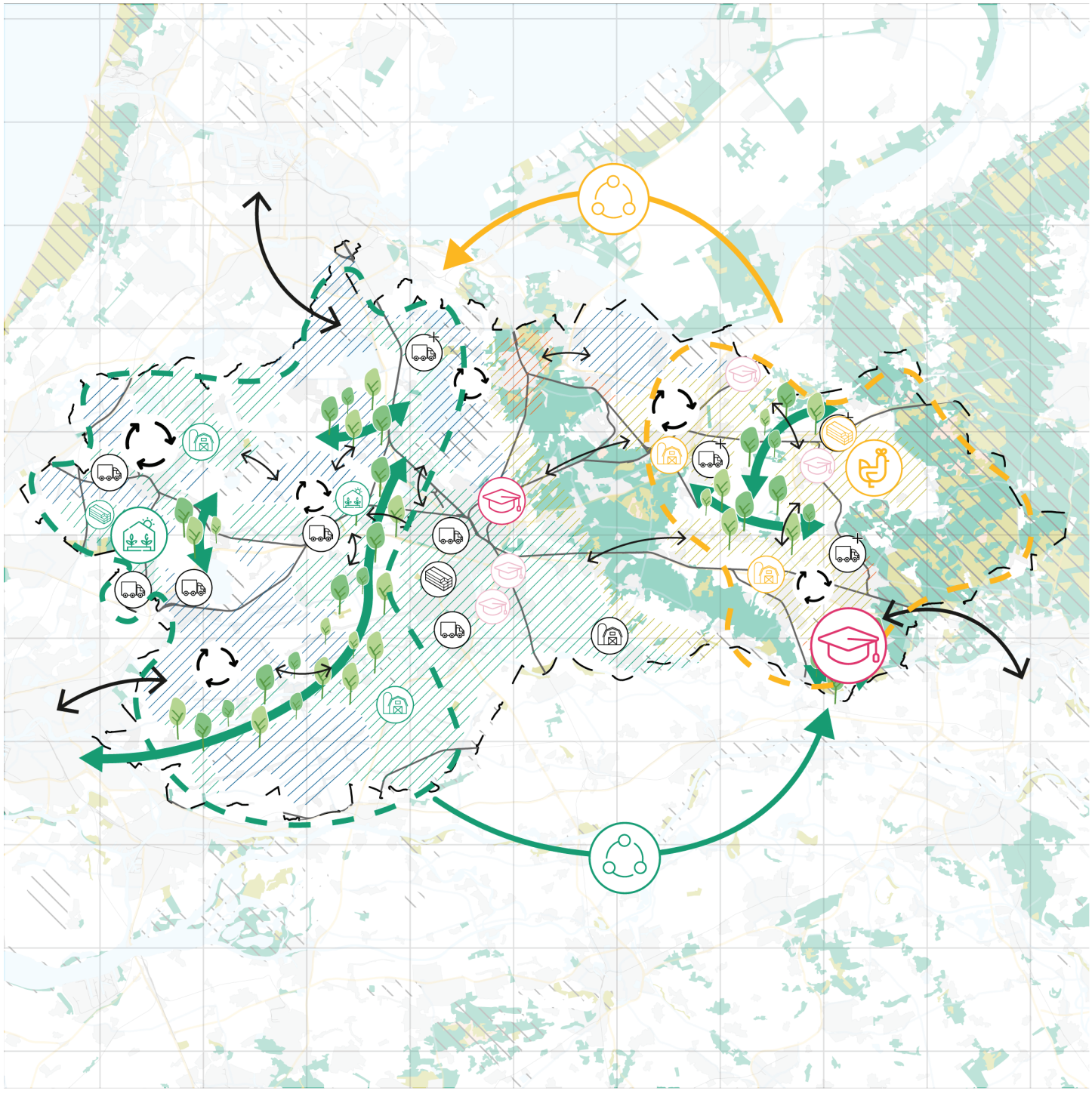
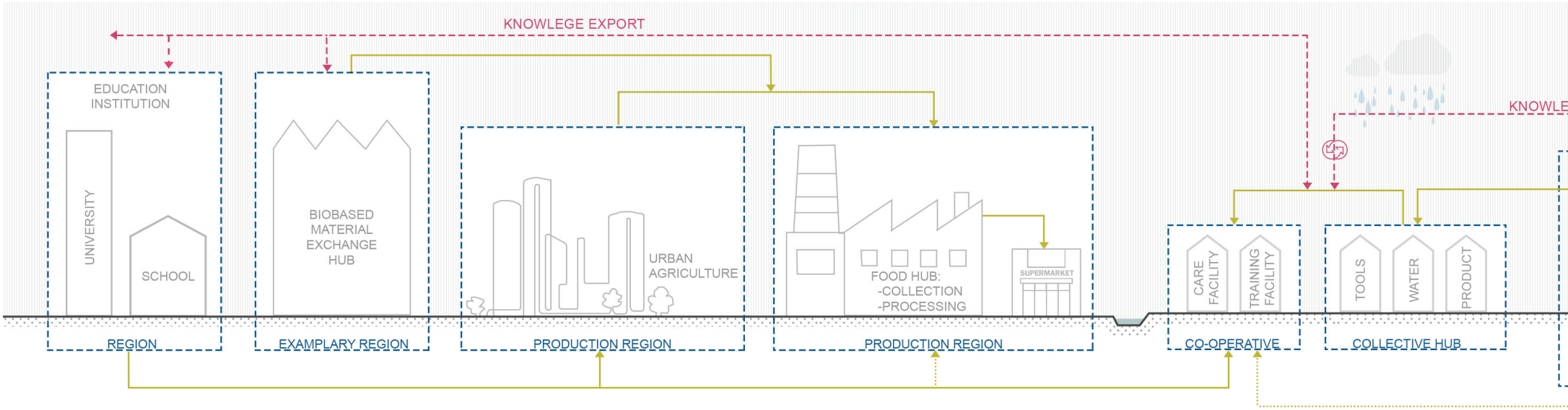


Figure 4.14 Regional vision map for examplary area: the Dutch Central Food Region

Figure 4.15 Current Situation, created by Authors

Figure 4.16 Vision, created by Authors

CHAPTER 5
OUR STRATEGY
FOR A CIRCULAR, COLLECTIVE AND REGENERATIVE FUTURE



5.1 A LOOK INTO THE FUTURE

Collectives
Existing farms will be split up into different collectives. They consist of at least four farms to make the creation of different hubs possible (one for water collection, one for tools and machinery, one for products such as the crops grown and one to make the creation of a caring or training facility possible).

Cooperation
Several collectives form a cooperation in which the caring and training infrastructure is handled. You can think about programmes such as daycares, care homes or kitchens for cooking workshops among other things. This empowers both the farmers by making a diversified business model possible, and the citizens by gaining knowledge.

Production region
Multiple cooperation form a production region. The fruits, crops, meat, etc. the farmers within these collectives produce are collected in a regional food hub where the processing, packaging handled. On top of this there are regional facilities for processing bio-waste. From here, the products are sent to the local markets within the production region, making it possible for the consumers to buy their products there.

If it is not possible to produce enough food on the agricultural area in a production region, more food should be produced within city boundaries in the form of vertical farms, greenhouses on roofs or edible vegetation. Food grown within cities that is being mass produced in vertical farms or greenhouses is also sent to the respective food hub. Food that is not mass produced, such as with the edible vegetation, is used by the people in the neighbourhood.

Example region
Materials are gathered, not based on the production region around an urban area, but based upon the soil in the example regions (e.g. the Groene Hart or the Food Valley). This makes it that the material hub is able to specialise in processing the materials that are grown there locally so that the production runs more efficiently. Material exchange is still possible between the different example regions.

Region
On the largest scale educational units such as universities or practical schools (MBO) provide knowledge to the farmers within the region (and vice versa), as well as providing knowledge to other regions in the Global South for example.

Regenerative zone
The further from the urban area, the more the agricultural land will fade into nature (by making use of extensive forms of agroforestry for example). These zones are called the green corridors and form the borders between the different production regions, and connect existing nature with each other. They act as a reparial zone for the damage that has been done to the land because of the intensive agriculture that has taken place there for years. The goal is to make the new forms of agriculture so nature-inclusive that they can be added to the National Ecological Network (NEN) in the long term.

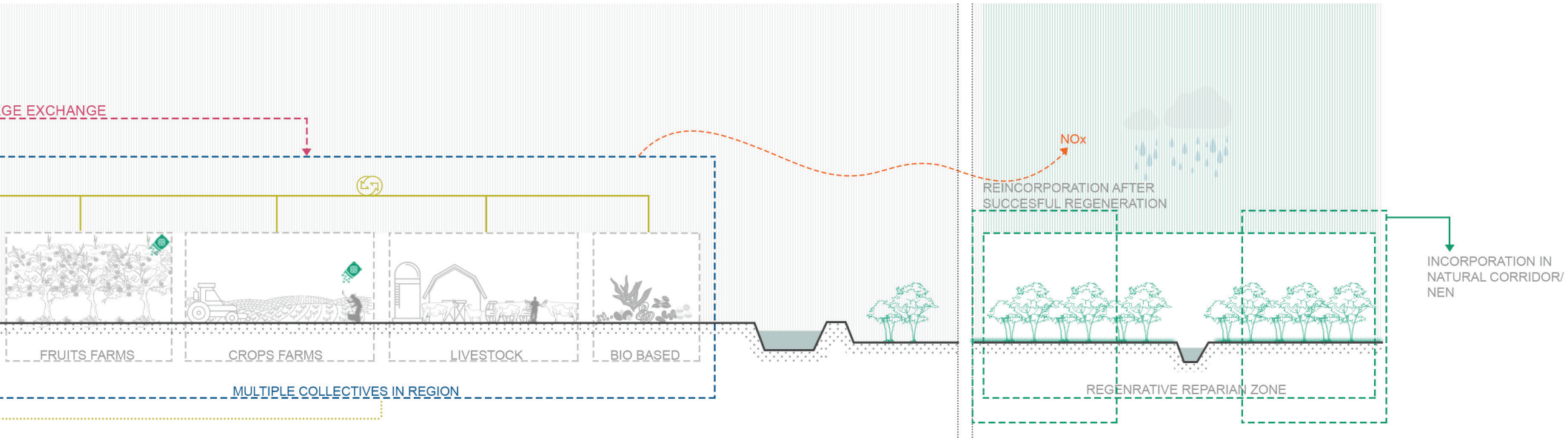


Figure 5.1 Systemic Section of a collective, regenerative and sustainable food production sector in the Netherlands

5.2 THE DONUT DIET: A NEW, LOCAL, SEASONAL AND SUSTAINABLE DIET

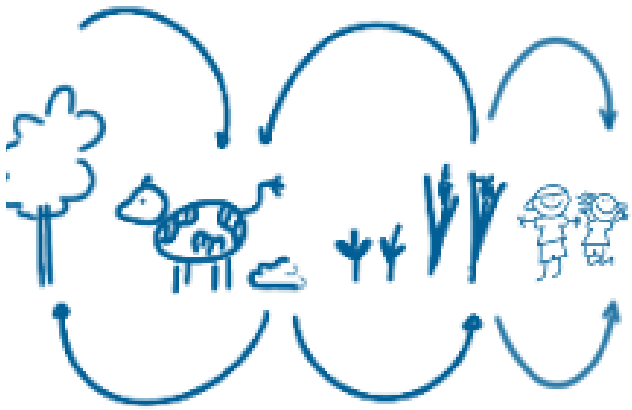
We want to achieve our proposed vision of a collective, regenerative and sustainable food production sector in the Netherlands by advocating a change in our diet. To achieve this vision, we have developed a strategy consisting of the following concepts.

New Diet

The new diet that we propose is a more natural, local and environmentally friendly based diet. By reducing the animal based products we reduce the stain on the climate. The nutrients that we take away in the diet are replaced by other foods like more nuts or algae products. This diet will depend on the soil of the region, so different regions will have different diets. If one region cannot support a healthy and diverse enough diet, it will import products from neighbouring regions.

Regional and Seasonal

Since the diet is based on the local food production, it will also be very regional and seasonal. Depending on what can grow when a region's diet and need for importing produce from neighbouring regions will fluctuate. Shrinking the scale that the diet you consume is being made helps close the large nitrogen and waste loops, so we can stay within the planetary boundaries.



Diversify Farming

Stepping away from intensive agriculture, farmers will have to diversify their crops within the collectives. This diversification will help support the variety of crops that are needed for a healthy diet. Furthermore, to lessen the strain on the soil these diverse crops will rotate within these collectives to regenerate the soil. Not only crops will be grown, but also biobased materials will be integrated in this cycle of rotation.

THE DONUT DIET: A NEW DIET

Although the current diet is almost 60% plant-based, a big part of it is still animal-based (dairy, meat, fish, etc.). This, in combination with an overconsumption of fats and sugars, makes it an unhealthy and not sustainable diet.

That is why we propose the donut diet: a diet based upon the recommended diet proposed by the German association DGE called the DGE-Ernähungskreis (Deutsche Gesellschaft für Ernährung, n.d.).

In this diet, animal-based products will be reduced by more than half. This is made possible through the addition of algae (which is a very nutritious ingredient) and a much bigger portion of nuts (from 0,5% to 9%), which are ingredients that can replace the nutritions that we got from meat or dairy. Because we work with more nutritious food and sugar is taken out of the diet in its entirety, it is possible to eat less in kilograms: from 488 kilograms per year currently to roughly 400 kilograms in the future.

The idea is to grow most of the ingredients in the new diet locally, and only import ingredients that are really necessary, the so-called 'exotic foods'.

In appendix 8.4 you can find the calculations supporting this dietary shift.

Figure 5.2 Current Plate

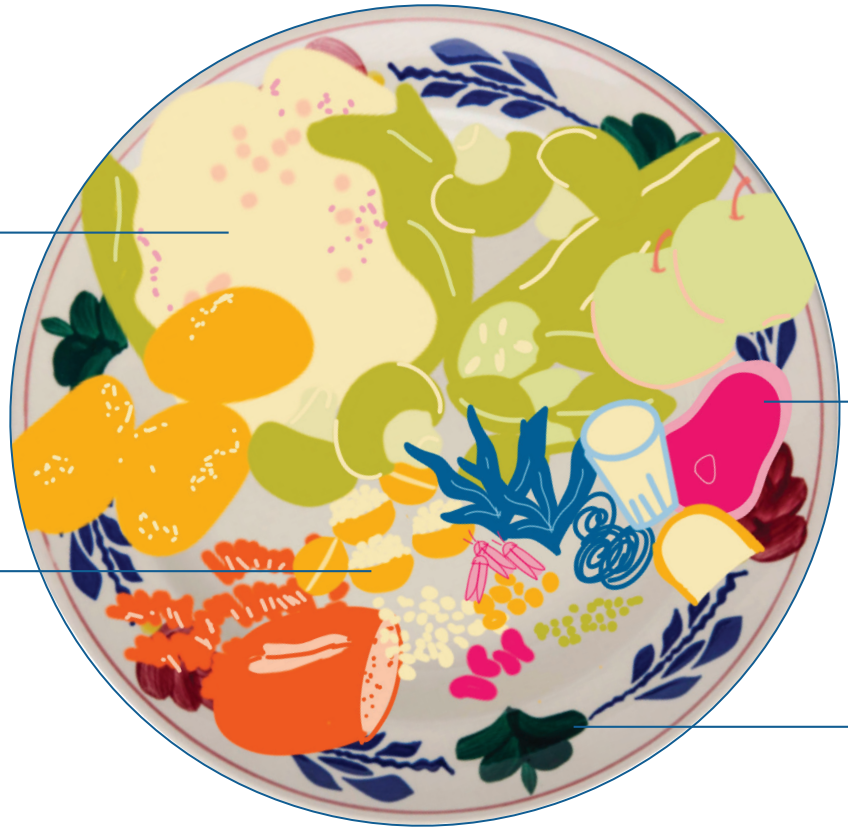


Figure 5.3 Proposed Diet

THE DONUT DIET: A LOCAL, SEASONAL DIET

A small selection of crops (upper diagram) and biobased materials (lower diagram) are collected on the opposite page. Every species has a specific soil type that it grows well on and season in which it can be harvested, which is made visible through the size of the circles: big (well), middle (medium), small (not well). With this information in combination with the soil in the region it is possible to grow a truly local diet, and if not, grow biobased materials locally.

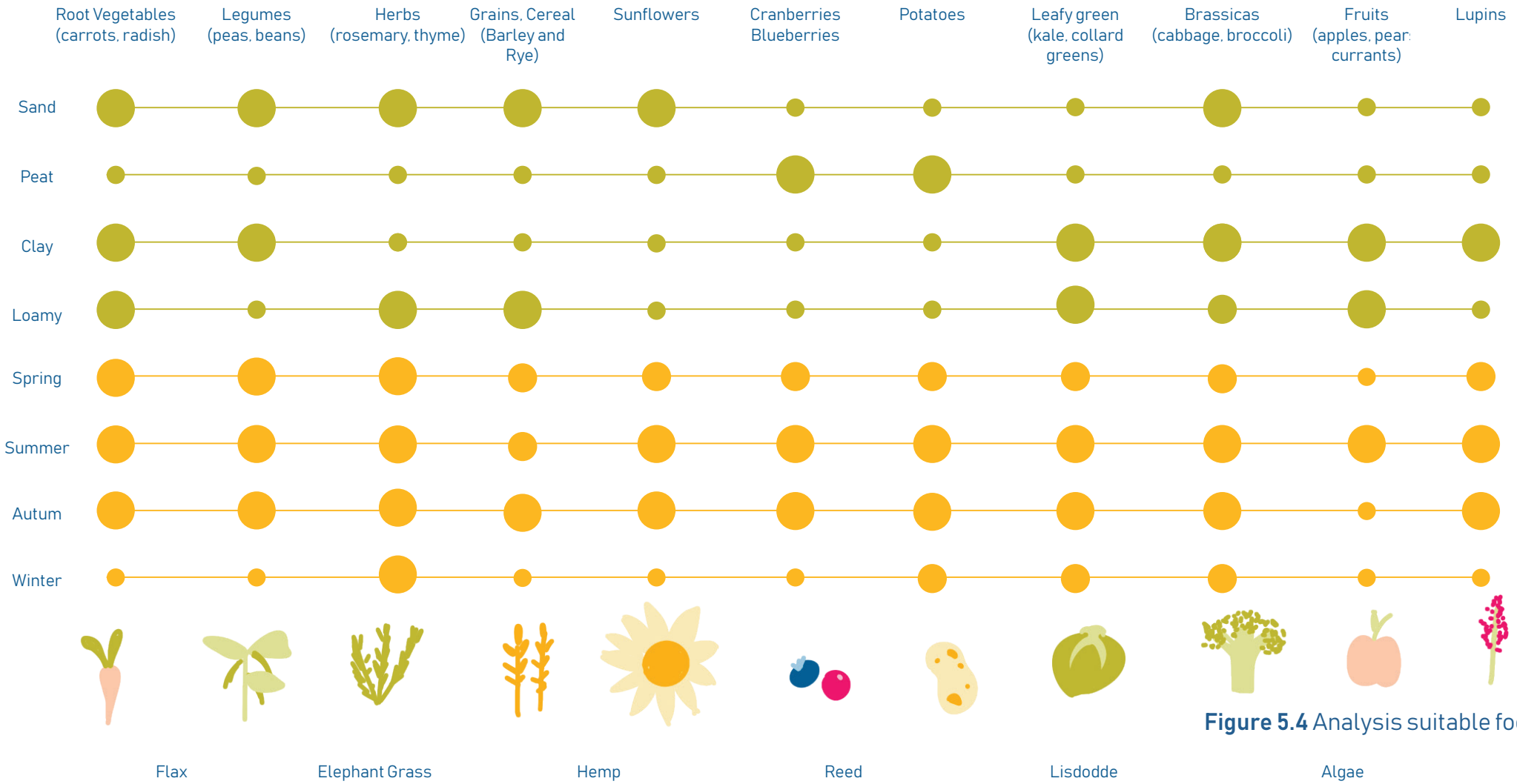


Figure 5.4 Analysis suitable food*

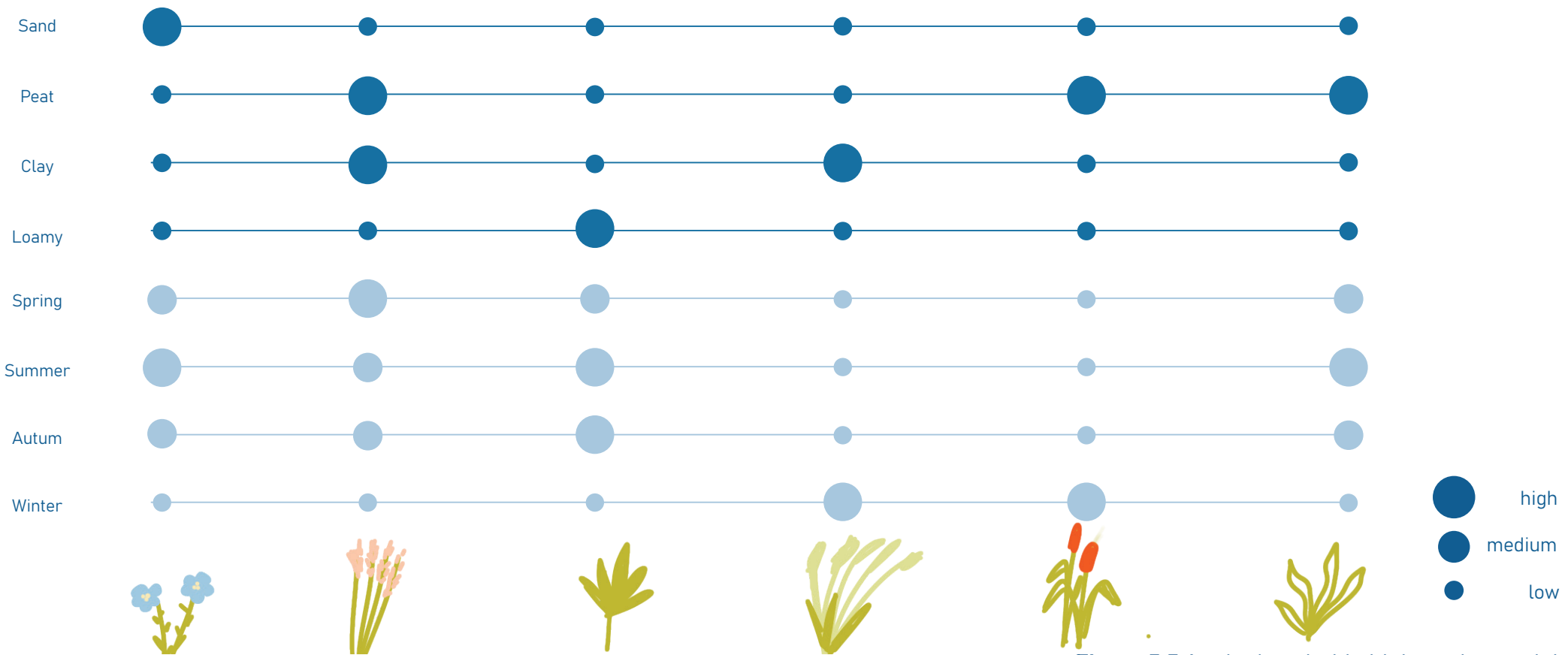
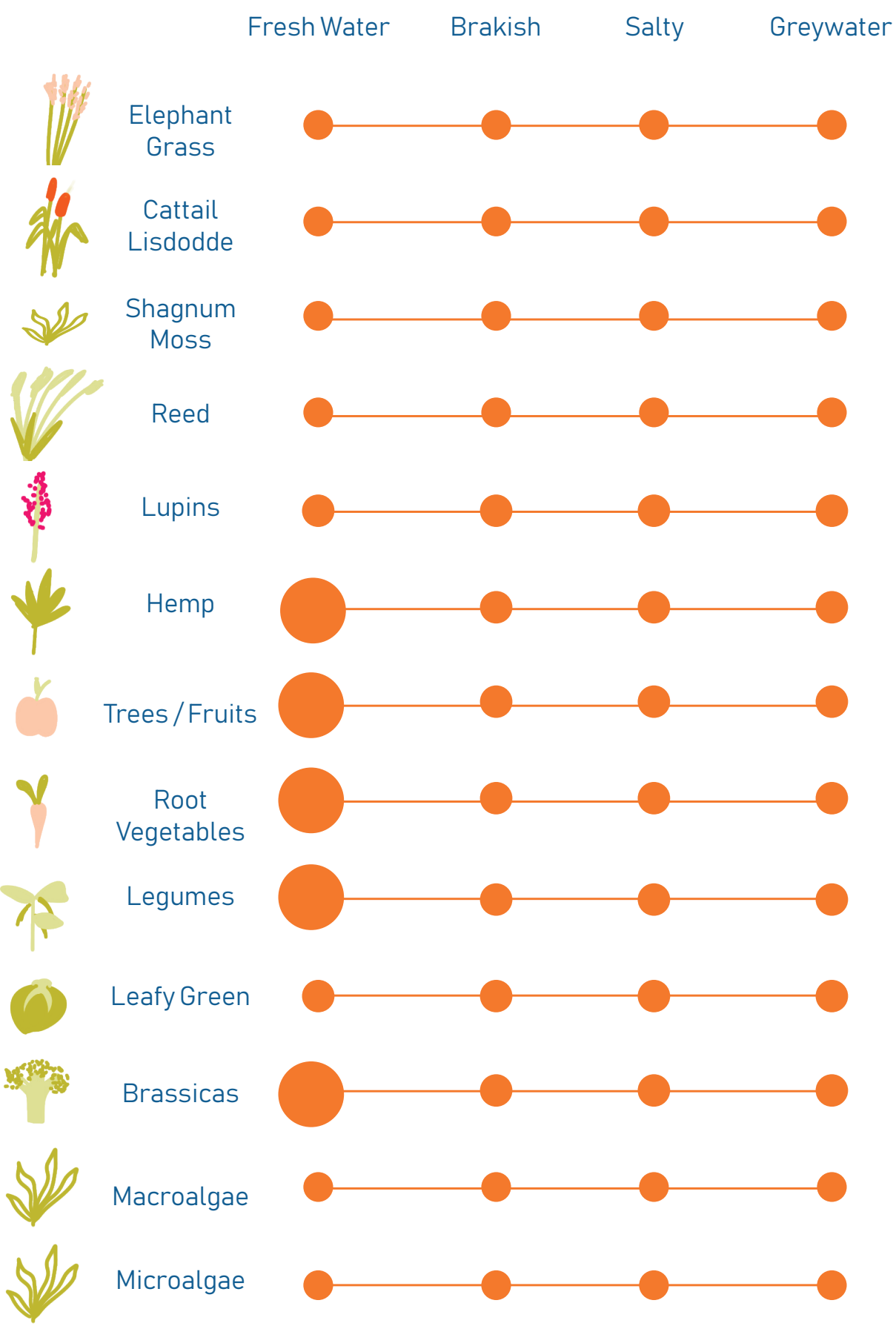


Figure 5.5 Analysis suitable biobased material

*The properties of suitable crops and biobased materials are shown with more detail in appendix 8.5

THE DONUT DIET: A LOCAL DIET

This diagram shows what kind of crop or biobased material grows well where, in combination with the type of water. In this way it is possible to see what the possibilities are in terms of with what natural water type a crop can grow, or even with grey water from the human cycle. Again, the circles show the suitability: big (well), middle (medium), small (not well).



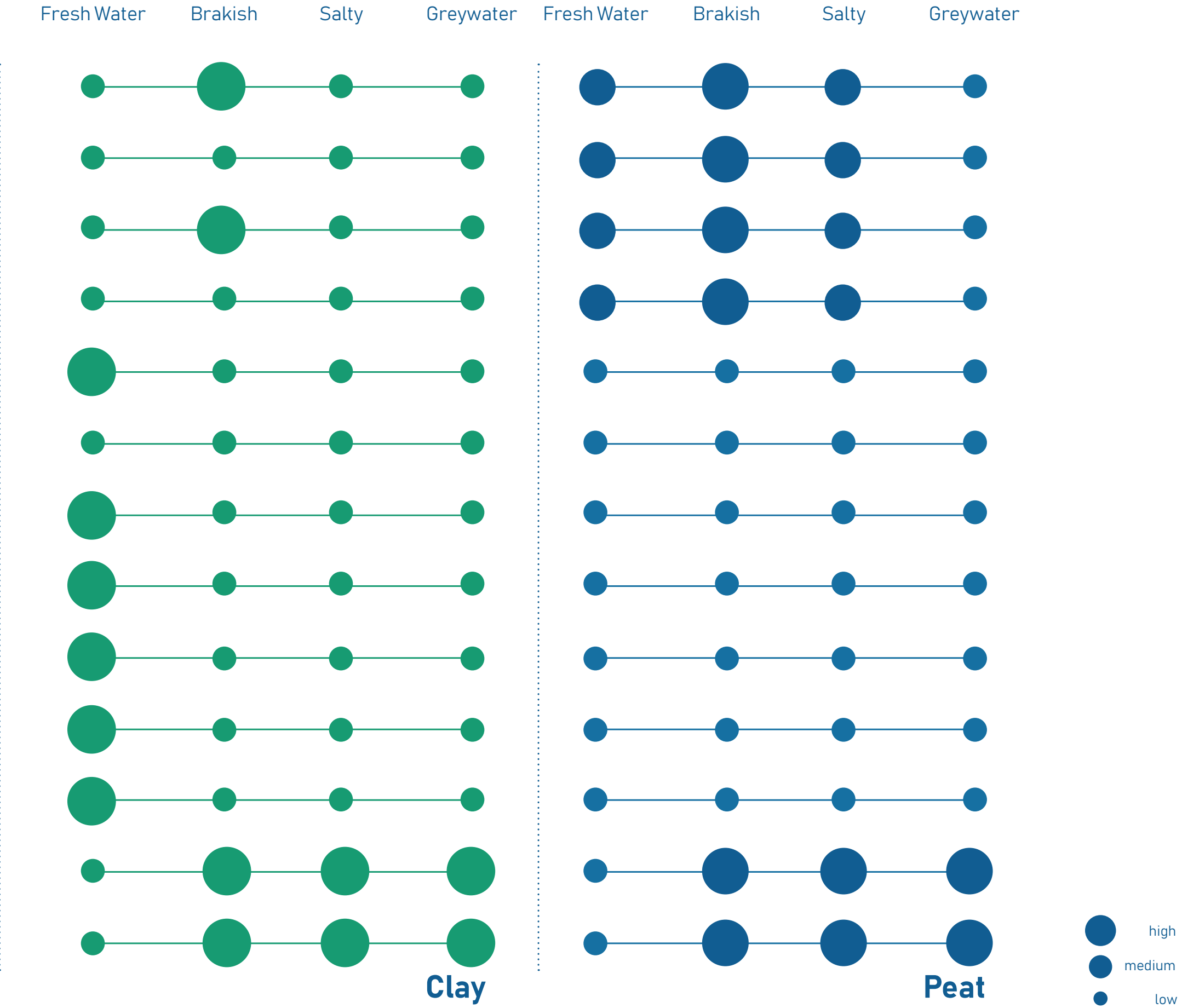


Figure 5.6 Analysis suitable farming related to soiltype

THE DONUT DIET: A SUSTAINABLE DIET

We took a closer look at the different farming practices and compared how suitable each of them is in relation to the soil types found in the Netherlands. We quickly realised that livestock farming on peatlands requires a lot of maintenance and is therefore not suitable.
The circles show the suitability: big (well), middle (medium), small (not well), light blue (rot relevant).

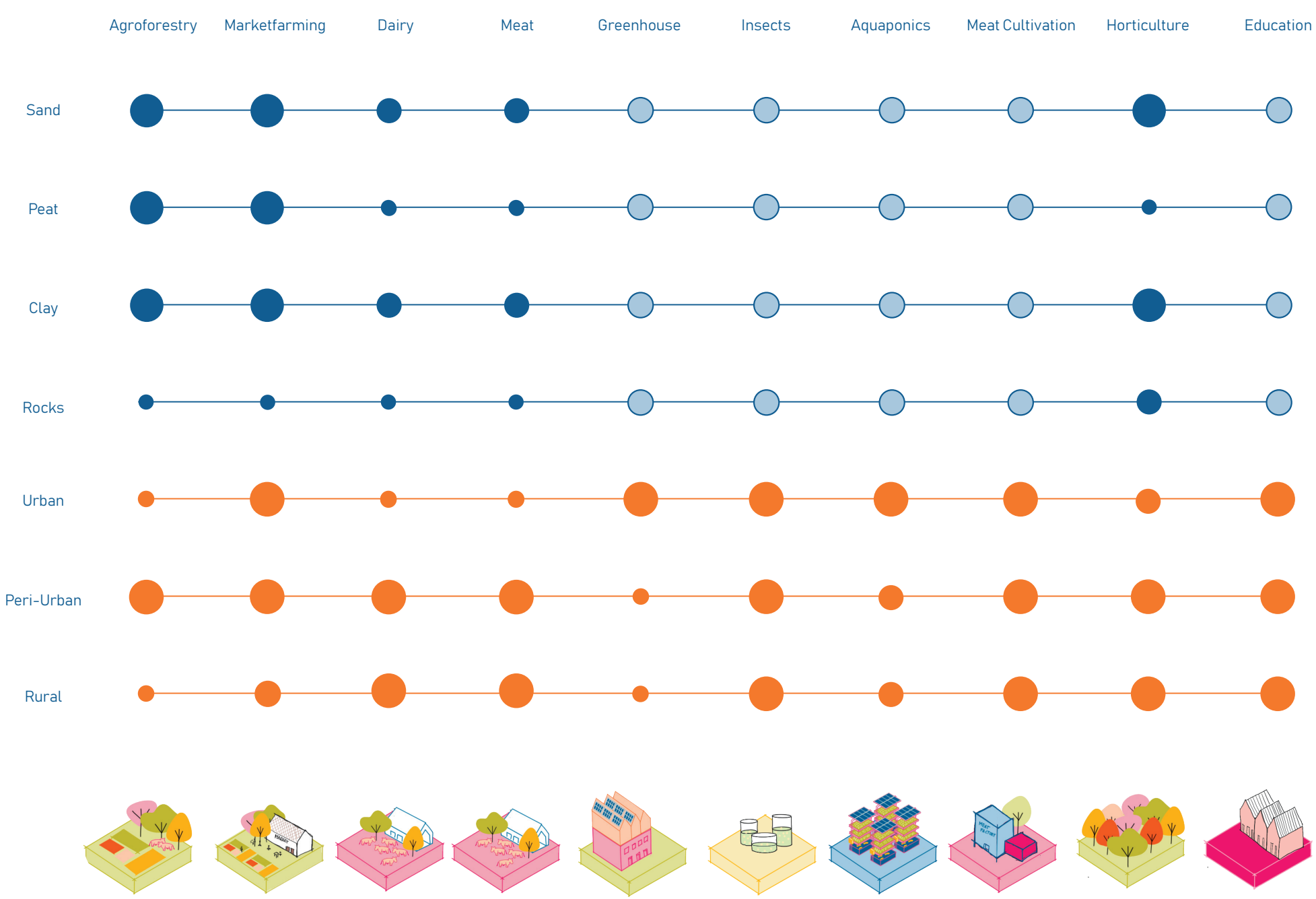


Figure 5.7 Analysis suitable agriculture

THE DONUT DIET: A SUSTAINABLE DIET

To follow up the analysis of the previous slide, we assessed the suitability of each type of farming according to its proximity to the built environment. We found that farming methods that do not depend on a specific soil type and produce large quantities of material, such as greenhouses, aquaponics, insect, fungal and algae farming, are particularly suitable in densely built areas where there is too little space for regenerative farming. This controlled way of farming opens up the possibility of closing material loops within the system itself, e.g. in aquaponics the nutrient exchange between fish and plants that benefit each other.

Regenerative farming methods, on the other hand, are suitable for peri-urban and rural areas, while purely bio-based materials can be grown further afield and act as regenerative buffer zones.

Algae farming, on the other hand, works in both urban and naturalised areas because this type of food can grow in almost all conditions - including wastewater (EUFIC, 2023a; EUFIC, 2023b; Priva, 2024).

The type of farming shown in each tile is most suitable in the area where the background is widest. We imagine a hard border from the urban fabric but outside that area the transition between agriculture and nature will be smooth.

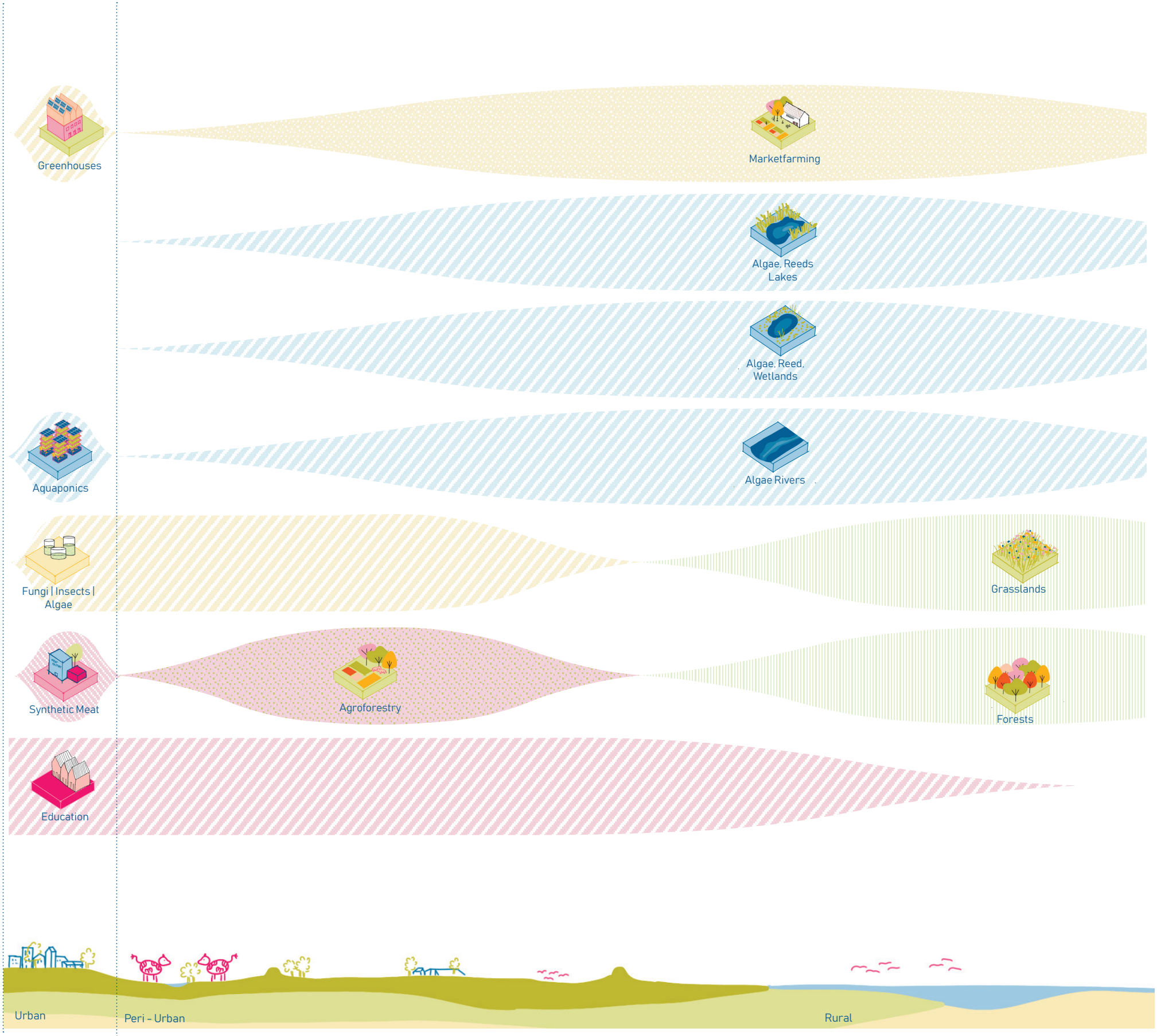


Figure 5.8 Analysis suitable agriculture

THE DONUT DIET: A NEW, LOCAL, SEASONAL AND SUSTAINABLE DIET

The next step was to calculate the number of people living in each production region to get a better idea of the amount of local food and bio-based materials needed.We then calculated the amount of each of the main soil types - peat, clay and sand - in each production region. Both based on the Neighborhood map 2023 (125 Centraal Bureau voor de Statiskiek, 2023).

In this way, we want to ensure that each production region is able to meet its basic food needs. We also wanted to get an overview of whether certain areas need to specialise according to soil type and therefore rely more on exchange between production regions.

Many food crops can be grown on sandy and clay soils, while peat areas will be mainly suitable for algae cultivation and bio-based materials. In the Utrecht, Amersfoort, Ede and Barneveld production regions, the focus will be on food, while in the Hilversum, Woerden and Gauda production regions, the focus will be on bio-based materials. In order to supply these production regions with both materials and food, we propose an exchange that takes place within the example region shown on the map. Alphen aan den Rijn, on the other hand, with 54% clay and 46% peat, will most likely be able to sustain itself.

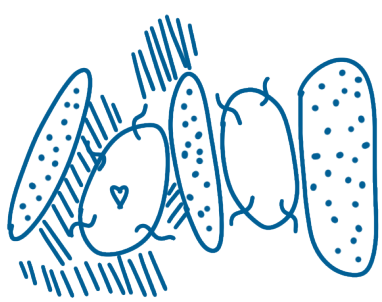


Figure 4.13 Examplary Region

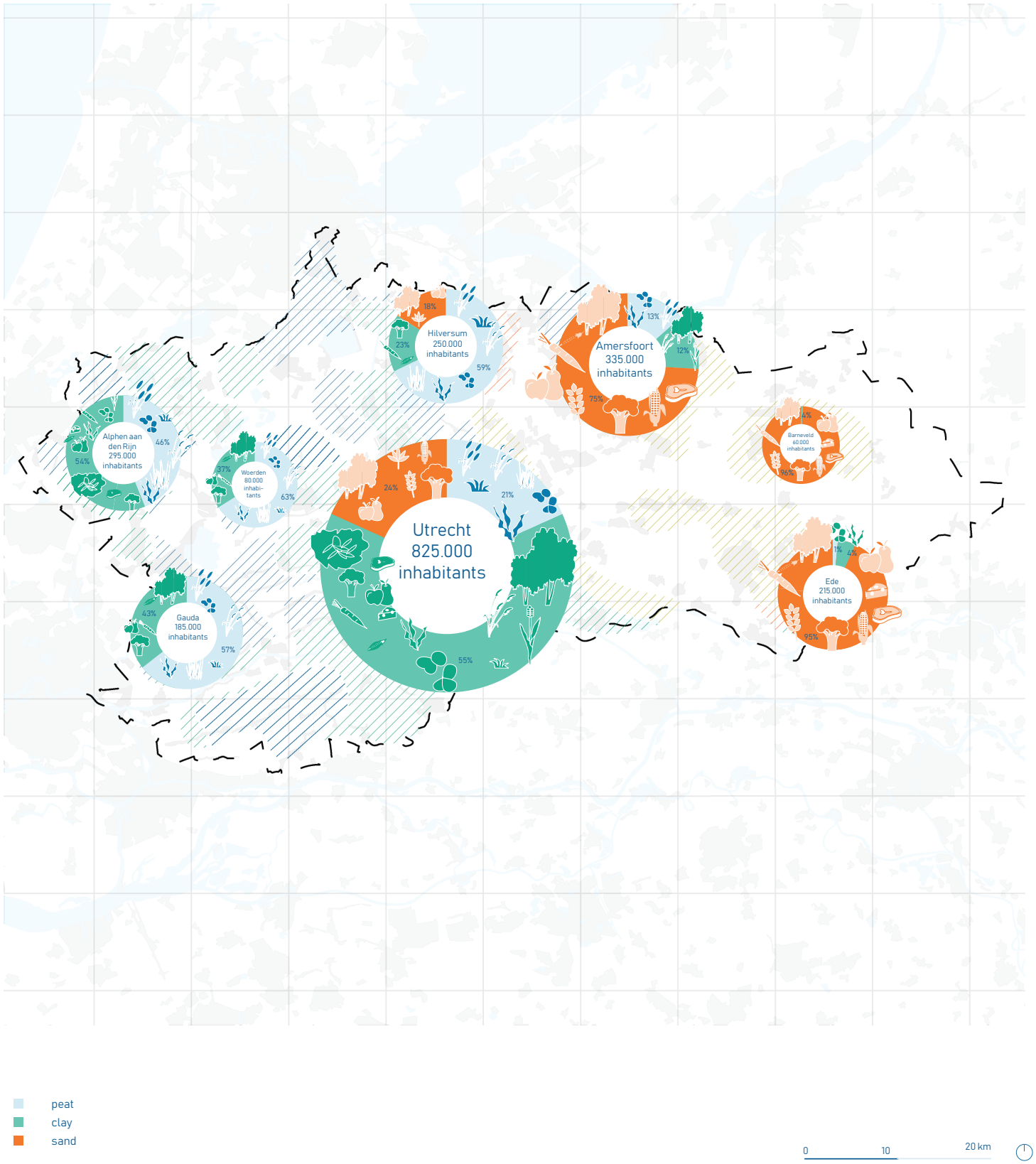


Figure 5.9 Examplery Region for Local Food and Biobased Material Production
Source: 125 Centraal Bureau voor de Statiskiek. (2023)

5.3 THE AGRICULTURE SYSTEM RE-ORGANISED: A PATTERN LANGUAGE

Based on the methodology used in the Cities of Making project (Hill, Adrian V (ed.), 2020), we have developed a pattern language for this project. It allows complex structures to be broken down and made accessible to farming communities without losing the complexity of each pattern. This way it allows to combine the bottom-up approach with top-down policies by using it as a communication tool.

The aim of the pattern is to propose a set of actions to be taken at a given scale. However, farmers can then decide where to implement each action. In this way, it acts as a steering tool, allowing flexibility in implementation without losing sight of the goal.

Each pattern has a title, an image and a short description that explains what the pattern is about. The letter in front of the title refers to the scale at which the pattern needs to be implemented, followed by the number that most helps to organise the patterns.A further layer of complexity is added by the icons below the title, which show the domain, based on our conceptual framework, that the pattern is most related to.The difference in colour also refers to the type of intervention, whether it is related to education, spatial change or policy.The last line shows important links to other patterns that complement each other.

The Pattern Language in full size can be found in the appendix 8.6.

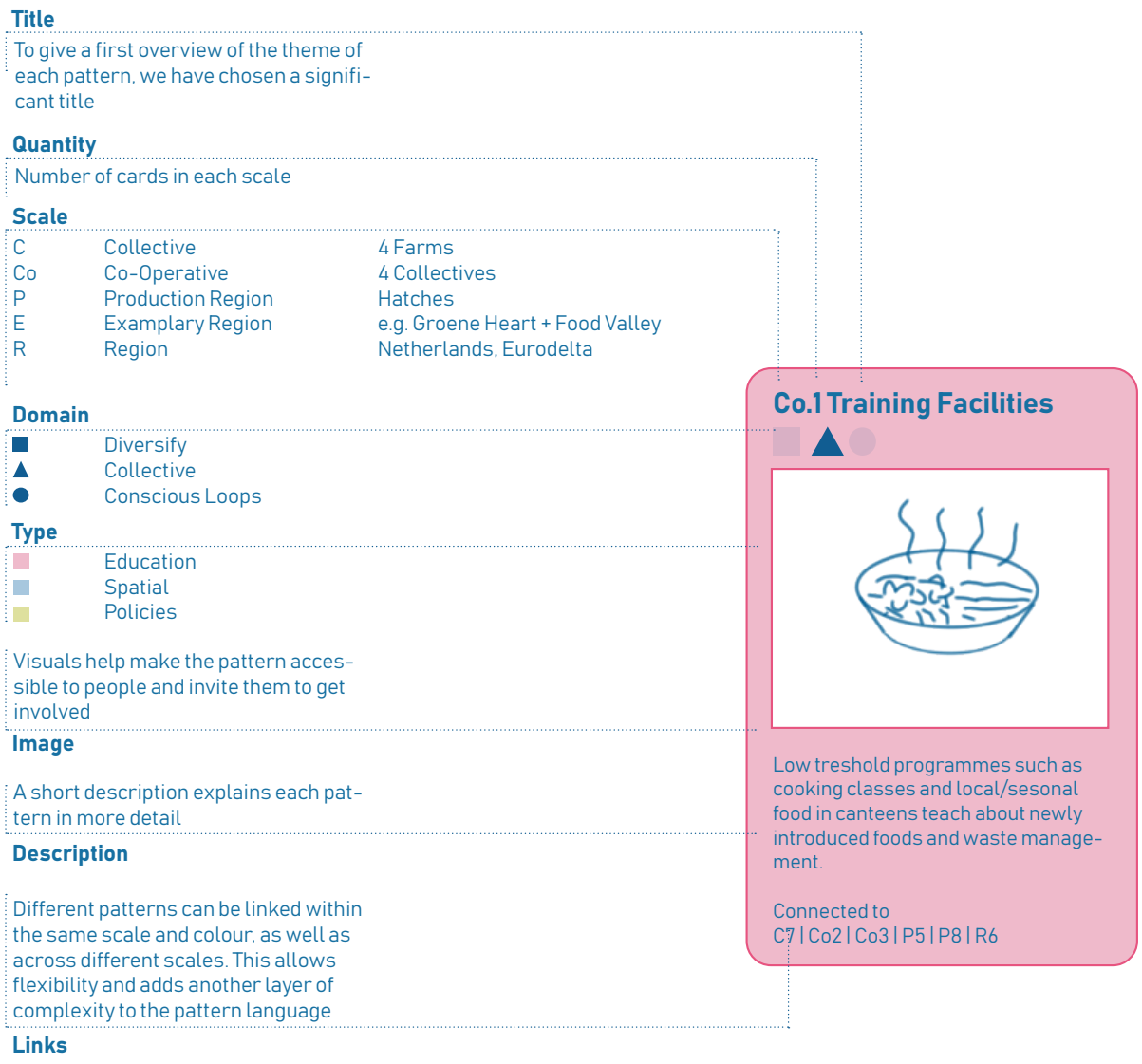
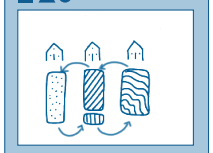


Figure 5.10 Pattern language explained

Collective

C.1 Regenerative Production



Regenerative practices such as aquaponics, including forest farming, silvopasture and alley cropping with crop rotation are used to improve soil fertility, optimise nutrients and prevent pests.

Connected to
C5 | P8 | P3 | P6 | E4 | E5 | R4 | R7 | R9

C.2 Value Water

Water can be used in a circular way by combining practices that complement each other (aquaponics, algae in wastewater, etc.).

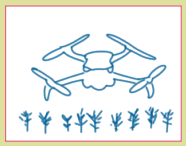
Connected to
C4 | P8 | P6 | E4 | E5 | R2 | R4 | R9

C.3 Digitalise

Digitalised material resources in a in a regionally and spatially linked database facilitate and optimise the local, distribution of resources, such as tools, land, materials.

Connected to
C4 | C6 | C8 | P1 | P2 | P6 | E1 | E2 | E3 | E4 | E5 | R9

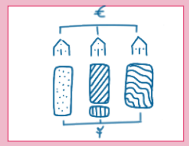
C.4 Automation



Automating agricultural processes can help save costs and preserve the environment.

Connected to
C2 | C3 | C8 | C9 | E4 | R2 | R4

C.5 Shared Risks & Benefits



Investment costs and risks due to unpredictable weather events can be shared by collectives.

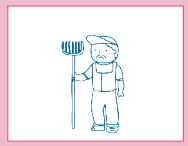
Connected to
C1 | C6 | C8 | Co2 | P2 | P7 | P8 | E2 | E4 | R3 | R4 | R7 | R9

C.6 Land Lease

Farmers can lease land from the municipality, making the sector more flexible and inviting people from outside existing farming communities.

Connected to
C3 | C5 | P3 | E5 | R4 | R7 | R9

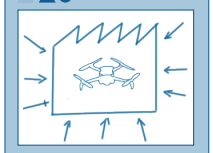
C.7 Community Engagement



Involving local initiatives and communities in a fair transition process is crucial for the transition to work.

Connected to
Co2 | Co3 | Co3 | P5 | P7 | P8 | R6

C.8 Shared Tools



Equipment can be purchased jointly and then shared between farmers. This reduces costs and the amount of tools and equipment needed.

Connected to
C3 | C4 | C5 | C9 | E5

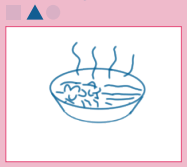
C.9 Production in Cities

Food and material production, such as vertical farming, aquaponics, algae-, fungi-, insectfarming and trees, must be increased within urban boundaries.

Connected to
C4 | C8 | C9 | P1 | P2 | P7 | E2 | R1 | R3 | R4 | R8

Co-Operative

Co.1 Training Facilities



Low treshold programmes such as cooking classes and local/sesonal food in canteens teach about newly introduced foods and waste management.

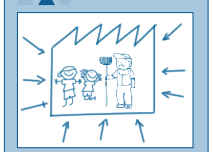
Connected to
C7 | Co2 | Co3 | P5 | P8 | R6

Co.2 Care Infrastructure

Farms will be diversified and care infrastructure such as schools, day-care centres, homes for the elderly and places for the disabled will be introduced.

Connected to
C5 | C7 | Co1 | Co3 | P8 | R4

Co.3 Community Center

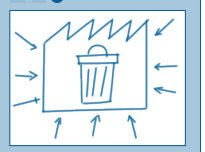


Community centres are being introduced to provide low-threshold meeting places where people can gather to cook, meet, share or use the care infrastructure.

Connected to
C7 | Co1 | Co2 | P5 | P7 | E3 | R1 | R4

Production Region

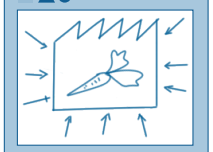
P.1 Biowaste Hubs



Establish facilities to implement closed-loop waste management. Storage capacity for collection in close proximity to shredding, washing and processing units is needed.

Connected to
C3 | C9 | P2 | P4 | P5 | P8 | E1 | E2 | R1 | R3 | R7 | R8

P.2 Food Hubs



Establish facilities to implement collective food sharing. Storage capacity for collection in close proximity to processing and prodcing units is needed.

Connected to
C3 | C5 | C9 | P1 | P4 | P7 | P8 | E2 | R1 | R8 | R3

P.3 Natural Zoning

To extend the natural ecosystem, Natura 2000 sites will be connected and regenerative agriculture will be introduced in relation to the proximity of settlements.

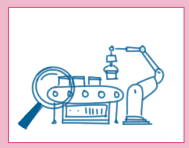
Connected to
C1 | C6 | P8 | E5 | R1 | R2 | R3 | R5 | R7 | R9

P.4 Cluster Complementary Production

A network of complementary production activities enables local processing and distribution.

Connected to
P1 | P2 | P6 | P8 | E1 | E4 | E5 | R1 | R3 | R8

P.5 Making Processes Visible



Food and materials value chain activities need visibility to link their products and services to the local market, and to ensure that the general public recognises their importance to the community.

Connected to
C7 | C9 | Co1 | Co3 | P1 | P7 | P8 | R6

P.6 Value Waste

Food waste and agricultural by-products can often be collected and converted into bio-based materials. They can be used for packaging, buildings, etc.

Connected to
C1 | C2 | C3 | C4 | P1 | P4 | E1 | E3 | E4 | R4 | R8

P.7 Local Markets

Opportunities to purchase locally produced goods will be introduced to strengthen the local food chain.

Connected to
C5 | C7 | C9 | Co3 | P2 | P5 | P8 | R3 | R8

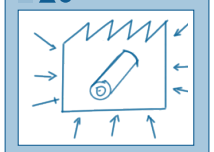
P.8 Reshape the Peri-Urban| Rural

The Peri Urban area will be transformed into a link between nature and the city.

Connected to
C1 | C2 | C5 | C7 | Co1 | Co2 | P1 | P2 | P3 | P4 | P5 | P7 | E1 | E3 | E5 | R2 | R4 | R5 | R7

Examplery Region

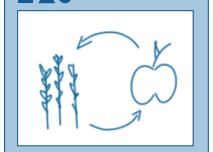
E.1 Material Collection Hubs



Establish facilities to implement collective (biobased) material sharing. Storage capacity for collection in close proximity to processing and prodcing units is needed.

Connected to
C3 | P1 | P4 | P6 | P8 | E2 | E3 | R1 | R3 | R8

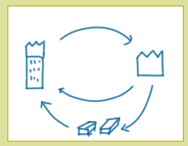
E.2 Material Exchange



Suitable areas specialise according to soil type and then exchange materials and food with each other.

Connected to
C3 | C5 | C9 | P1 | P2 | E1 | E3 | E4 | R3 | R8

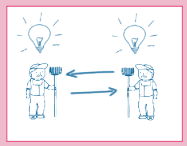
E.3 Urban Mining



The built environment must be preserved and only necessary changes adapted. Material from demolished buildings must be reused and new building material must be introduced only as bio-based material.

Connected to
C3 | Co3 | P6 | P10 | E1 | E2 | E4 | E5 | R3 | R8

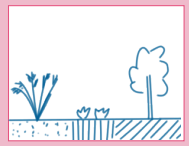
E.4 Knowledge Exchange



Farming collectives have the opportunity to specialise in a way of farming that works well under local conditions, and this knowledge is shared between communities to enable a resilient farming system.

Connected to
C1 | C2 | C3 | C4 | C5 | P4 | P6 | P10 | E3 | E5 | R2 | R4 | R6 | R7 | R8 | R9

E.5 Soilrelated Farming

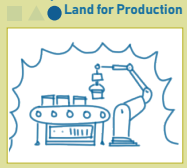


Different types of soil are suitable for growing specific foods or bio-based materials. Agriculture will be developed in proportion to the benefits.

Connected to
C1 | C2 | C3 | C6 | C8 | P3 | P4 | P8 | E2 | E4 | R4 | R7 | R9

Region

R.1 Keep Infrastructure for Land for Production



Redundant infrastructure and buildings will not be demolished or simply converted into housing, but will be converted for advanced manufacturing industries.

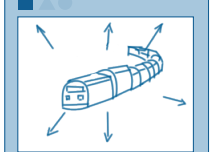
Connected to
C9 | Co3 | P2 | P3 | P4 | P10 | E1 | R3 | R4 | R5 | R8

R.2 Depave & Regreen

Soil compacted by extensive use of heavy machinery is regenerated into healthy soil with high water storage capacity.

Connected to
C2 | C4 | P3 | P8 | E4 | R3 | R4 | R5 | R7 | R9

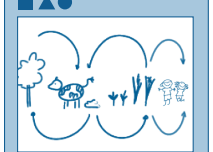
R.3 Links to Infrastructure



Production and processing units benefit from their proximity to the relevant infrastructure linking the distribution networks.

Connected to
C1 | C2 | C5 | C8 | C9 | P3 | P4 | P7 | E1 | E2 | E3 | R1 | R2 | R4 | R5

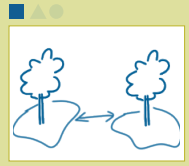
R.4 Diversify Landuse



Combining different land use purposes, such as livestock, crops, forests and care infrastructure instead of large scale intensive farming

Connected to
C1 | C2 | C4 | C5 | C6 | C9 | Co2 | Co3 | P5 | P6 | P8 | E4 | E5 | R1 | R2 | R3 | R7 | R8 | R9

R.5 Regenerative Corridors



Natura 2000 sites will be expanded and connected through regenerative corridors such as wetlands or forests that can be harvested after a few years.

Connected to
P3 | P8 | R1 | R2 | R3 | R4 | R7 | R9

R.6 Education Campus

Production and knowledge must be combined and made transparent and thus accessible to the public to trigger a mindset change.

Connected to
C7 | Co1 | P5 | E4

R.7 Regenerative Farming

The aim of regenerative farming is to strike a balance between an economically viable business model and ecosystem and spatial qualities.

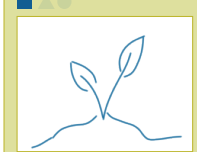
Connected to
C1 | C5 | C6 | P1 | P3 | P8 | E4 | E5 | R2 | R4 | R5 | R9

R.8 Reshape Import & Export

A shift in our current import-export system is crucial. Instead of trading luxury goods, we should be exchanging knowledge and essential products such as raw materials.

Connected to
C9 | P1 | P2 | P4 | P6 | P7 | E1 | E2 | E3 | E4 | R1 | R4

R.9 Healthy Soil



Healthy soil is essential to the donut diet. Soil regeneration is a top priority to increase water holding capacity and biodiversity. Once restored, it can be used for production again.

Connected to
C1 | C2 | C3 | C5 | C6 | P3 | E4 | E5 | R2 | R4 | R5 | R7

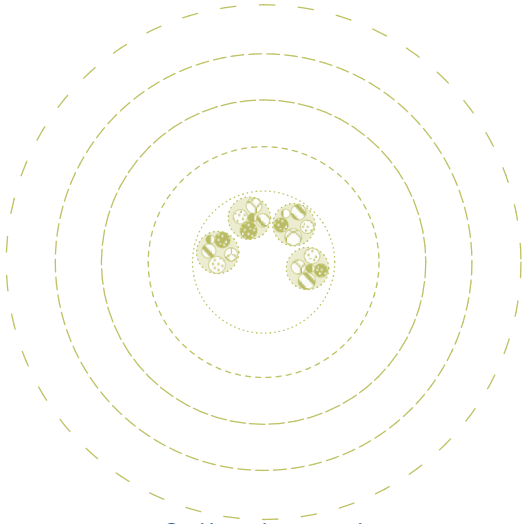
■ Diversify
▲ Collective
● Conscious Loops

Education
Spatial
Policies

Figure 5.11 Pattern language overview

5.4 SPATIAL IMPLICATIONS THROUGH THE SCALES

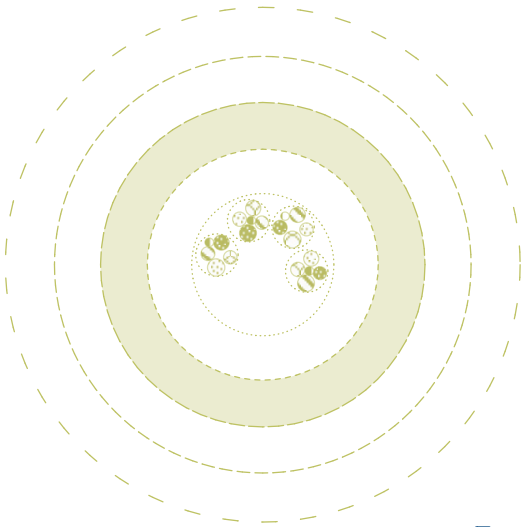
To get more insight in the system we are implementing, we will take a look at the new agriculture system through the different scales. In figure 5.12 you can see the different scales we work with. In the following pages these scales will show a map of our new agriculture system with textual explanation.



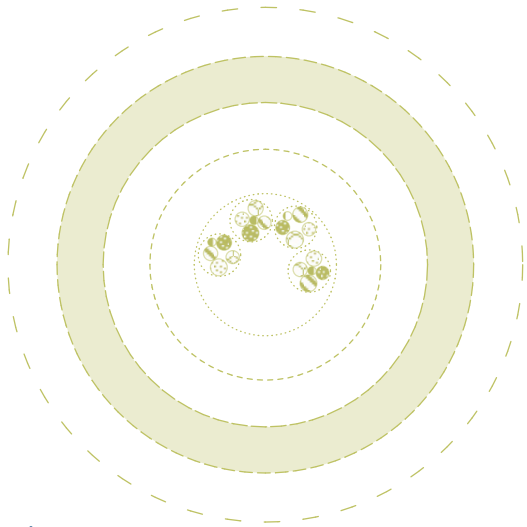
Collective scale

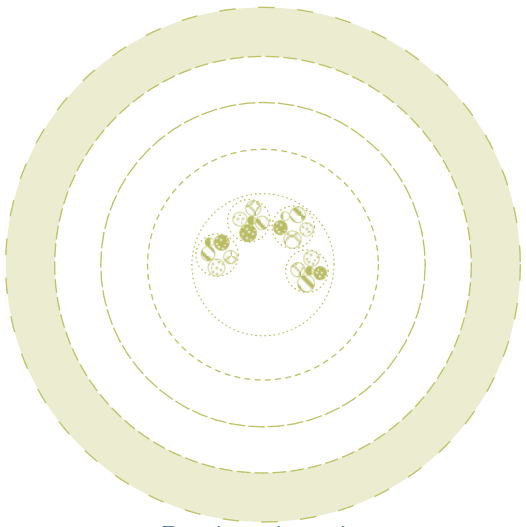
Cooperation scale

Production region scale



Examplary region scale





Regional scale

Figure 5.12 Scale overview

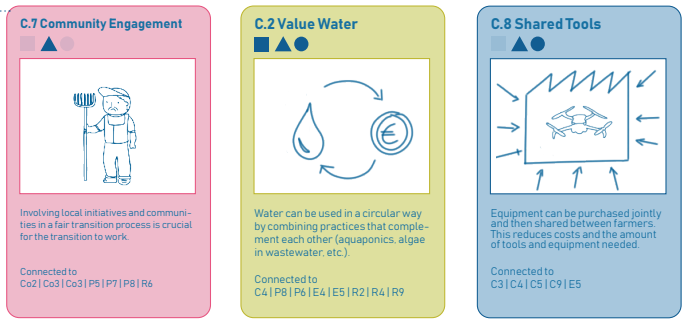
COLLECTIVE SCALE

A collective consists of at least four farms. The stables, previously used for livestock, are transformed into hubs for the collectives: a water hub, a hub for general tools and a hub for the products produced within the collective. A fourth stable is reserved for transformation into a training or care centre, working at the level of the co-operative.

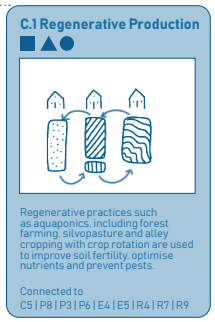
Agricultural production is shifting towards regenerative and nature-based production, resulting in the landscape changing from a rigid agricultural polder landscape to a more natural one. This will lead to a differentiation in agriculture based on soil type. Therefore, collectives will most likely specialise in food or bio-based materials based on the region and further diversify their business model by adding social and educational facilities.

Risks and benefits will be shared collectively, allowing for the introduction of new tools and formats such as apps to optimise local resource distribution, smart agriculture and land leases that allow for further diversification of the farming business.

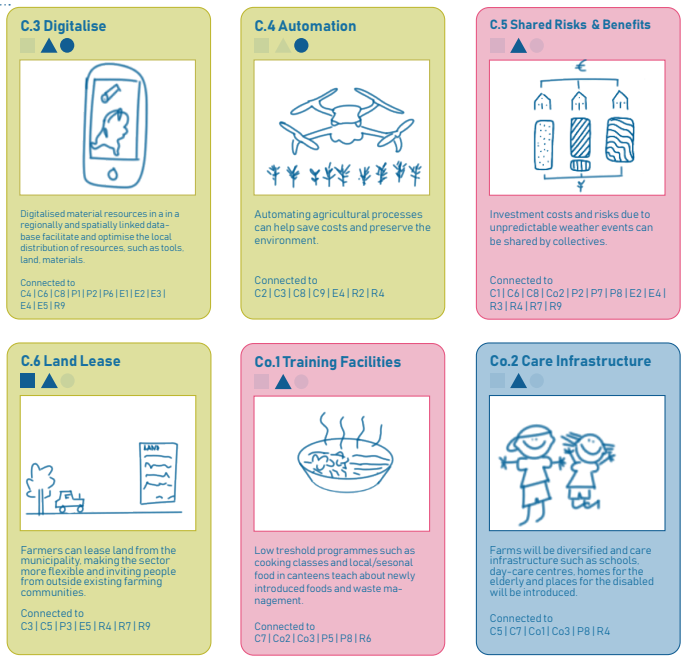
Transforming Stables into Hubs



Transforming Agricultural Production



Diversify Agricultural Business Modell



- Farms
- Tool Hub
- Produce Hub
- Water Hub
- Community Centre
- Water
- Existing Roadways
- Existing Railways
- Neighbouring Collectives
- Collectives

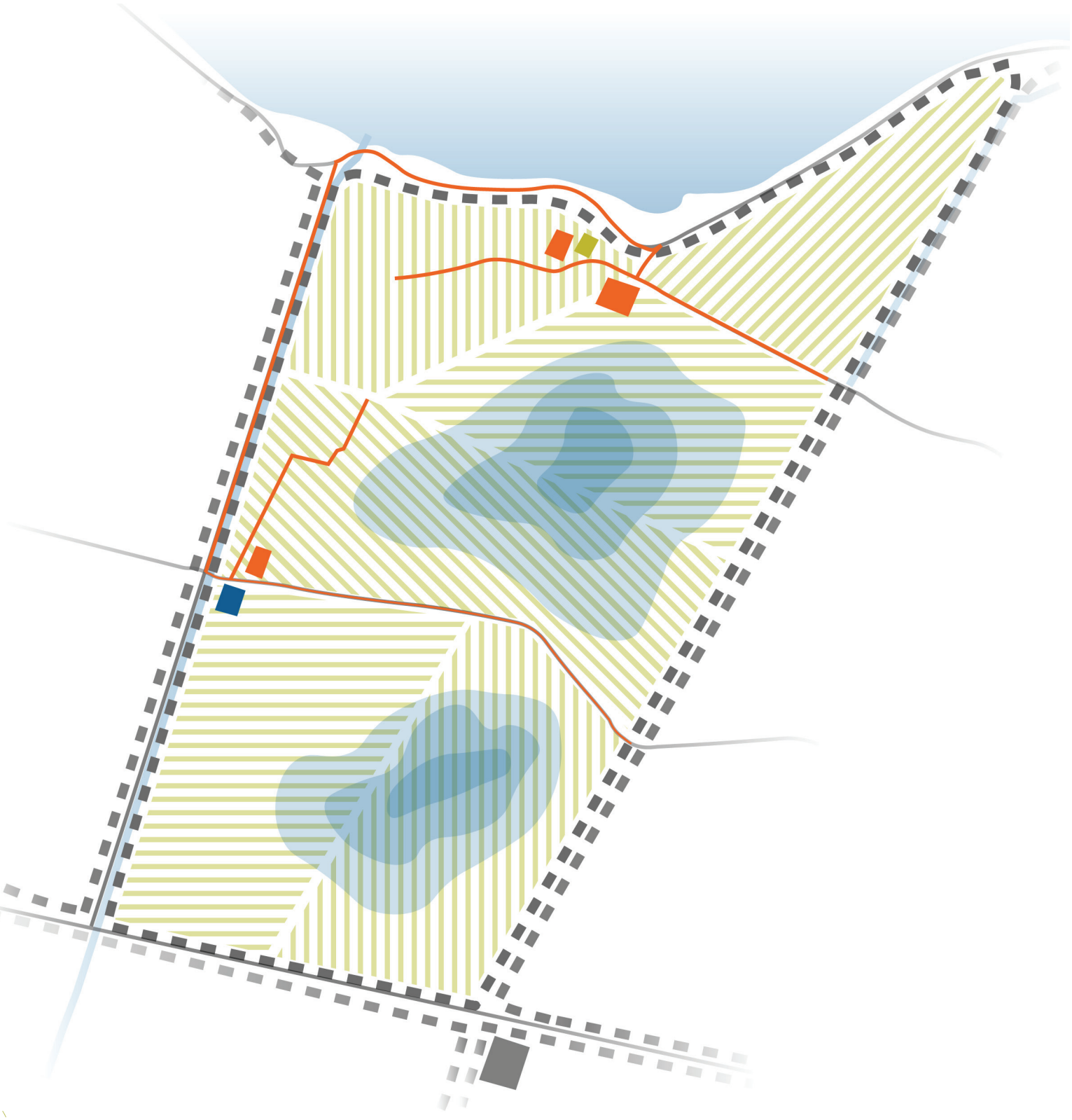


Figure 5.13 Collective scale map

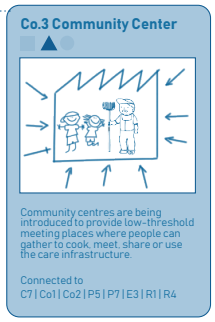
COOPERATION SCALE

A cooperation consists of several collectives. They share a common community centre where knowledge is shared specifically for that cooperation, by organising workshops or experiencing cooking as a collective knowledge exchange. It is located in the centre of the cooperation, so that it is equally accessible to all collectives. On this scale, the care stables are also used to provide childcare, retirement homes and other social facilities in close proximity.

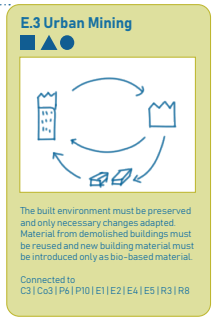
In order to preserve both nature and agricultural areas, and thus to remain within the planetary limits, the urban fabric will not be expanded any further. In order to meet the social limits, it will be densified within the existing boundaries shown in red. Buildings will be redesigned rather than demolished, and new additions will be built using only recycled or bio-based materials.

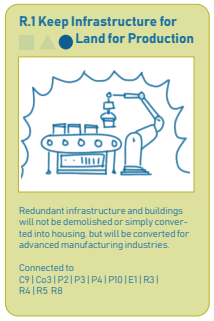
By forming collectives within the urban fabric and transforming vacant buildings, car parks, etc. into efficient production centres, urban areas will be better equipped to meet their needs for food and material production. By incorporating food forests as part of parks and educational facilities, food production becomes not only part of the city but also part of everyday life.

Introduce Caring Infrastructure



Transform and Densify





Production in Cities

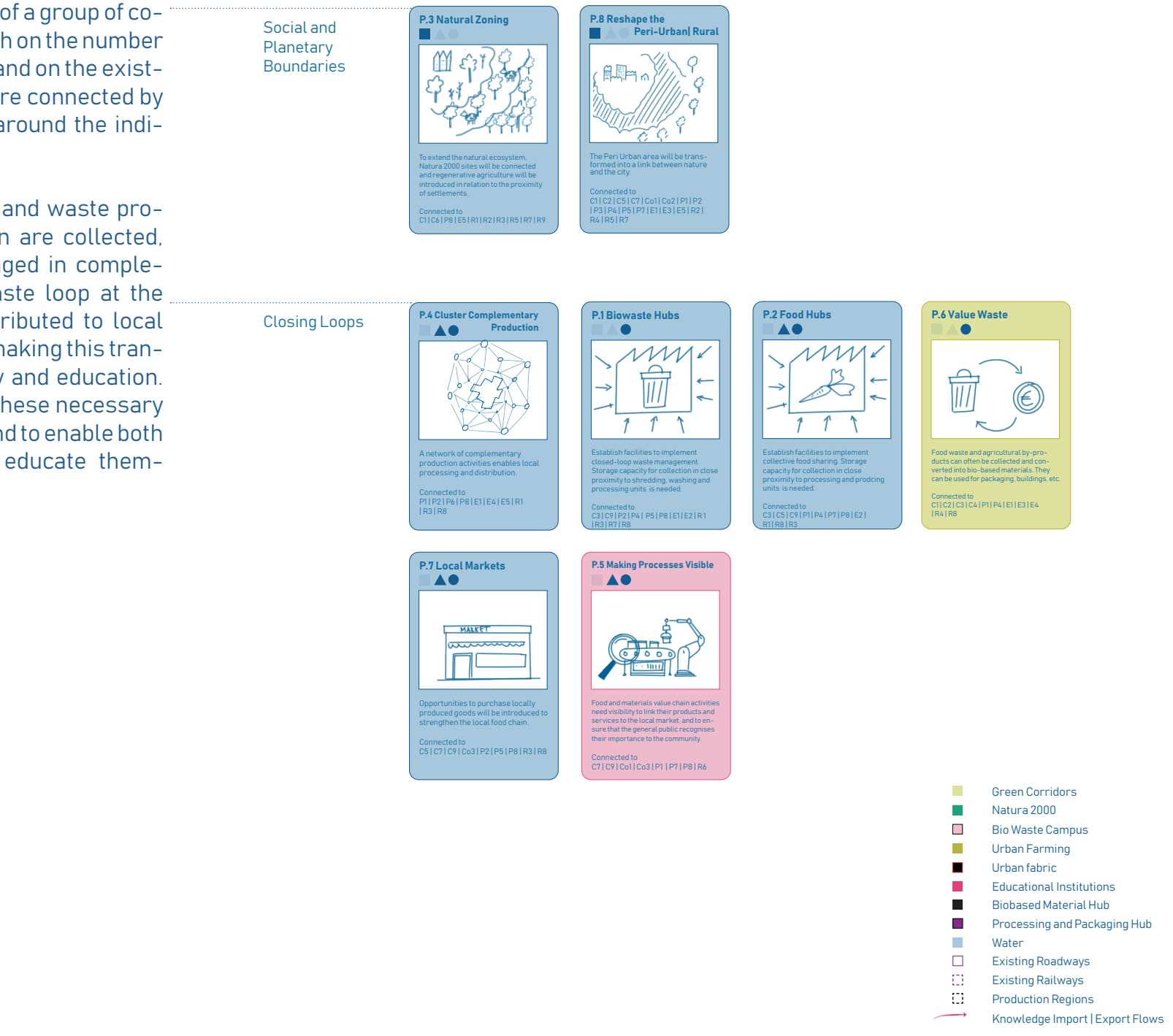
- Farms
- Specialised Tools Hub
- Urban Farming
- Urban fabric
- Community Centre
- Biobased Material Hub
- Water
- Existing Roadways
- Existing Railways
- Collectives
- Cooperation

Figure 5.14 Cooperation scale map

PRODUCTION REGION SCALE

The production region consists of a group of co-operatives. Its size depends both on the number of inhabitants it has to support and on the existing Natura 2000 areas, which are connected by newly added green corridors around the individual production regions.

The food, bio-based materials and waste produced in the production region are collected, washed, processed and packaged in complementary hubs, closing the waste loop at the local level. They are then distributed to local markets. An important part of making this transition possible is transparency and education. It is therefore crucial to make these necessary production processes visible and to enable both professionals and society to educate themselves.



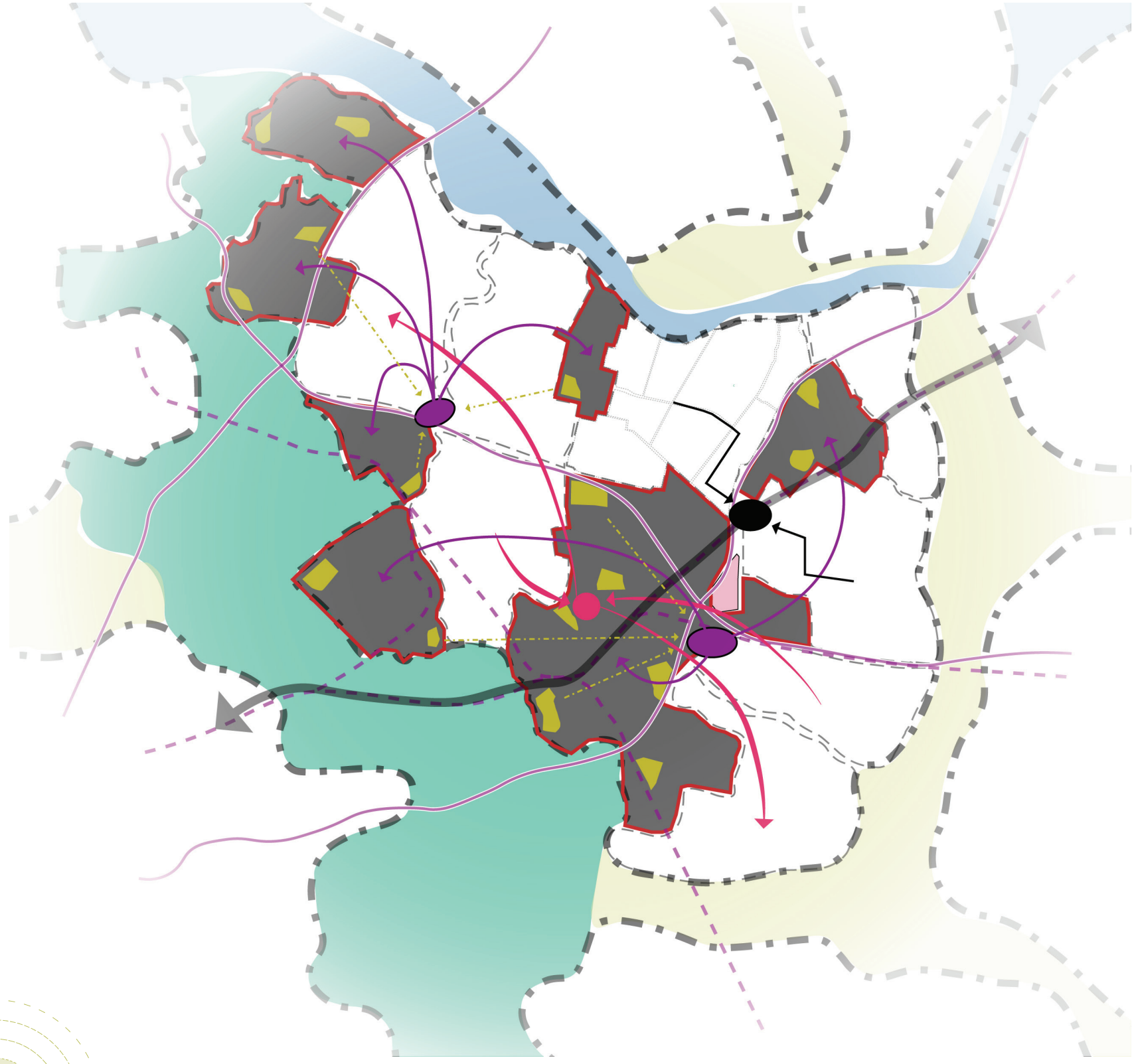


Figure 5.15 Production region scale map

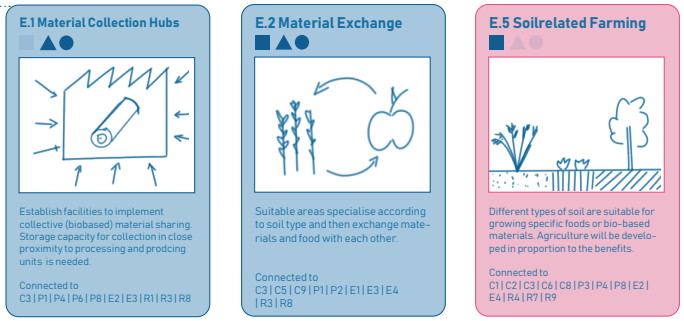
EXAMPLARY REGION SCALE

Several production regions make up the exemplary region. These regions are often dependent on a specific soil type (e.g. Groene Heart) and can therefore specialise accordingly. If we stop maintaining the polder landscape in order to move towards a more regenerative agricultural model, areas with peaty soils will mainly produce bio-based materials in the future. Areas with sandy and clay soils will produce more food. In order for each exemplary region to meet its needs for both diverse, local food and bio-based materials, an exchange will be crucial.

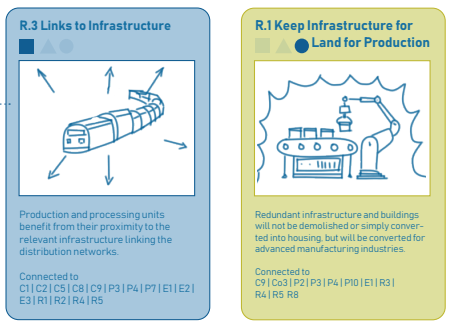
The food and material hubs are strategically located next to major infrastructural arteries that need to be maintained. However, product flows are not evenly distributed across the production region, as they depend on each region's ability to sustain itself.

The exemplary region contains several educational institutions, such as universities and technical colleges. These institutions form a network and exchange knowledge within the production region and beyond its borders. In this way, they benefit from each other's knowledge of climate-adapted, soil-related agricultural practices, new developments in digitalisation, etc.

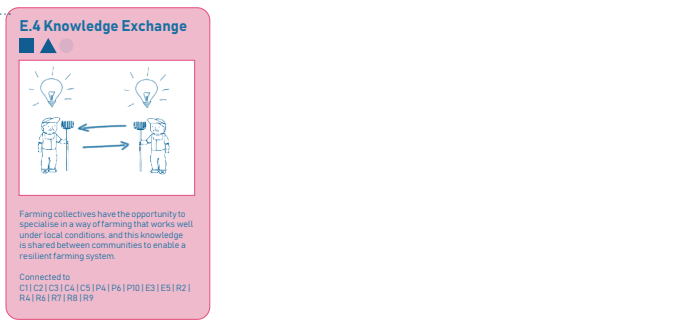
Material Exchange



Infrastructure



Knowledge Exchange



- Green Corridors
- Natura 2000
- Educational Institutions
- Biobased Material Hub
- Processing and Packaging Hub
- Water
- Existing Roadways
- Existing Railways
- Examplery Regions
- Knowledge Import | Export Flows

Figure 5.16 Examplary region scale map

REGIONAL SCALE

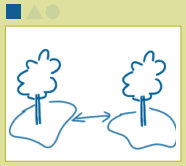
The National Ecological Network (NEN) with integrated Natura 2000 areas is clearly visible at this scale. It will be maintained and expanded by introducing additional green corridors linking Natura 2000 areas inside and outside the Netherlands. These corridors will serve as recreational areas and can be used for the production of bio-based materials once the soil has regenerated.

Instead of promoting large-scale, intensive farming, we are introducing incentives for diversified business models that promote small-scale, regenerative and soil-based farming methods and can be combined with care facilities.

We also want to transform the current import and export system. Instead of importing raw materials and exporting processed goods, exploiting labour in the Global South, we want to move towards knowledge exchange. In this way, we hope to empower the Global South to process their own materials, thereby promoting a more equitable distribution of resources around the globe. This changing infrastructure leads to vacant industrial areas that can be transformed for local food and material production.

Environmental Sustainability

R.5 Regenerative Corridors



Natura 2000 sites will be expanded and connected through regenerative corridors such as wetlands or forests that can be harvested after a few years.

Connected to
P3 | P8 | R1 | R2 | R3 | R4 | R7 | R9

R.2 Depave & Regreen

Soil compacted by extensive use of heavy machinery is regenerated into healthy soil with high water storage capacity.

Connected to
C2 | C4 | P3 | P8 | E4 | R3 | R4 | R5 | R7 | R9

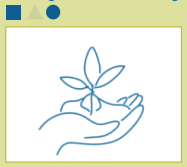
Empower Small Scale Farming

R.4 Diversify Landuse

Combining different land use purposes, such as livestock, crops, forests and care infrastructure instead of large scale intensive farming

Connected to
C1 | C2 | C4 | C5 | C6 | C9 | Co2 | Co3 | P5 | P6 | P8 | E4 | E5 | R1 | R2 | R3 | R7 | R8 | R9

R.7 Regenerative Farming



The aim of regenerative farming is to strike a balance between an economically viable business model and ecosystem and spatial qualities.

Connected to
C1 | C5 | C6 | P1 | P3 | P8 | E4 | E5 | R2 | R4 | R5 | R9

R.9 Healthy Soil

Healthy soil is essential to the donut diet. Soil regeneration is a top priority to increase water holding capacity and biodiversity. Once restored, it can be used for production again.

Connected to
C1 | C2 | C3 | C5 | C6 | P3 | E4 | E5 | R2 | R4 | R5 | R7

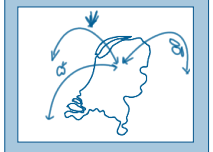
Social Sustainability

R.6 Education Campus

Production and knowledge must be combined and made transparent and thus accessible to the public to trigger a mindset change.

Connected to
C7 | Co1 | P5 | E4

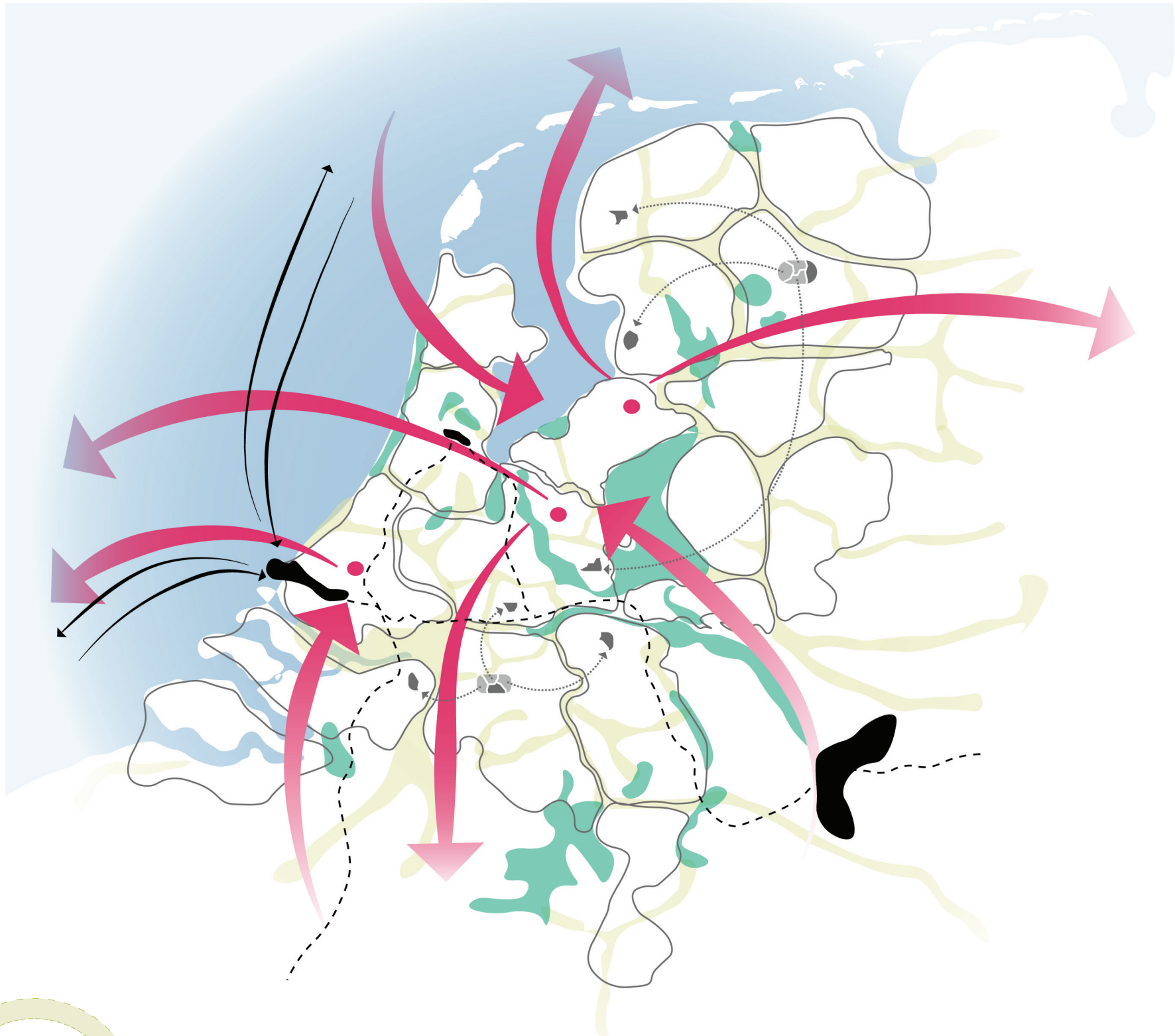
R.8 Reshape Import & Export



A shift in our current import-export system is crucial. Instead of trading luxury goods, we should be exchanging knowledge and essential products such as raw materials.

Connected to
C9 | P1 | P2 | P4 | P6 | P7 | E1 | E2 | E3 | E4 | R1 | R4

- Green Corridors
- Natura 2000
- Import/export areas
- Relocating companies
- Water
- Existing Railways
- Examplery Regions
- Food Import | Export Flows
- Knowledge Import | Export Flows



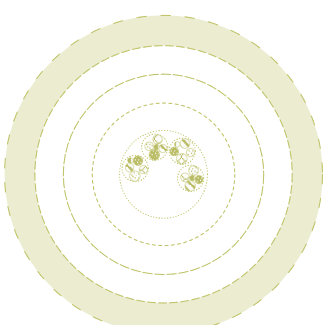


Figure 5.17 Regional scale map

0 14 28 km

5.5 LAND TYPOLOGIES

The typology map shows the soil type, overlaid with a map showing the rural, peri-urban and urban areas of the example region on a 1x1 kilometre grid. All typologies are represented in the area, and thus a good mix of different agricultural forms would be able to sustain the example region. Most of the urban area can be found in the western part of the region, which is logical as this is part of the Randstad. Urban areas are still not the dominant factor though, because peri-urban and rural areas do make up a big part of this part of the region. On sandy soil, in the eastern part of the region, peri-urban and rural areas are even more dominant, as there are almost no urban areas to be found there.

Based on this typology map, in combination with the existing infrastructure, we are able to identify interesting areas for pilot projects. The three locations of the pilot projects are based upon three different types of typologies and their proximity to big infrastructure:

Bodegraven (peri-urban and peat)
Bodegraven is chosen as it is located on the edge of three production regions, and thus a green corridor has to be created there, as well as the presence of companies related to the dairy industry whose buildings will be transformed into a regional food hub.

Utrecht (urban and clay)
The case of Utrecht will show how cities will change with the addition of food production within their boundaries. This area is interesting as there are lots of companies located there that are related to food (such as distribution centres for supermarkets or companies that process coffee). These will be transformed into vertical farms and a food hub to make it possible to grow food locally as well. Unbuilt areas will be transformed into production sites for materials and food. Neighbourhoods that are likely to undergo a renewal are proposed to have food production integrated in them such as with greenhouses on top of roofs.

Nijkerk (rural/peri-urban and sand)
Nijkerk is interesting as there is a milk processing unit located there which will be transformed into a fungi/insect farm, with the help of the educational institute located there. This practical school focused on agriculture will also be able to experiment on some parcels that will be reserved for the students to test new forms of agriculture.

Nijkerk

Utrecht

Bodegraven

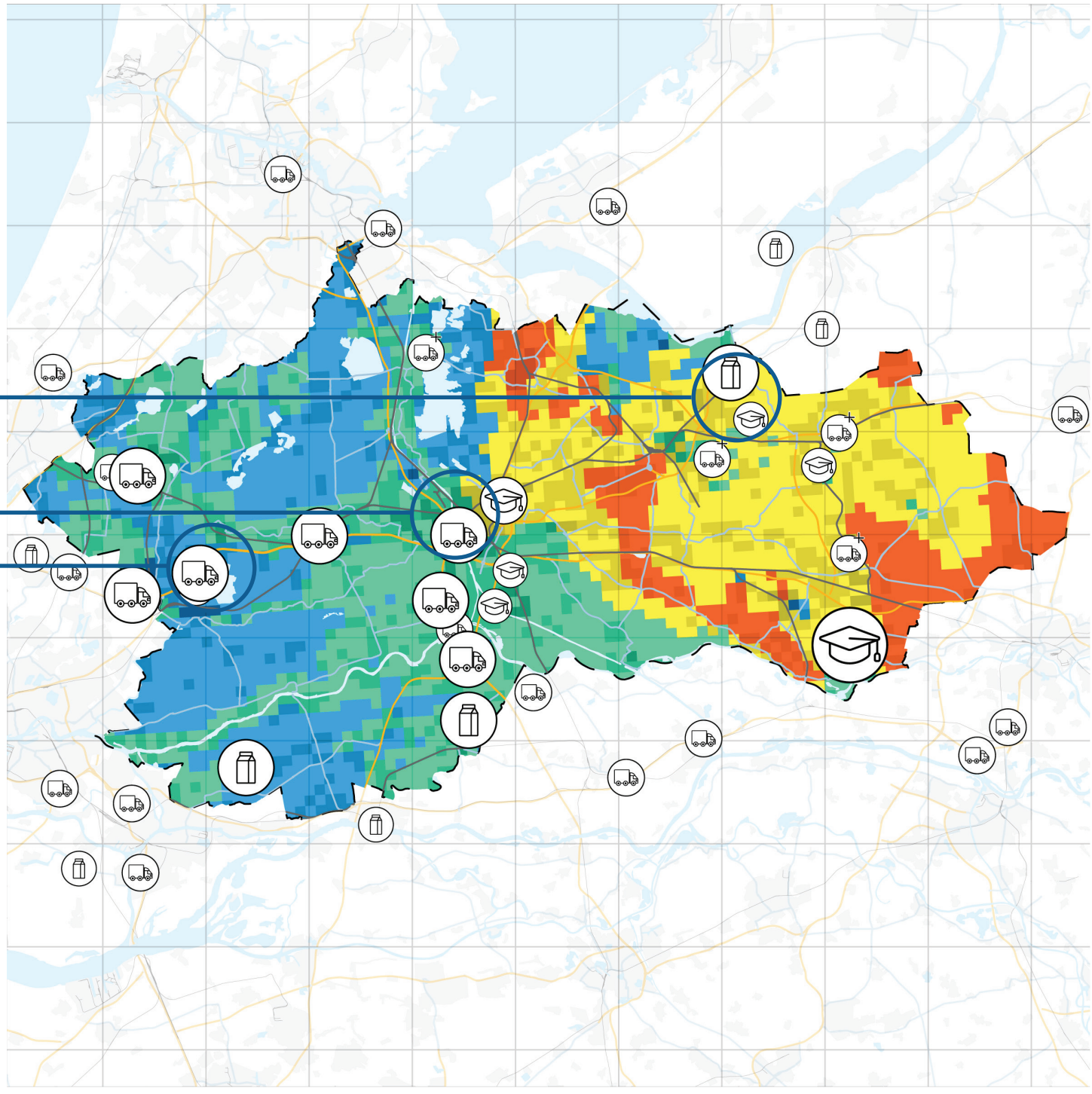


Figure 5.18 Typology map with pilot project locations

5.6 PILOT PROJECTS

BODEGRAVEN

Bodegraven is situated along the highway from Utrecht to Rotterdam and the railway from Utrecht to Leiden. This area is interesting as two things come together here: the border of several production regions and the addition of a regional food hub.

Since three production regions come together here (Woerden (which includes Bodegraven), Gouda and Alphen aan den Rijn), a **green corridor** will be created to separate them. The green corridors run from and to existing nature to create connections for wildlife. This specific corridor runs from the Reeuwijkse Plassen (seen in the bird's eye) to the Nieuwkoopse Plassen. Along the green corridor and existing nature agroforestry will be the main form of agriculture, slowly fading into more 'intensive' agriculture (see the diagrams on the page **102**).

In the analysis we saw that some companies related to cheese were located in the industrial areas of Bodegraven. As 80% of the dairy production will be reduced, these companies will probably cease to exist in the future. The vacant buildings will then be transformed into the **food hub** for the production region because of its strategic location along big infrastructure. The food hub consists of processing food, processing bio-waste and packaging.

The existing farms will be split up into **collectives**, creating several hubs per collective (tools, water, community and cattle). The thick black line around Bodegraven represents the current built up area, which forms a hard border because urban expansion is not allowed anymore; all to built structures will have to be built in the existing urban areas.

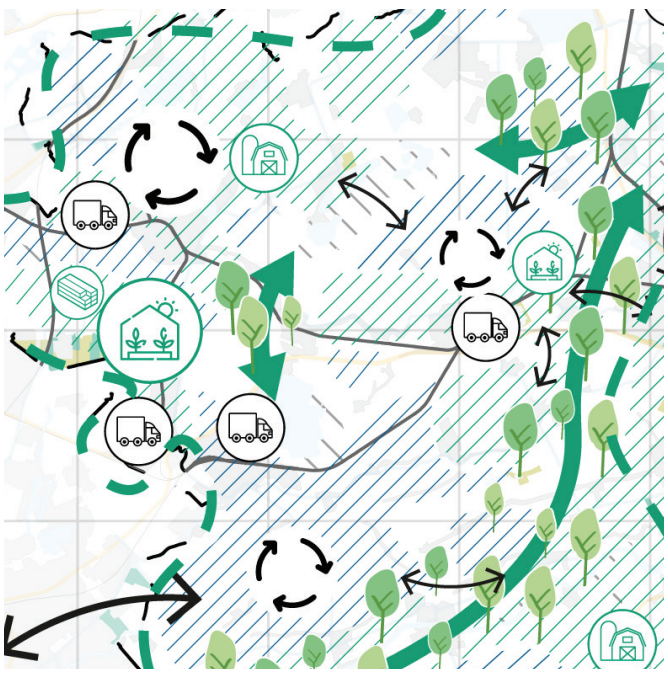


Figure 5.19 Zoomed in Map and Aerial Photography, Source: Google Earth, 2024.

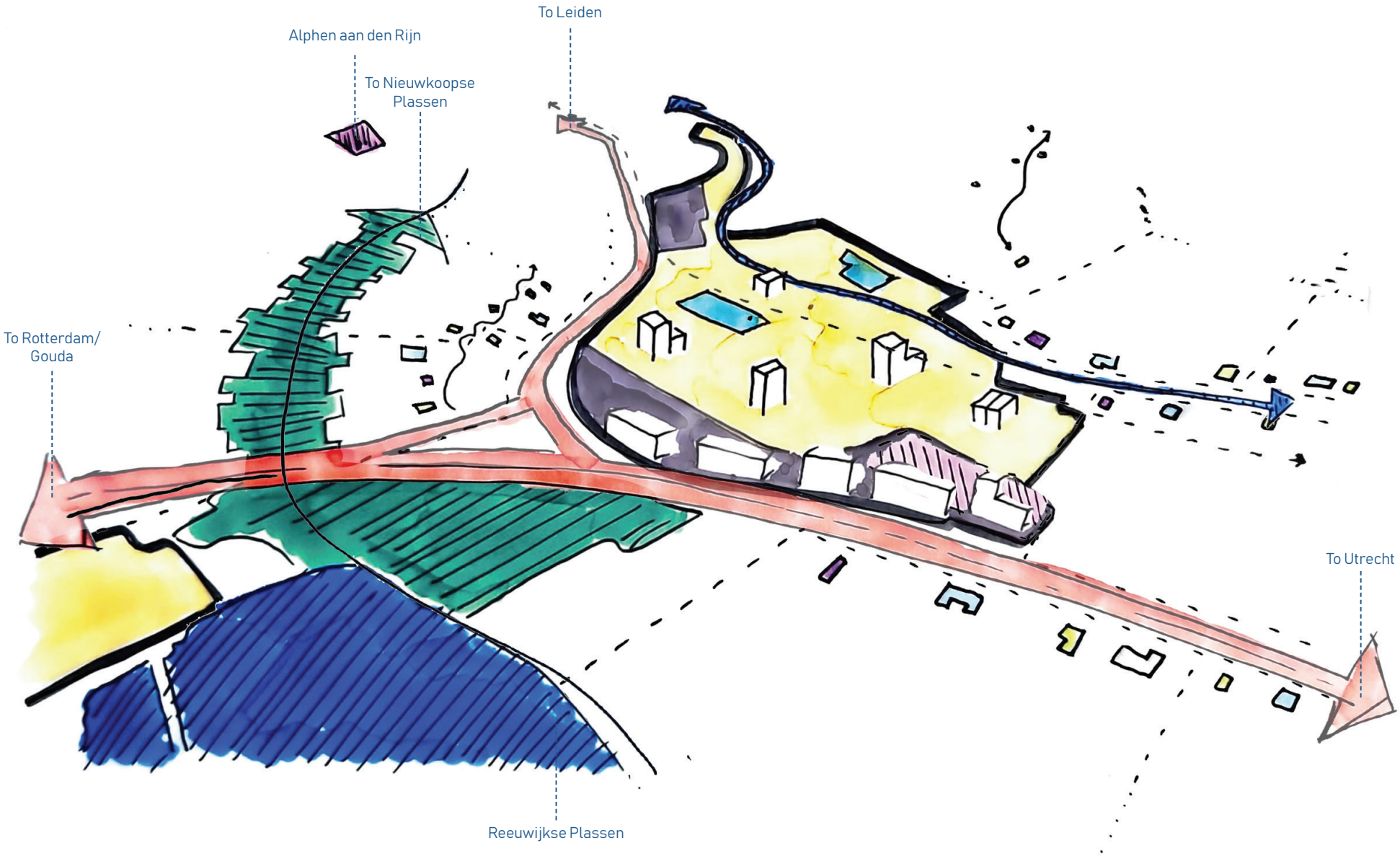


Figure 5.20 Birdseye view Bodegraven

PILOT PROJECT BODEGRAVEN: PATTERN IN USE

Densification
Since the city boundaries will be kept in place, urban areas will densify. This will reshape the urban landscape as we know it

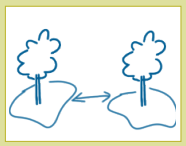
P.8 Reshape the Peri-Urban| Rural

The Peri Urban area will be transformed into a link between nature and the city.

Connected to
C1 | C2 | C5 | C7 | Co1 | Co2 | P1 | P2 | P3 | P4 | P5 | P7 | E1 | E3 | E5 | R2 | R4 | R5 | R7

Green corridors
The green corridors form the boundaries of the production region to ensure that the planetary boundaries are not exceeded

R.5 Regenerative Corridors



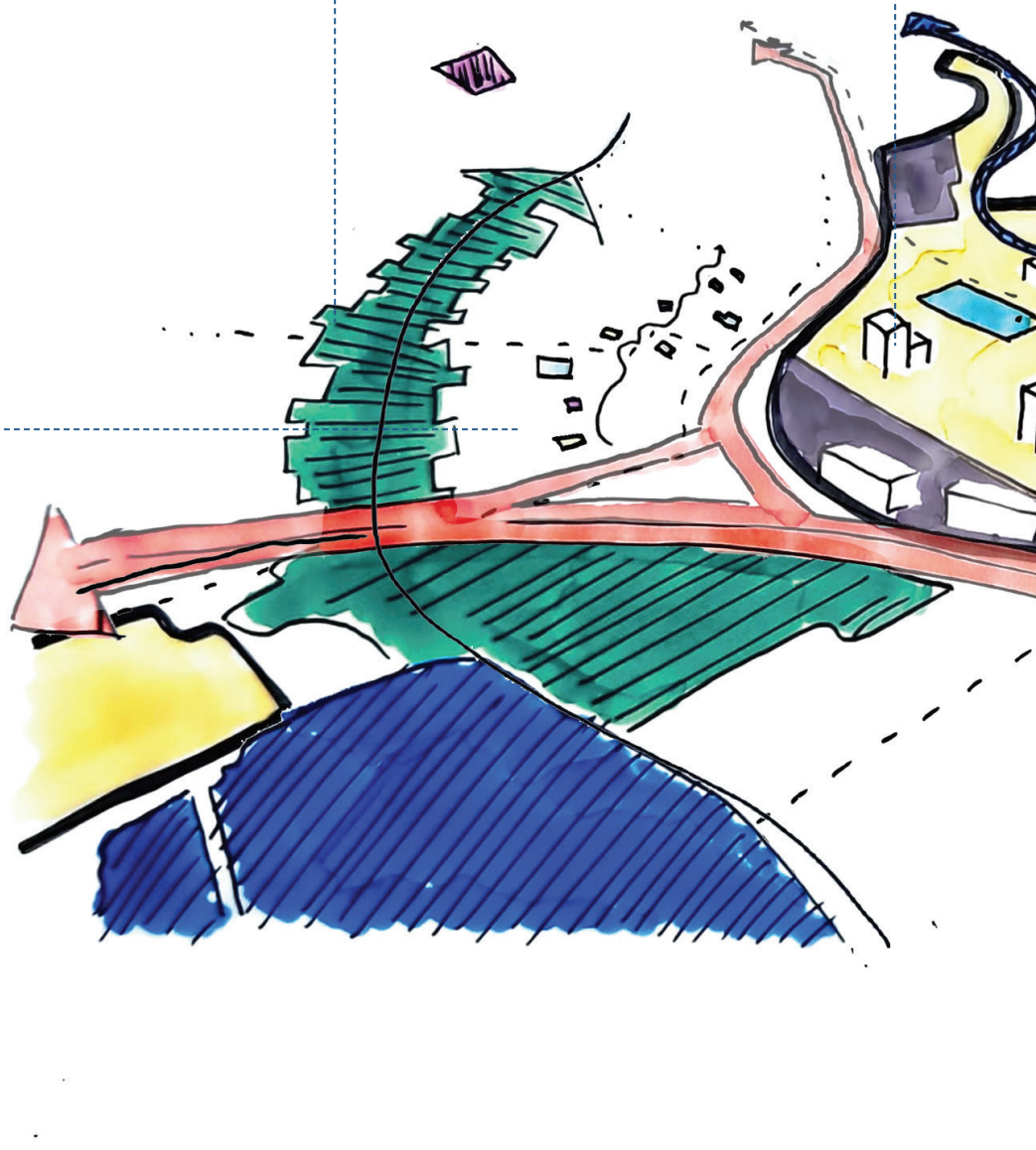
Natura 2000 sites will be expanded and connected through regenerative corridors such as wetlands or forests that can be harvested after a few years.

Connected to
P3 | P8 | R1 | R2 | R3 | R4 | R7 | R9

P.3 Natural Zoning

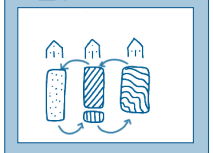
To extend the natural ecosystem, Natura 2000 sites will be connected and regenerative agriculture will be introduced in relation to the proximity of settlements.

Connected to
C1 | C6 | P8 | E5 | R1 | R2 | R3 | R5 | R7 | R9



Regenerative farming
The existing agricultural fields will transform into a regenerative form with soilbased solutions

C.1 Regenerative Production



Regenerative practices such as aquaponics, including forest farming, silvopasture and alley cropping with crop rotation are used to improve soil fertility, optimise nutrients and prevent pests.

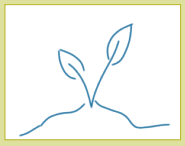
Connected to
C5 | P8 | P3 | P6 | E4 | E5 | R4 | R7 | R9

R.7 Regenerative Farming

The aim of regenerative farming is to strike a balance between an economically viable business model and ecosystem and spatial qualities.

Connected to
C1 | C5 | C6 | P1 | P3 | P8 | E4 | E5 | R2 | R4 | R5 | R9

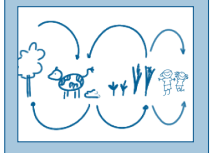
R.9 Healthy Soil



Healthy soil is essential to the donut diet. Soil regeneration is a top priority to increase water holding capacity and biodiversity. Once restored, it can be used for production again.

Connected to
C1 | C2 | C3 | C5 | C6 | P3 | E4 | E5 | R2 | R4 | R5 | R7

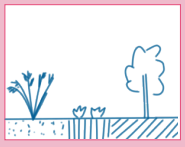
R.4 Diversify Landuse



Combining different land use purposes, such as livestock, crops, forests and care infrastructure instead of large scale intensive farming

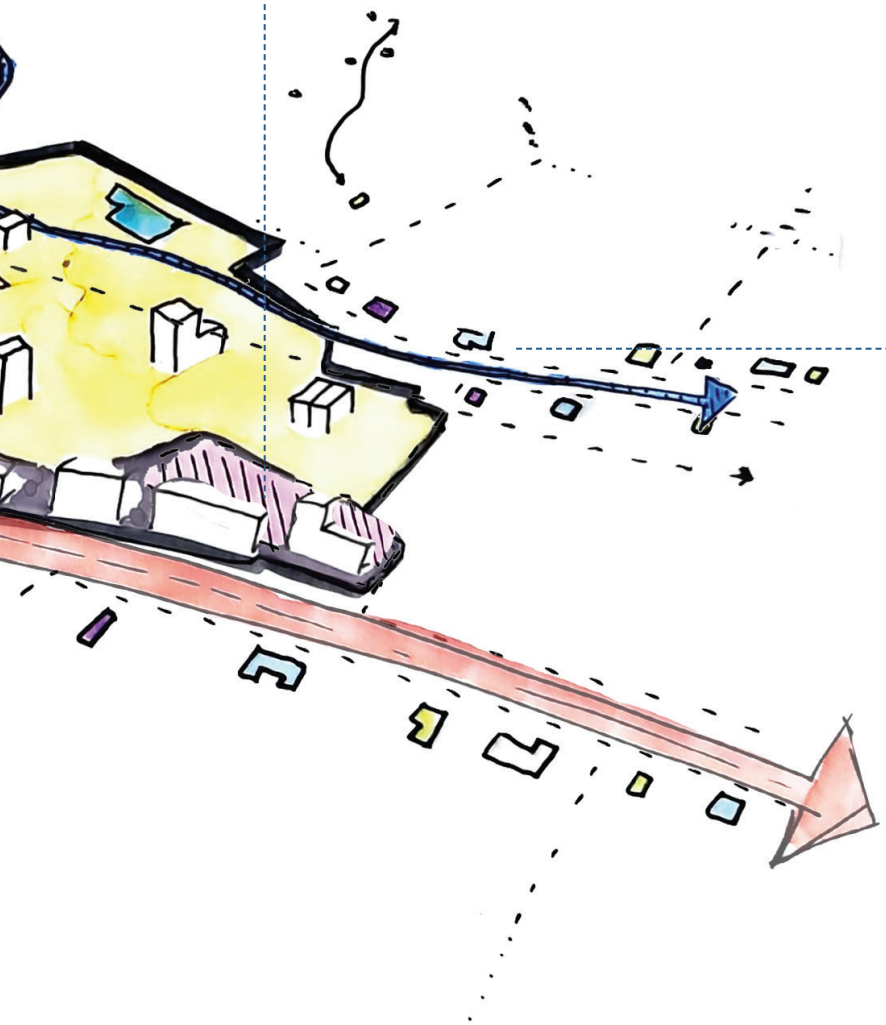
Connected to
C1 | C2 | C4 | C5 | C6 | C9 | Co2 | Co3 | P5 | P6 | P8 | E4 | E5 | R1 | R2 | R3 | R7 | R8 | R9

E.5 Soilrelated Farming



Different types of soil are suitable for growing specific foods or bio-based materials. Agriculture will be developed in proportion to the benefits.

Connected to
C1 | C2 | C3 | C6 | C8 | P3 | P4 | P8 | E2 | E4 | R4 | R7 | R9



R.3 Links to Infrastructure

Production and processing units benefit from their proximity to the relevant infrastructure linking the distribution networks.

Connected to
C1 | C2 | C5 | C8 | C9 | P3 | P4 | P7 | E1 | E2 | E3 | R1 | R2 | R4 | R5

P.6 Value Waste

Food waste and agricultural by-products can often be collected and converted into bio-based materials. They can be used for packaging, buildings, etc.

Connected to
C1 | C2 | C3 | C4 | P1 | P4 | E1 | E3 | E4 | R4 | R8

P.1 Biowaste Hubs

Establish facilities to implement closed-loop waste management. Storage capacity for collection in close proximity to shredding, washing and processing units is needed.

Connected to
C3 | C9 | P2 | P4 | P5 | P8 | E1 | E2 | R1 | R3 | R7 | R8

P.2 Food Hubs

Establish facilities to implement collective food sharing. Storage capacity for collection in close proximity to processing and prodcing units is needed.

Connected to
C3 | C5 | C9 | P1 | P4 | P7 | P8 | E2 | R1 | R8 | R3

Regional hub
The regional hub located next to the highway will handle everything food related after it has been brought there so that it can be send to local markets

C.2 Value Water

Water can be used in a circular way by combining practices that complement each other (aquaponics, algae in wastewater, etc.).

Connected to
C4 | P8 | P6 | E4 | E5 | R2 | R4 | R9

C.5 Shared Risks & Benefits

Investment costs and risks due to unpredictable weather events can be shared by collectives.

Connected to
C1 | C6 | C8 | Co2 | P2 | P7 | P8 | E2 | E4 | R3 | R4 | R7 | R9

C.6 Land Lease

Farmers can lease land from the municipality, making the sector more flexible and inviting people from outside existing farming communities.

Connected to
C3 | C5 | P3 | E5 | R4 | R7 | R9

C.8 Shared Tools

Equipment can be purchased jointly and then shared between farmers. This reduces costs and the amount of tools and equipment needed.

Connected to
C3 | C4 | C5 | C9 | E5

Co.1 Training Facilities

Low treshold programmes such as cooking classes and local/sesonal food in canteens teach about newly introduced foods and waste management.

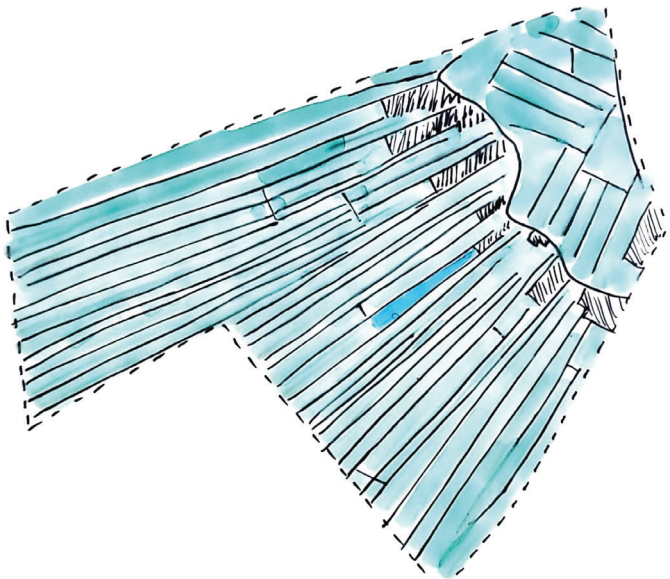
Connected to
C7 | Co2 | Co3 | P5 | P8 | R6

Collectives
Farmers will work together with each others and share tools, land, etc.

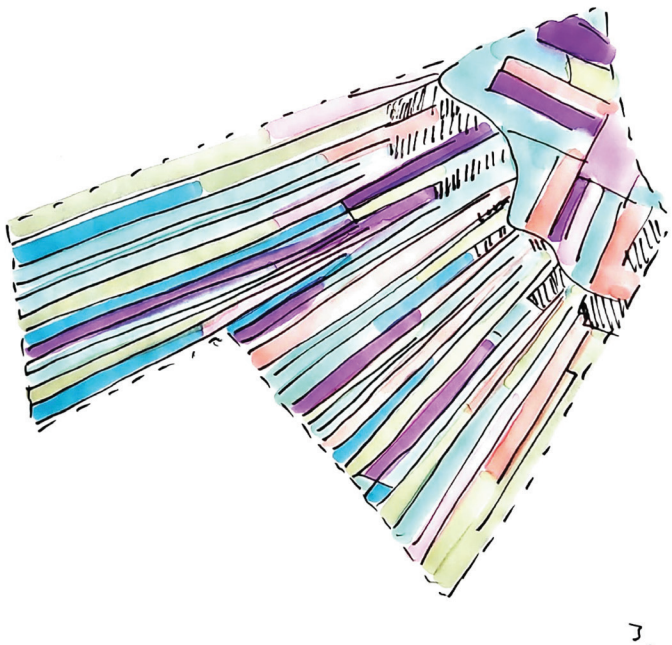
Figure 5.21 Birdseye view Bodegraven, linked to pattern language

PILOT PROJECT BODEGRAVEN: COLLECTIVE SHIFT

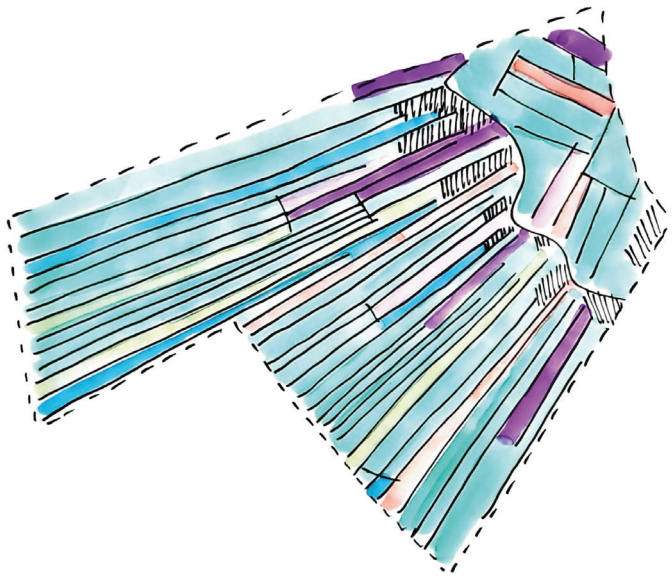
The diagrams show the change that the land of a collection will go through over the years. Currently, the collection only has grassland suited for cows, but in the future this landscape will change to a much more diverse agricultural system (hence the colours, which merely represent the diverse landuse and no specific crops or landuse), maintaining the historic polder landscape. Since this collection has a green corridor running through it on the westside, the more agroforest-like and nature-based forms of agriculture will be present there, while closer to the existing urban fabric more 'intensive' forms of agriculture will be present (see the diagrams on the page **104-105**).



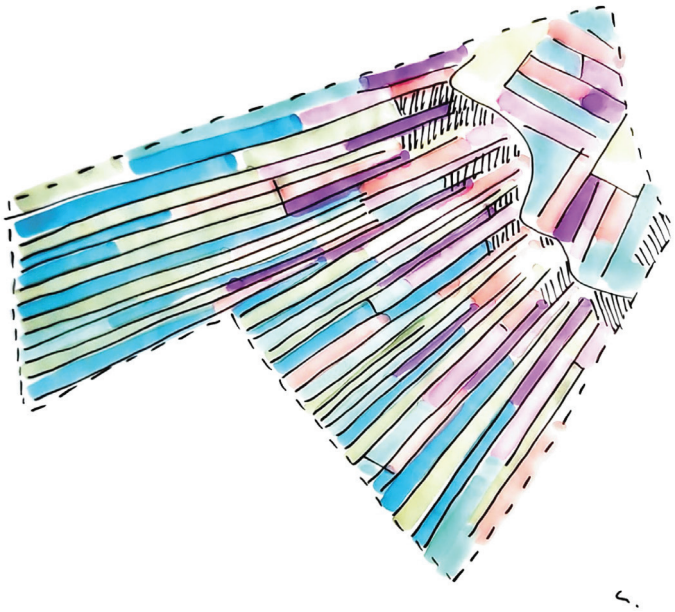
2024
mostly maintained grassland



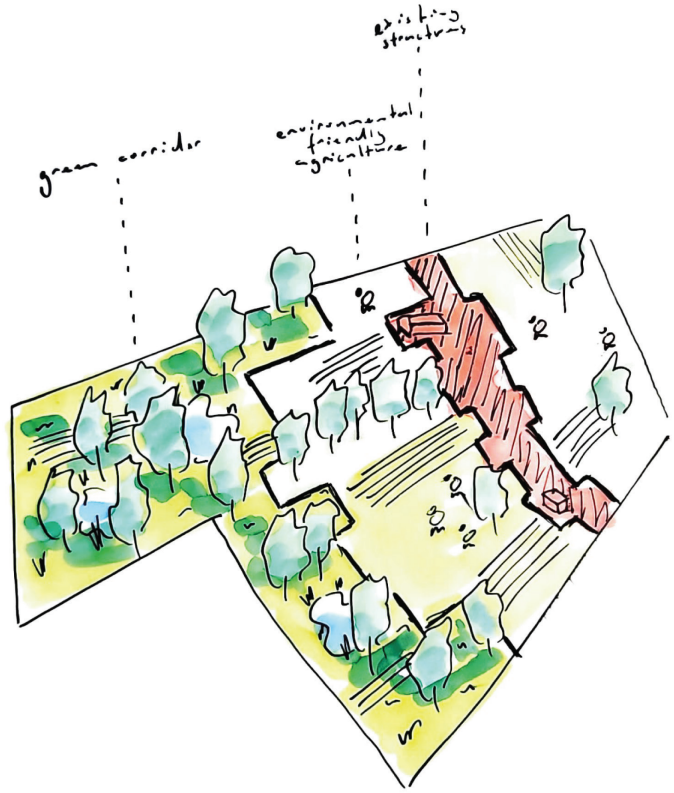
2075
the green corridor takes form



2050
the first pioneers start to diversify farming



2125
a balanced polder

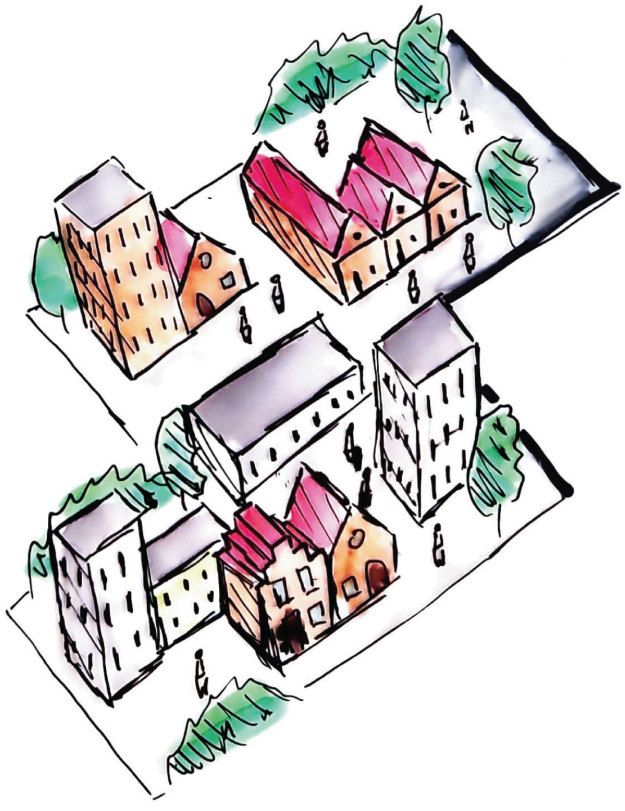


The zoning from urban to nature

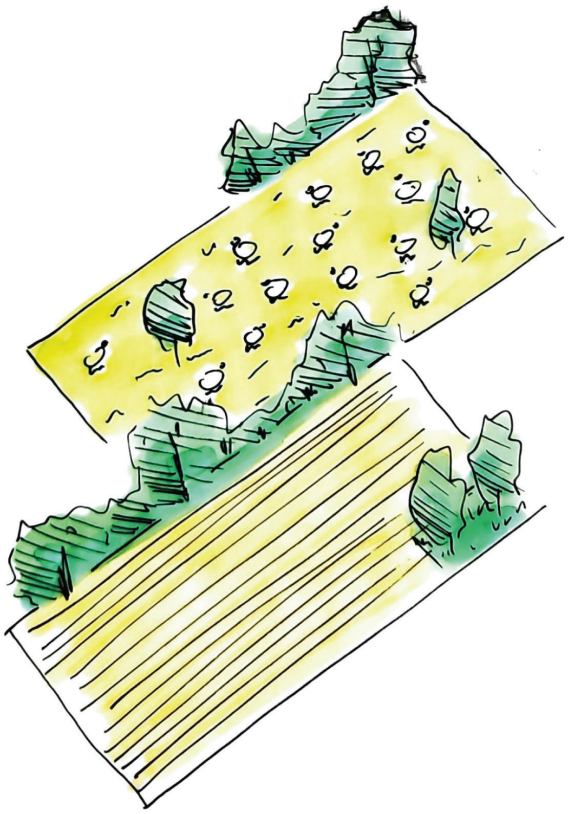
Figure 5.22 Transition from current agriculture to regenerative agriculture, created by Authors

PILOT PROJECT BODEGRAVEN: DIAGRAM GRADUAL AGRICULTURE

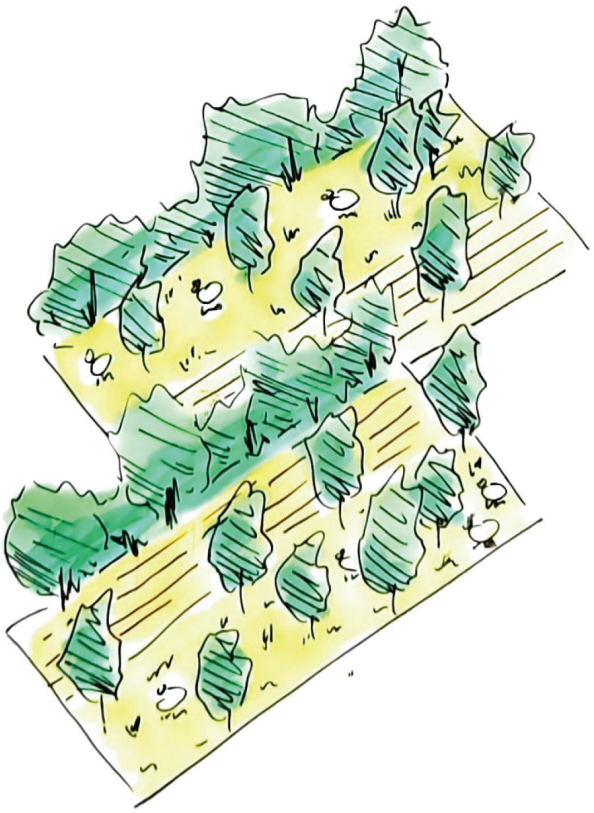
The type of agriculture that can be executed depends on a couple factors, but also very important is the proximity to nature and to the existing urban fabric. In our vision, the closer to nature a parcel gets, the more nature-based and agroforest-like it will be. Then, when a parcel is more closely situated to existing urban fabric, a more intensive, but still sustainable form, could be possible. This creates a sort of gradient, in which farming close to urban fabric will be more intensive, while close to nature it will be less intensive and more nature-based.



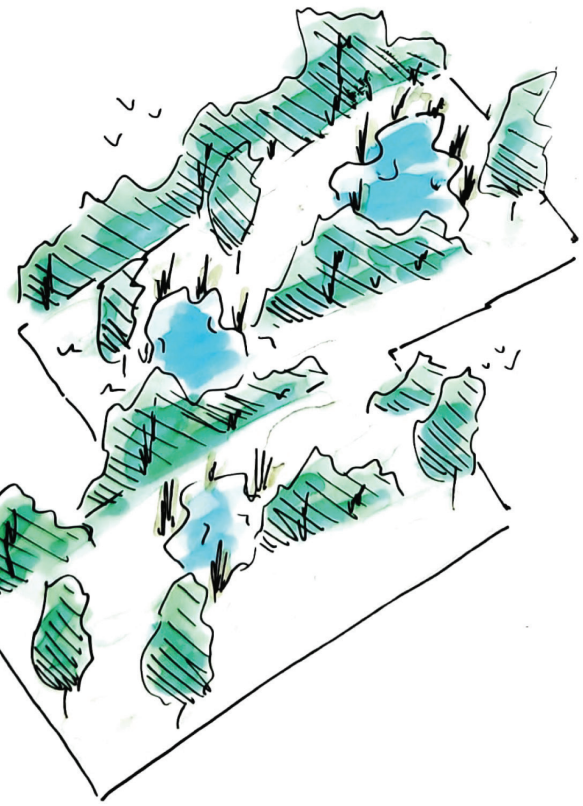
Urban areas will get denser and the border with the countryside will get sharper



Closer to urban areas the agriculture will be relatively more intensive



Closer to nature the agriculture will be less intense



The quality of the nature is improved

Figure 5.23 Zoning from built up area to nature, created by Authors

PILOT PROJECT NIJKERK

Northeast of Amersfoort lies the town Nijkerk. The soil there is made up of clay, which is clearly visible in the way the parcels are shaped. A railway and highway both going to Amersfoort and Zwolle run through Nijkerk.

Located in Nijkerk is a **practical school** focused on agriculture. This school will play an important role in the agricultural shift we propose as it will act as a knowledge hub, where experiments take place on the parcels reserved for the school. By doing this practical knowledge is built up over the years, empowering both students and farmers.

Currently a big **milk processing** unit is settled in the industrial area of Nijkerk. Since milk consumption will be reduced by 80%, this milk processing unit will cease to exist. The buildings will be transformed into an **algae farm** (algae plays an important role in the new diet). Since algae farms are relatively new, the school will help with knowledge and is able to experiment, hoping to eventually create a sustainable farm there.

Just as in Bodegraven, the farms will be split up into **collectives**, creating several hubs per collective. Around the existing nature, agroforestry will be the main form of agriculture, slowly fading into more 'intensive' agriculture (see the diagrams).

The thick black line represents the current built up area, which forms a **hard border** because urban expansion is not allowed anymore; all to built structures will have to be built in the existing urban areas.

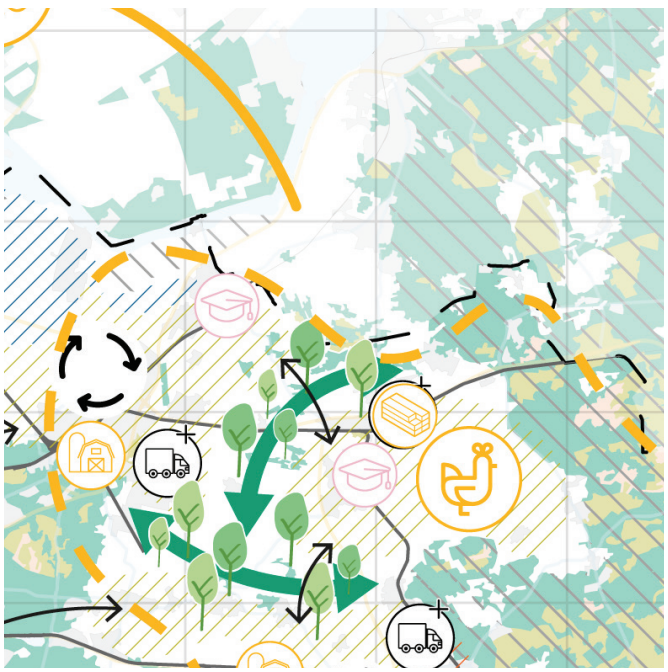


Figure 5.24 Zoomed in Map and Aerial Photography, Source: Google Earth, 2024.

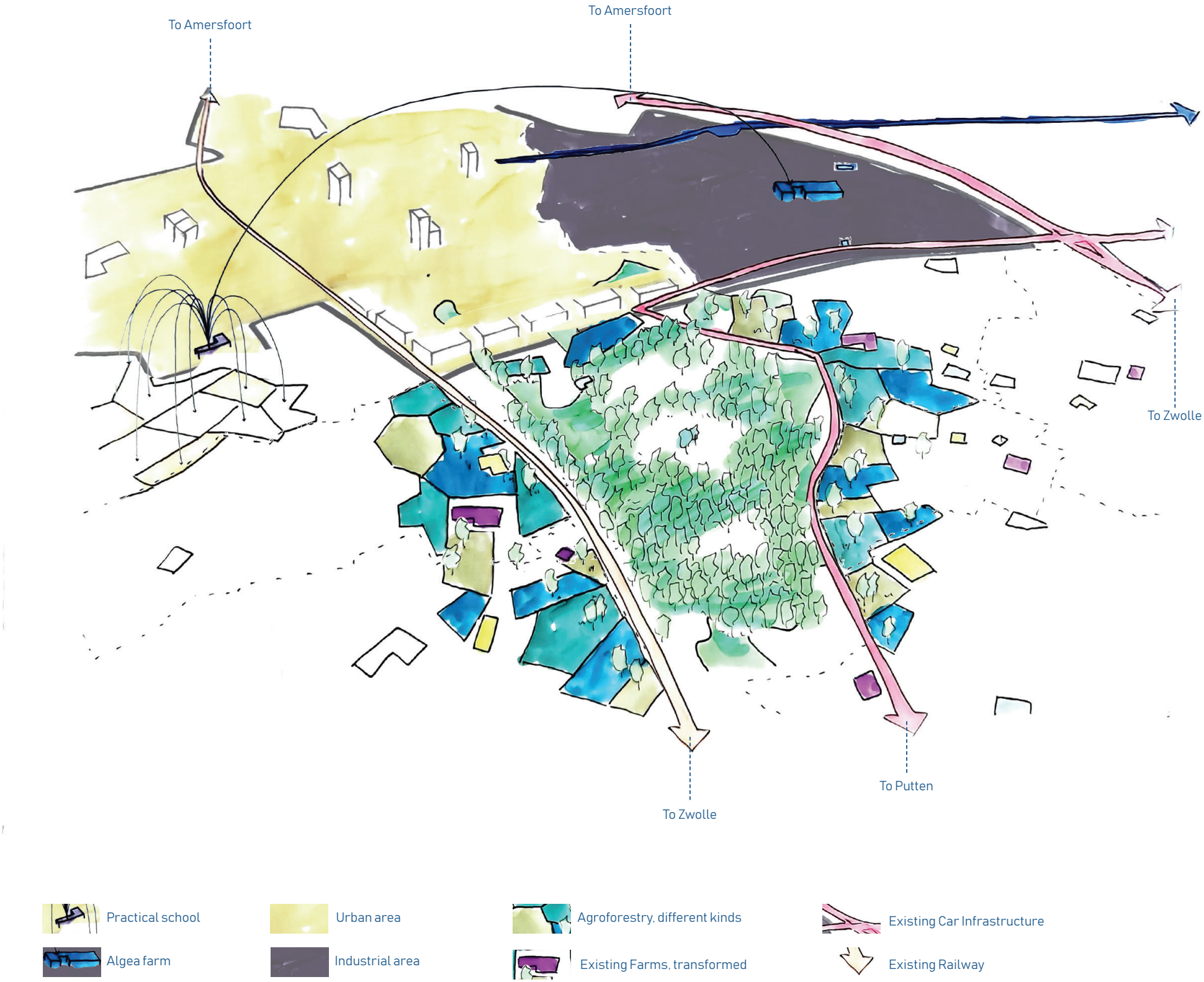
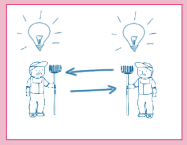


Figure 5.25 Birdseye view Nijkerk

PILOT PROJECT NIJKERK: PATTERN IN USE

Practical school
The practical school will get parcels to experiment on and exchange their knowledge with the farmers

E.4 Knowledge Exchange



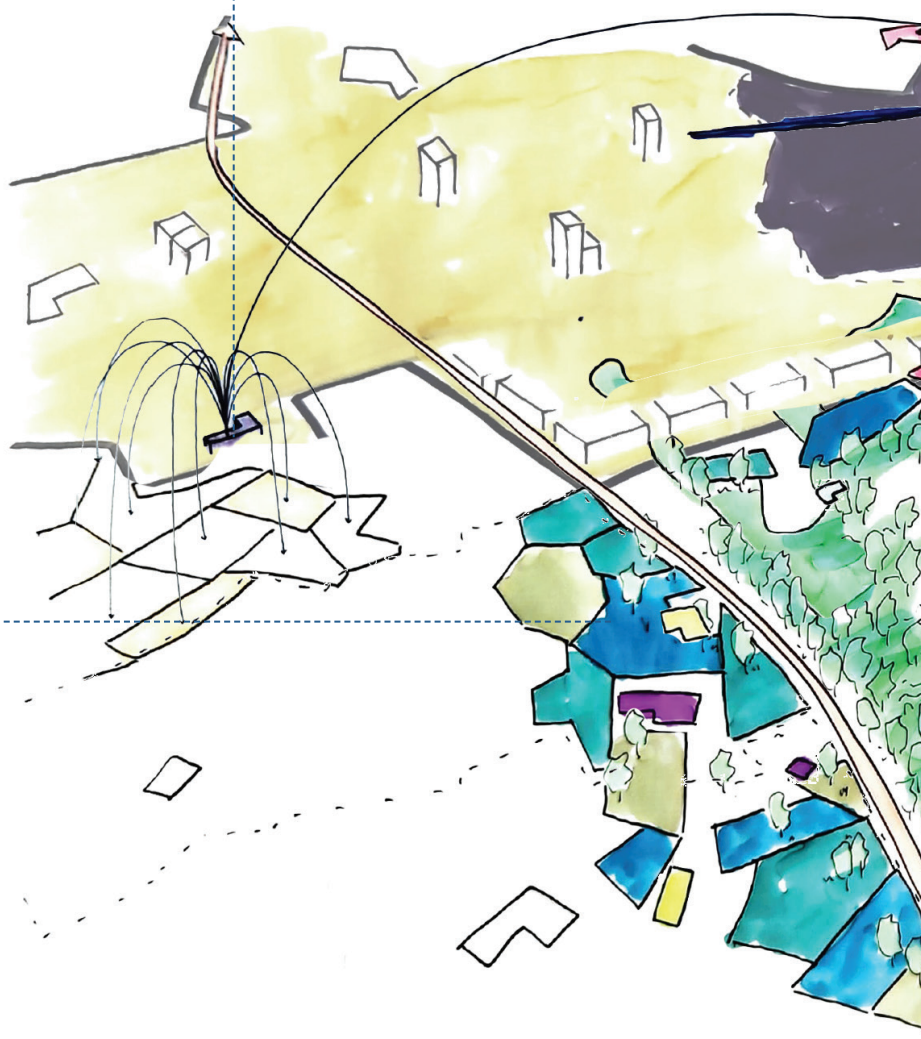
Farming collectives have the opportunity to specialise in a way of farming that works well under local conditions, and this knowledge is shared between communities to enable a resilient farming system.

Connected to
C1 | C2 | C3 | C4 | C5 | P4 | P6 | P10 | E3 | E5 | R2 | R4 | R6 | R7 | R8 | R9

R.6 Education Campus

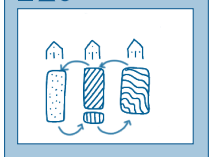
Production and knowledge must be combined and made transparent and thus accessible to the public to trigger a mindset change.

Connected to
C7 | Co1 | P5 | E4



Regenerative farming
The existing agricultural fields will transform into a regenerative form with soilbased solutions

C.1 Regenerative Production



Regenerative practices such as aquaponics, including forest farming, silvopasture and alley cropping with crop rotation are used to improve soil fertility, optimise nutrients and prevent pests.

Connected to
C5 | P8 | P3 | P6 | E4 | E5 | R4 | R7 | R9

R.7 Regenerative Farming

The aim of regenerative farming is to strike a balance between an economically viable business model and ecosystem and spatial qualities.

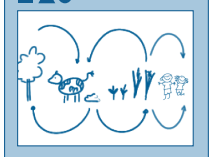
Connected to
C1 | C5 | C6 | P1 | P3 | P8 | E4 | E5 | R2 | R4 | R5 | R9

R.9 Healthy Soil

Healthy soil is essential to the donut diet. Soil regeneration is a top priority to increase water holding capacity and biodiversity. Once restored, it can be used for production again.

Connected to
C1 | C2 | C3 | C5 | C6 | P3 | E4 | E5 | R2 | R4 | R5 | R7

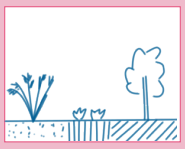
R.4 Diversify Landuse



Combining different land use purposes, such as livestock, crops, forests and care infrastructure instead of large scale intensive farming

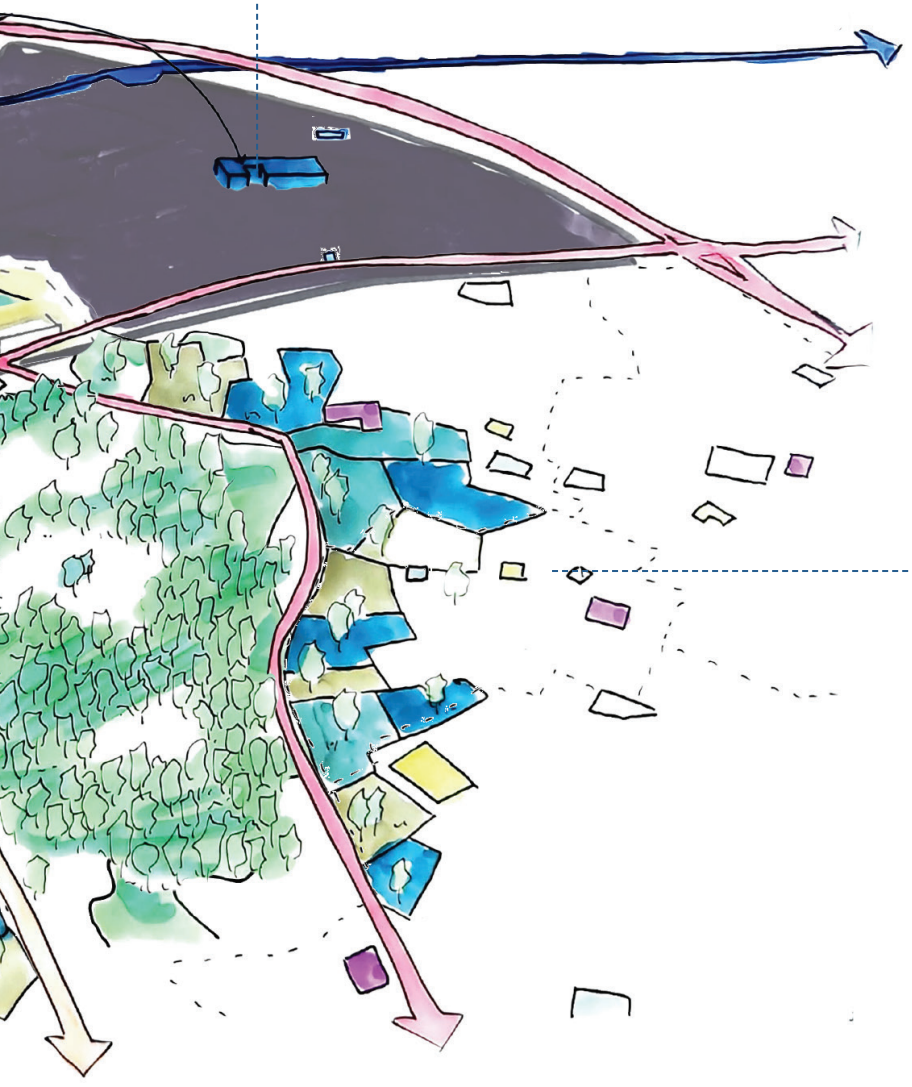
Connected to
C1 | C2 | C4 | C5 | C6 | C9 | Co2 | Co3 | P5 | P6 | P8 | E4 | E5 | R1 | R2 | R3 | R7 | R8 | R9

E.5 Soilrelated Farming



Different types of soil are suitable for growing specific foods or bio-based materials. Agriculture will be developed in proportion to the benefits.

Connected to
C1 | C2 | C3 | C6 | C8 | P3 | P4 | P8 | E2 | E4 | R4 | R7 | R9

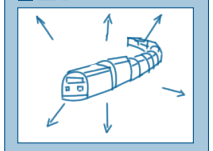


C.9 Production in Cities

Food and material production, such as vertical farming, aquaponics, algae-, fungi-, insectfarming and trees, must be increased within urban boundaries.

Connected to
C4 | C8 | C9 | P1 | P2 | P7 | E2 | R1 | R3 | R4 | R8

R.3 Links to Infrastructure



Production and processing units benefit from their proximity to the relevant infrastructure linking the distribution networks.

Connected to
C1 | C2 | C5 | C8 | C9 | P3 | P4 | P7 | E1 | E2 | E3 | R1 | R2 | R4 | R5

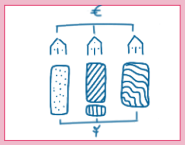
Algea farm
An existing milk processing unit will be transformed into an algea farm

C.2 Value Water

Water can be used in a circular way by combining practices that complement each other (aquaponics, algae in wastewater, etc.).

Connected to
C4 | P8 | P6 | E4 | E5 | R2 | R4 | R9

C.5 Shared Risks & Benefits



Investment costs and risks due to unpredictable weather events can be shared by collectives.

Connected to
C1 | C6 | C8 | Co2 | P2 | P7 | P8 | E2 | E4 | R3 | R4 | R7 | R9

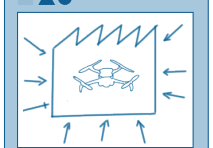
C.6 Land Lease

Farmers can lease land from the municipality, making the sector more flexible and inviting people from outside existing farming communities.

Connected to
C3 | C5 | P3 | E5 | R4 | R7 | R9

Collectives
Farmers will work together with each others and share tools, land, etc.

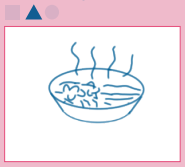
C.8 Shared Tools



Equipment can be purchased jointly and then shared between farmers. This reduces costs and the amount of tools and equipment needed.

Connected to
C3 | C4 | C5 | C9 | E5

Co.1 Training Facilities



Low treshold programmes such as cooking classes and local/sesonal food in canteens teach about newly introduced foods and waste management.

Connected to
C7 | Co2 | Co3 | P5 | P8 | R6

Figure 5.26 Birdseye view Nijkerk, linked to pattern language

PILOT PROJECT UTRECHT

The pilot project in the urban area is situated in the northwestern part of the city of Utrecht. It revolves around an industrial area along the Amsterdam-Rijnkanaal where a lot of big infrastructure comes together: two train lines to Amsterdam, The Hague and Rotterdam and the highway going to Amsterdam.

This pilot project is about showing how the cityscape changes with the addition of food production within city borders. To do this we scanned the areas for any companies related to food and potential areas where food could be grown.

Some of the companies we found were related to products that will not have a place in the future diet anymore such as coffee. This means that those companies will disappear in the future, and that the buildings become vacant. Those buildings will then be transformed into vertical farms, sending the food directly to the biggest vacant building that will be transformed into a food hub (see section 1 on page 117).

The unbuilt areas will be transformed into parks with edible vegetation (see section 2 on page 117). Existing parks will slowly transform into being edible as well. The maintenance will be done by elementary schools, simultaneously keeping the new parks neat, as well as teaching the children about the food production that takes place locally.

Unbuilt areas that are too far from elementary schools, and thus can not be maintained by them will transform into a production forest. Trees will be grown from which the wood will eventually be used for the construction of new vertical farms (as could be seen on the sequence). In this way the city is also prepared for growing more food for a growing population if needed.

Lastly, the oldest neighbourhood in this area is marked with yellow. Here, a restructuring of the neighbourhood is most likely to take place because of the state of the houses. It is thus interesting to see how with the restructuring of the neighbourhood new forms of urban agriculture could be added, such as with greenhouses on the roof (see section 3 on page 117).

Figure 5.27 Zoomed in Map and Aerial Photography, Source: Google Earth, 2024.

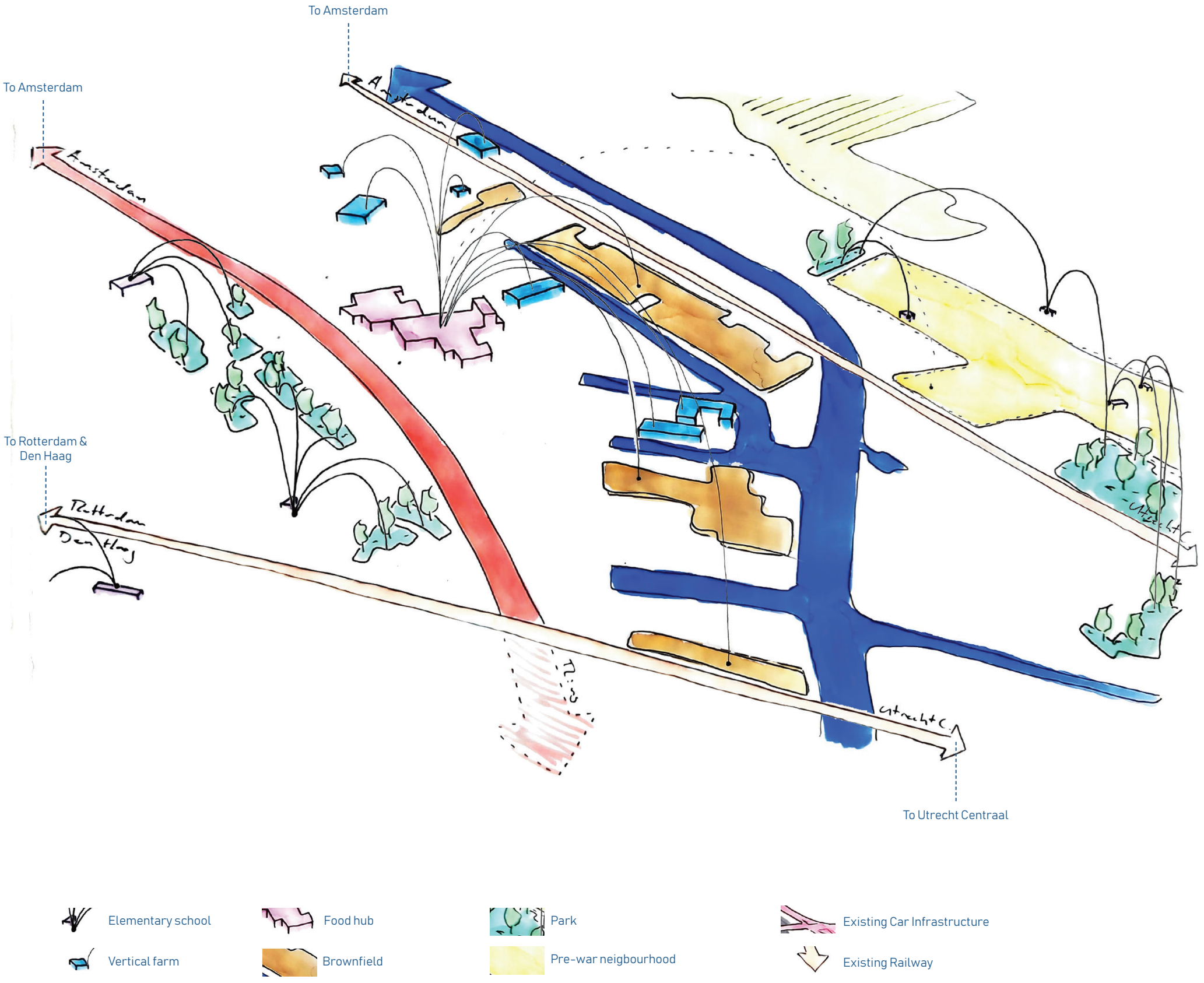
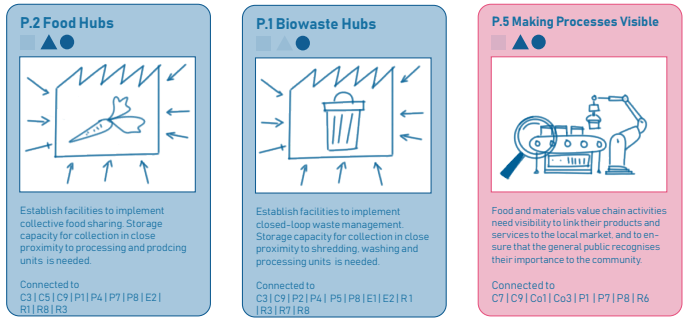


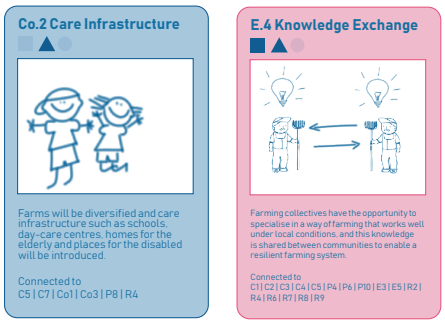
Figure 5.28 Birdseye view Utrecht

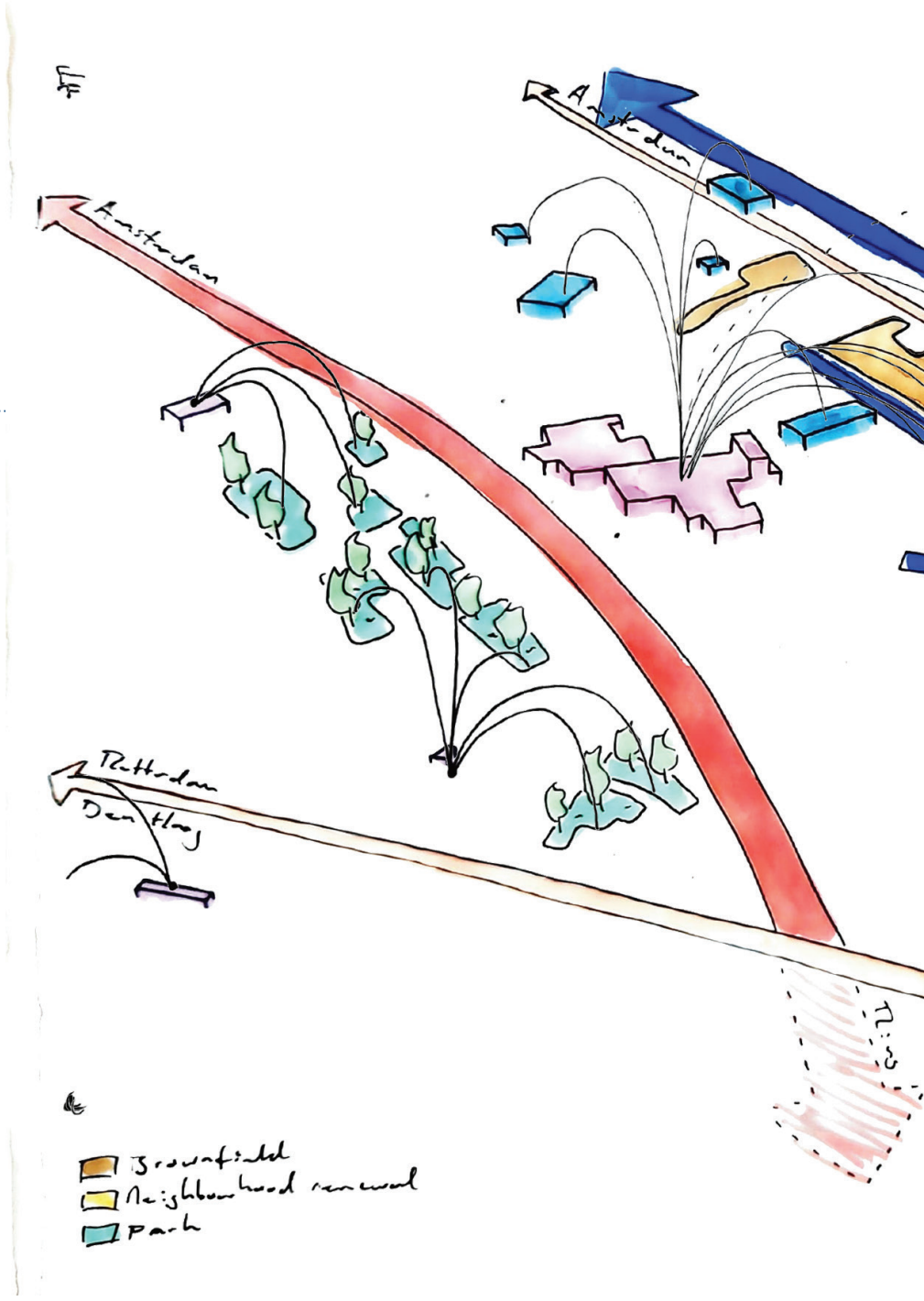
PILOT PROJECT UTRECHT: PATTERNS IN USE

Hub
The hub will be located in a reused building and most of the processes related to food will take place there, to then be shipped to a local market

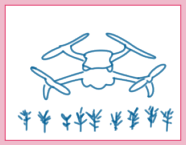


Elementary schools
Elementary schools will play a role in the maintainance of the edible vegetation, keeping both the park neat and teaching them about food





C.4 Automation

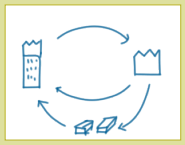


Automating agricultural processes can help save costs and preserve the environment.

Connected to
C2 | C3 | C8 | C9 | E4 | R2 | R4

Vertical farms
The production inside vertical farms will be mostly automated to make it as efficient as possible

E.3 Urban Mining



The built environment must be preserved and only necessary changes adapted. Material from demolished buildings must be reused and new building material must be introduced only as bio-based material.

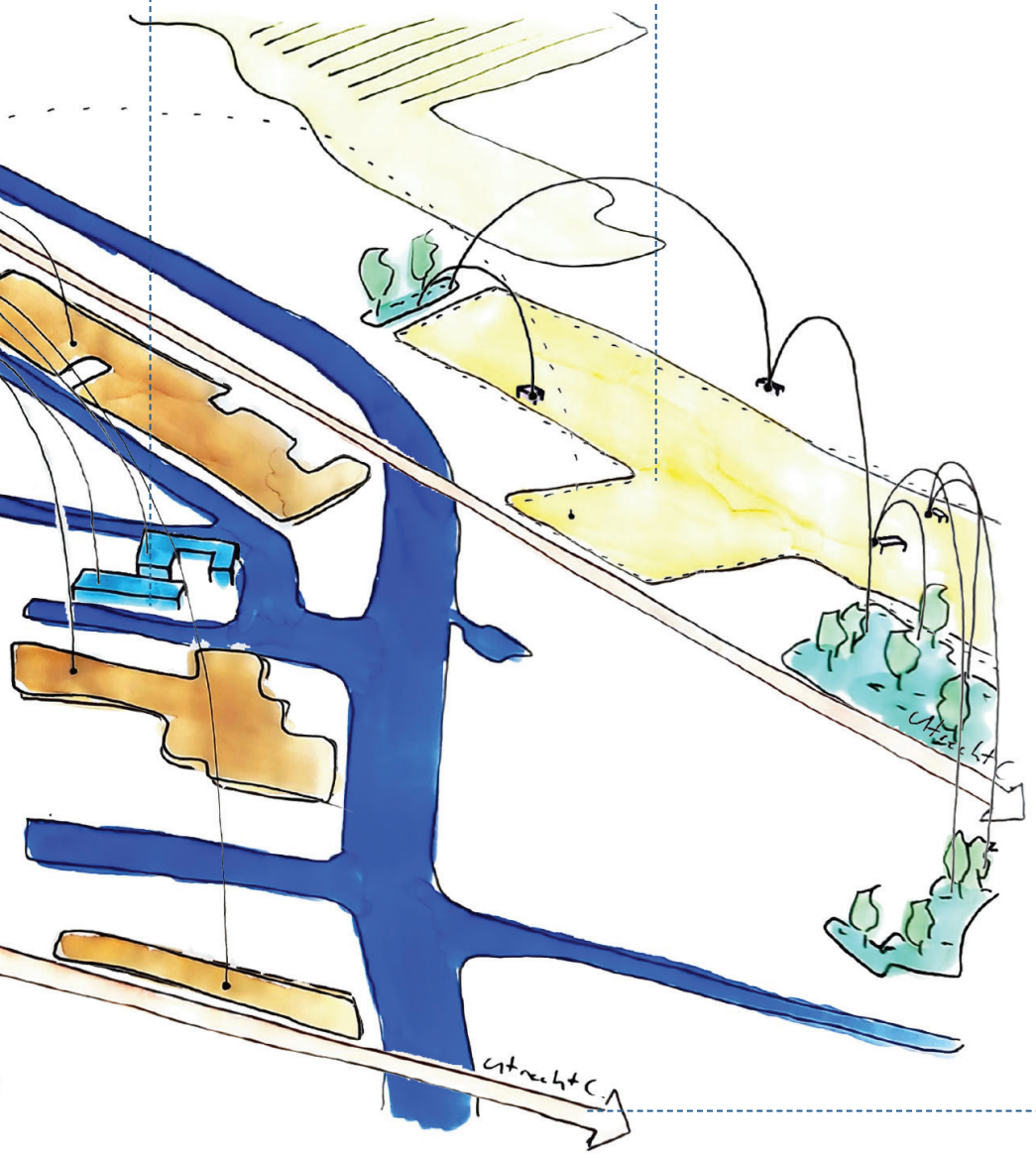
Connected to
C3 | Co3 | P6 | P10 | E1 | E2 | E4 | E5 | R3 | R8

C.9 Production in Cities

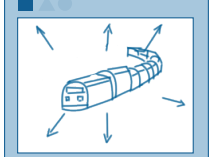
Food and material production, such as vertical farming, aquaponics, algae-, fungi-, insectfarming and trees, must be increased within urban boundaries.

Connected to
C4 | C8 | C9 | P1 | P2 | P7 | E2 | R1 | R3 | R4 | R8

Neighbourhood renewal
With the renewal of the neighbourhood existing materials can be mined, and new forms urban agriculture can be added



R.3 Links to Infrastructure



Production and processing units benefit from their proximity to the relevant infrastructure linking the distribution networks.

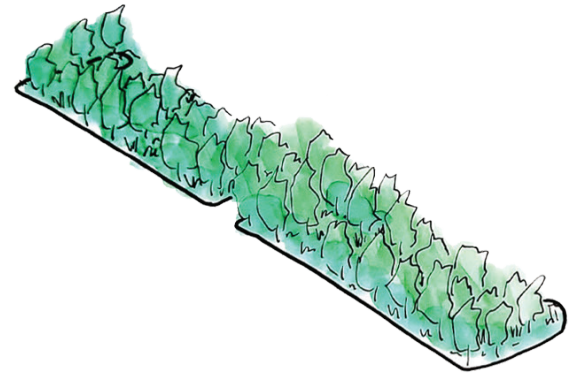
Connected to
C1 | C2 | C5 | C8 | C9 | P3 | P4 | P7 | E1 | E2 | E3 | R1 | R2 | R4 | R5

Existing infrastructure
Due to the existing railways and highways, this place is well reachable.

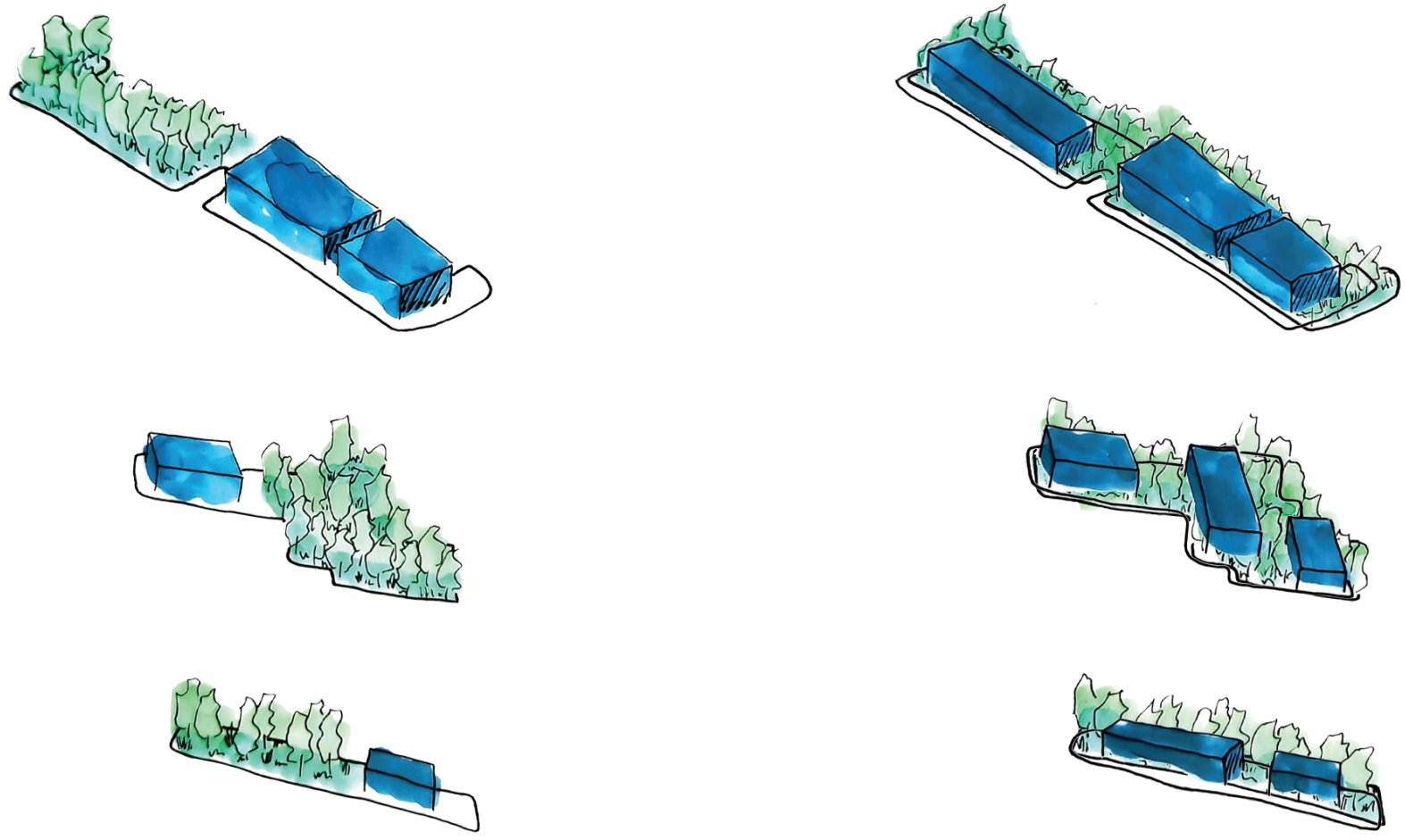
Figure 5.29 Birdseye view Utrecht, linked to pattern language

PILOT PROJECT UTRECHT: SEQUENCE

The sequence on this page shows the transformation the brownfields will undergo in the coming years. First a production forest will be planted and when the trees are fully grown they will be used to gradually build new vertical farms. In this way Utrecht is ready to feed a growing population.



2030
The brownfields will be transformed into a production forest.



2090
The production forest will be farmed in phases and vertical farms are built from the wood.

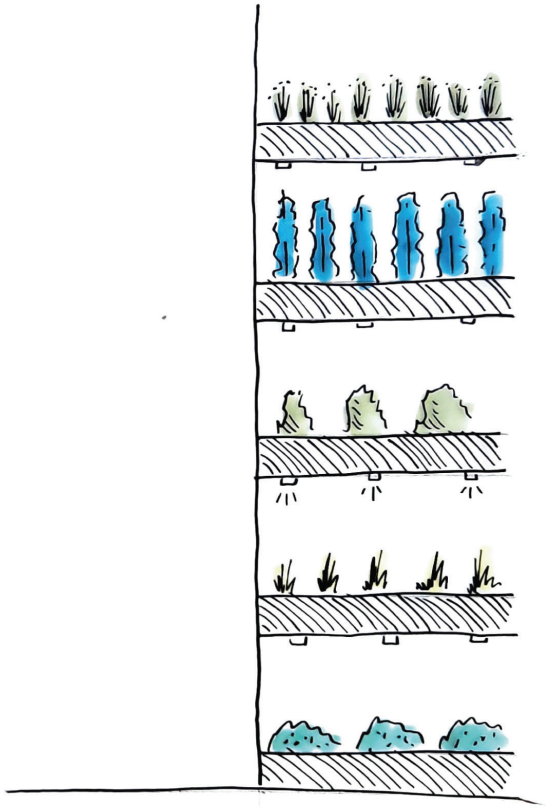
2125
Most of the trees are cut and used for the construcion of the vertical farms, some trees are left to ensure biodiversity.

Figure 5.31 Brownfield Transformation into Production Areas, created by Authors

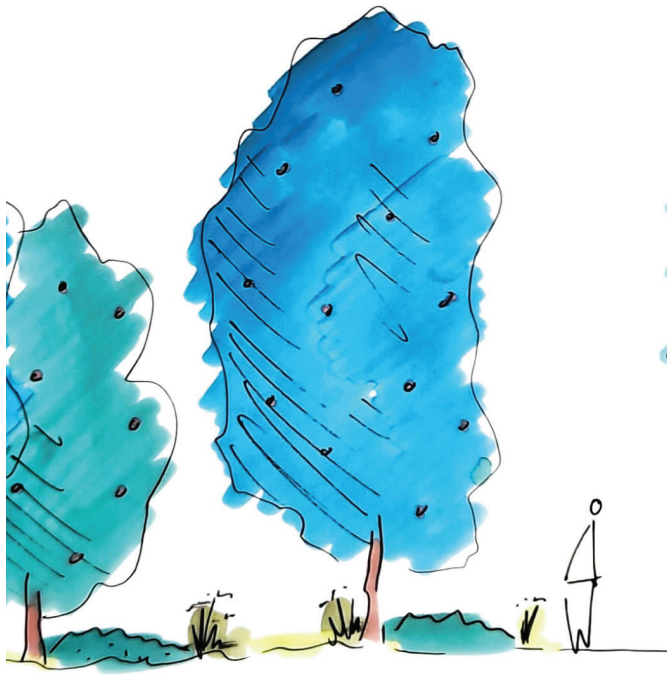
PILOT PROJECT UTRECHT: DIFFERNT FORMS OF URBAN AGRICULTURE

There are a lot of ways to produce food inside of city boundaries, but for the pilot project of Utrecht three are most important, being: vertical farms (inside repurposed buildings, edible vegetation in parks (maintained by elementary schools) and greenhouses on roofs (made possible by urban renewal).

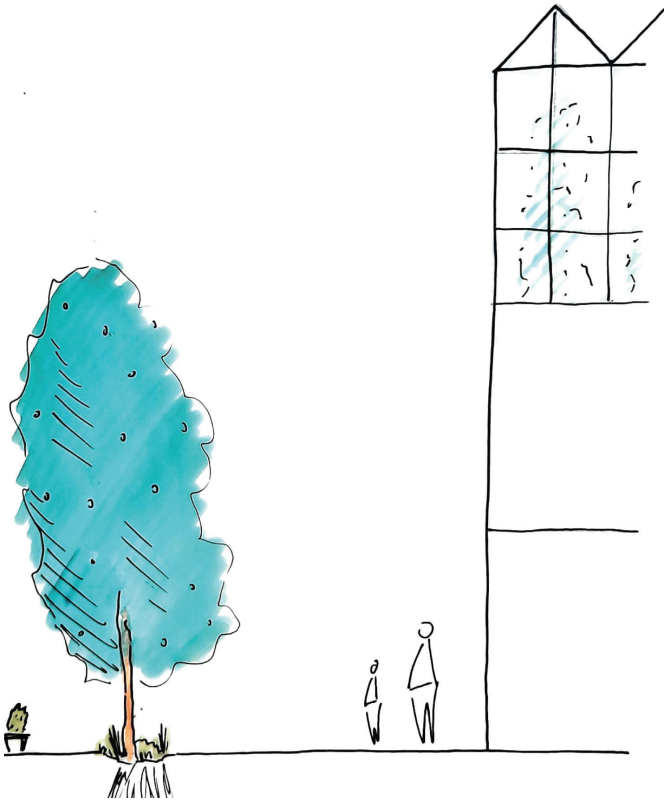
More sketches showing the process of developping the pilot projects can be found in appendix 8.7.



Vertical farms



Edible vegetation in parks



Greenhouses on top of roofs

Figure 5.32 Foodproduction in Cities, created by Authors

5.7 POLITICS, POLICIES AND SUBSIDIES: FUTURE PROSPECTS

In chapter 2.5 Politics, policies and subsidies, the current policies effecting the topics addressed in this project are mentioned. In order to implement our proposed changes to the agriclture system, these policies will have to transform too. In this chapter, we will address the current policies and explain the changes we might make to them.

The first four policies that were addressed, the SDG's, the European Green Deal, the Leipzig Charter, and the Paris Agreement form the very basis and framework this project is built upon. Therefore, we will not alter or change the agreements in any way. We have considered them in the process of this project, and the project exists within their boundaries. The SDG's and European Green Deal consist of goals for 2030 and 2050. Upon reaching these moments, we intend to adjust the goals and make a 'New European Green Deal,' as we expect these topics and goals to still be relevant.

Also part of the 'political framework' this project build upon, are the **National Ecological Network** and **Natura 2000** policies. These have a clear future in our project: one of our goals is to repair the regenerative nature of our environment and keep this in tact. An important aspect in doing this, is connecting different ecological areas to each other, to create ecological corridors and strenghten the ecosystem overall. This we are doing through building nature corridors as an integral part of our urban and peri-urban structures. This we combine with a follow-up on the current Natura 2000 legislation. As of now, agricultural areas cannot be part of protected Natura 2000 areas. This will remain the case at first, to ensure the regeneration and repair of vulnerable and damaged nature areas. However, once the argicultural transition has progressed further and agriculture happens in a regenerative manner, while biodiversity is allowed to flourishes, agriculture areas will also be able to become protected under Natura 2000.

CAP will be rigorously reformed. The subsidies based on surface area and production will be phased out and replaced by subsidies based on sustainable and regenerative ways of farming. This includes limiting the use of artificial fertiliser and feed in order to apply for subsidies. A large part of the subsidies will be freed up to go towards building shared infrastructure and facilities for the collective farming concept. Eventually, the goal is to phase the agriculture subsidies out completely. Of course this can only happen once the collective and regenerative farming system is fully in place and has become the new standards. Because the costs of producing food will not suddenly drop, the price difference due to missing subsidies will be compromised by the consumer. This is why, when this moment in the transition arrives, we want to implement a subsidy system for grocery allowence for the comsumer themselves, based on income. This system will be similar to the 'zorgtoeslag' and 'huurtoeslag' system The Netherlands knows now.

An important addition to CAP will be a new system for landownership. To stimulate the transition towards collective agriculture, a new policy for landsharing is introduced. By making a diversified agirculture system a prerequiste to performing agriculture by law, we promote farmers to form collectives with colleagues with a different focus within agriculture. Large bio-industry companies are encouraged to either split up their company and join one of those collectives, or employ other farmers to complement their skillset and perform diverse agriculture within the company. The more in depth choices for both individual farmers and large bio-industry companies, and how these choices relate to each other, are explained in the diagram in figure 5.33.

The last current policy left is ETS, a system that has been receiving increasing critisism for adjusting to the climate goals and progress to slowely. Since there is evidence that this policy is not contributing to speedy sustainable develpment, we phase this policy out as soon as possible. The first step is to take all emission rights from previous years out of the market. Then, the possibilty of trading the rights will disappear. This will promote more sustainable development, as (even the large) companies now have to perform within their original assigned emission rights. Then the last step is to let the number of available emission rights decrease to be under the planetary boundary quicker than is happening now. This planetary boundary might differ per location: places with a buffer area nearby could cope with more emission, while areas that were severely damaged in the past might not be.

A last addition to the policy framework is the policy that puts down in writing that agriculture companies and research institutions have to contribute to knowledge exchange within the national agriculture sector as well as to international locations to share knowledge on how to produce and process food locally.

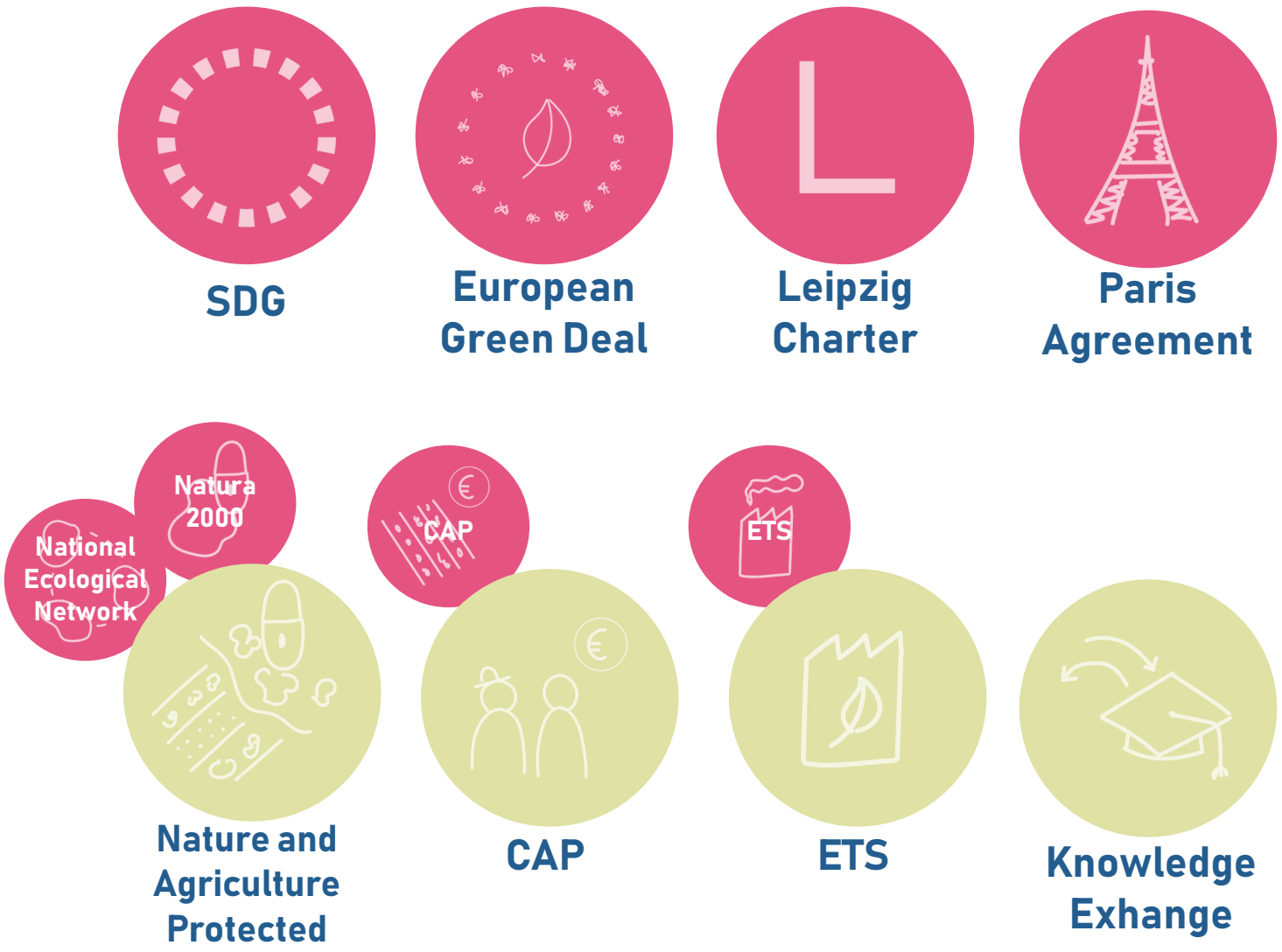


Figure 5.33 Updated policies to address and implement the agriculture transition

5.8 STRATEGY TIMELINE

The timeline provides a series of milestones that we need to reach in order to achieve our vision of a collective, sustainable and fair farming system. These milestones are shown in dark green (in figure 5.30 shown on the next page) and are non-negotiable. They are complemented by actions, divided into three categories: (1) knowledge promotion, (2) spatial implications and (3) policies to be introduced.
However, within each category of action (knowledge, space, policy) we propose a more flexible approach. This means that all these actions contribute to the achievement of the milestones, but are not necessarily interdependent for another action to happen.

To give an example, the milestone "The Netherlands has a diversified agricultural system" ending in "All agricultural areas are included in the NEN" is a change we believe needs to happen to reach our vision.
To achieve this milestone, we can use several actions within the knowledge category that contribute to a change of mindset in society. This can be achieved through different forms of education, e.g. international academic knowledge exchange (see pattern language R.6), low-threshold education (Co.1), making processes visible (P.5) and knowledge exchange at local level (E.4).

In terms of spatial impact, we need to shift back to smaller plot sizes, which can be achieved through a range of policies, such as policies that limit the use of pesticides and fertilisers (R.7; R.9), subsidies for diversified land use (C.6;C.9), as well as collectively available subsidies for minimally invasive farming tools (C.3; C.4), and subsidies to start knowledge sharing to make it more financially attractive.

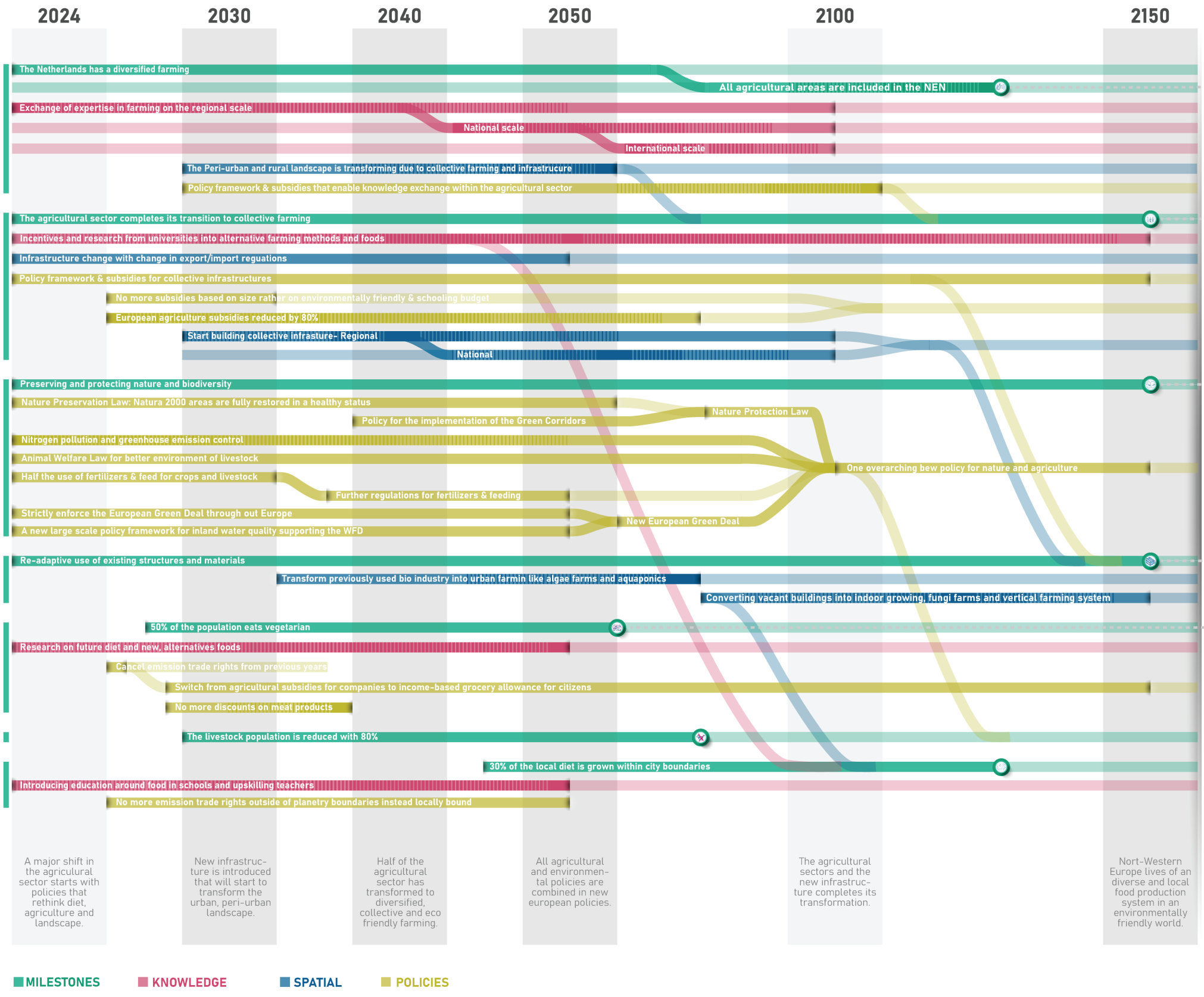
For the milestone 'Agriculture completes its transition to collective farms' future research still needed to suuplement our strategy, forms the basis. Spatial changes will need to be implemented with regards to different infrastructures. Infrastructures will be transformed for collective use. This also impacts another milestone 'Re-adaptive use of existing structures and materials'. The spatial transitions from that milestone are closely linked to the policies introduced and spatial changes that start from the transition milestone.

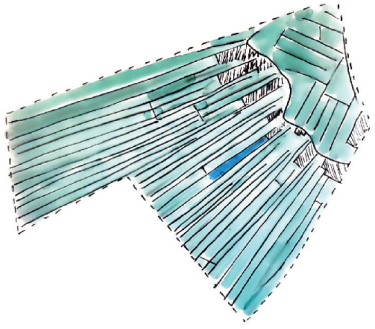
The last major milestone, 'Preserving and protecting nature and biodiversity', is the most policy heavy one. Since this goal revolves mostly around setting stricter rules and protecting the status quo there are no direct spatial relations in the first phases. The current policies regarding this topic are spread out and each deal of one topic within this complex milestone. In our envisioned future nature, water systems and agriculture are so intertwined that one overarching policy is needed addressing all of these topics simultaneously.

The final three milestones are more straight to the point. These milestones include specific markers that will be hit and can be used as a more concrete goal to also help the conversation about this transition. These can work similarly as concrete years that are now mentioned within the Green Deal, or specific targets that are included in the SDG's.

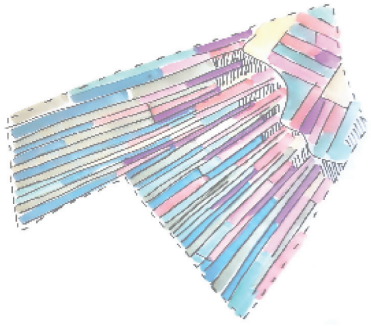
STRATEGY TIMELINE

DONUT DIET

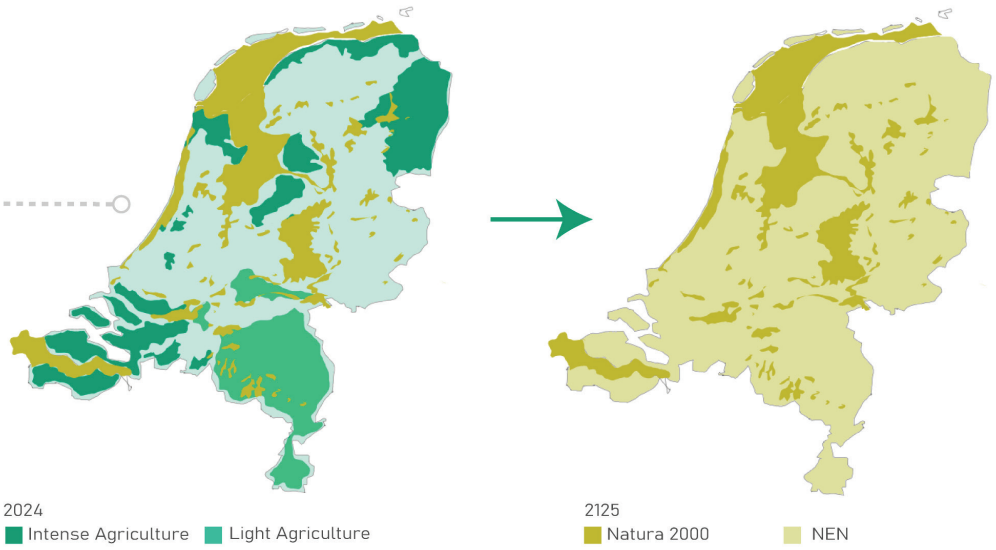




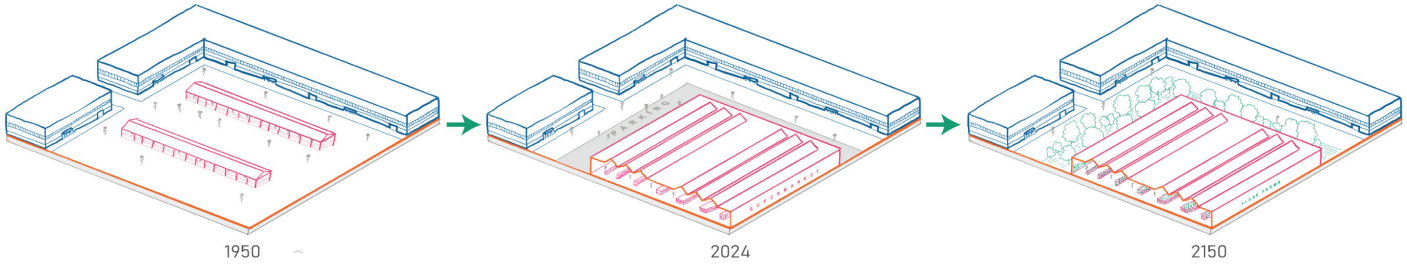
2024 - Grassland

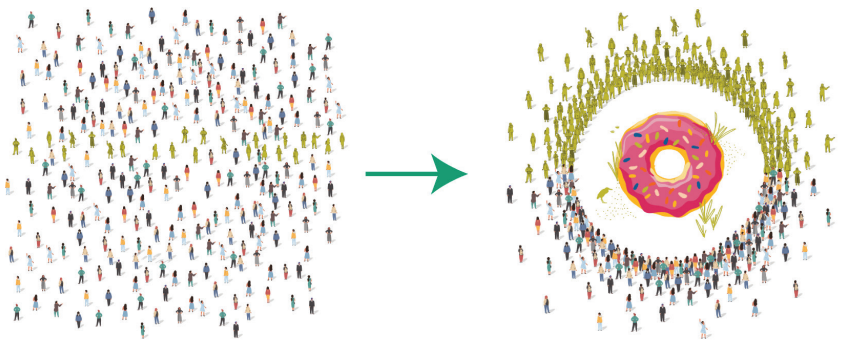


2150 - Diversified yet collective



Preserving nature & Biodiversity





2024 - 5% people eat vegetarian

2050 - 50% people eat vegetarian

Figure 5.30 Strategy timeline untill 2150 with example diagrams.

6. CONCLUSIONS AND REFLECTIONS

6.1 SUMMARY AND CONCLUSIONS

There is a disbalance in the nitrogen cycle, mainly caused by an increasingly intensifying agricultural sector. This leads to a degradation of nature and biodiversity loss. Policies have been made on a European scale to reduce the amount of nitrogen emitted by the agricultural sector, but this caused backlash as farmers fiercely protested against them in many European countries. Many farmers fear for their future, and something needs to be done to ensure both their livelihood and the quality of European nature.

Spatially, the location where most of the nitrogen is emitted is where there are heavy industries to be found. This is not only the industry one sees in the Ruhrgebiet or in the harbour of Rotterdam, but also intensive agriculture as to be found in Gelderland and Noord-Brabant. As this report focuses on the agricultural sector, we dissected the main elements related to nitrogen there, concluding that the main cause of nitrogen emission comes from the protein-rich feed and fertilisers that are being used.

Another aspect of the agricultural sector is the import and export taking place, where the Global North is currently exploiting the Global South in favour of cheap, exotic food in the supermarket, as well as having a huge impact on the environment because of the shipping that needs to take place. We want to replace this by localising the food chain, making farmers work in collectives to make them less vulnerable for risks and to be able to diversify their business model, making them future-proof. In this way a seasonal and local diet starts to exist based upon regenerative farming, making it possible to restore the balance with nature.

To work out this vision an exemplary region has been chosen located in the middle of the Netherlands. Here we defined production regions surrounding the main urban areas in the region, where their boundaries are formed by green corridors connecting the existing nature. Food and materials grown within these production regions are mostly consumed locally, but due to limitations of soil, exchange is made possible through strategically located hubs next to existing infrastructure. Knowledge in the region will become more important, where not only universities, but also practical schools and business themselves work towards the shift of the agricultural sector.

The diet will change from being roughly 60% plant-based and 33% animal-based, to 75% plant-based and 15% animal based with an increasingly important role for nuts who will replace the nutritions from meat and dairy products. To make this shift possible we made a typology map (by overlaying the soil type with the rural/peri-urban/urban) on which can be based what crops and agricultural types can fit where.

To show how the vision will look spatially we worked out three pilot projects which were based upon three different typologies and the already existing infrastructure: Nijkerk (sand, rural, a practical school and a milk processing unit), Utrecht (clay, urban and distribution centres) and Bodegraven (peat, peri-urban and companies related to the dairy industry). These projects showed how the landscape will transform overtime with the introduction of regenerative agriculture, food and material hubs and food production within city boundaries, eventually working towards a sustainable landscape and local diet.

6.2 SCIENTIFIC AND SOCIETAL RELEVANCE

Our plan introduces new frameworks, policies and societal changes that need to happen to make our strategy work. These things are not all ready to go for implementation.

We have a heavy focus of education and research integrated in our strategy, because some major steps still need to be taken to make our plan feasible. We proposed to transform vacant buildings and infrastructure into urban farming forms like algae farming. However the current scale of these urban farming methods are now relatively small. Universities and the agricultural sector are working on improving the efficiency and functionality of these methods. These steps together with gaining the knowledge of how to upscale this into a larger network will need to be made in the first phases of the strategy to actually be implemented later on.

Besides urban farming, the other forms of farming we put central to our plan and vision, collective farming, crop rotation and agroforestry, are now also mainly used in small scale projects. The transition to our envisioned future can only be realised if the current research into these methods also scales up.

Moving on from the research, the political landscape will have to shift its mentality as well. For example, the Animal Welfare Law was discussed in parliament a few weeks ago at the time of writing. The old plan had rules on the treatment of animals in livestock agriculture. That version of the plan was originally voted in and would have subsequently banned intensive farming. When the minister of agriculture realised this, the plan was modified (Offringa, 2023). This shows that even though the current political situation still puts a hold on these changes, shifting away from intensive agriculture might be less farfetched than one would think.

Changing politics goes together with a change in society. Over the years the diet has slowly been changing and our plan accelerates this change only further. The changes have now mainly come from people themselves with the agricultural sector not shifting as a whole. By implementing changes that force that shift, more people will need to change their diet purely on the basis of the availability of (cheap) food.
All these changes and developments are on the horizon in our current society. In our vision and strategy we firmly pick a side and introduce frameworks that are needed to reach the desired future. Science and society are developing towards this desired further, but would need a push to really reach it.

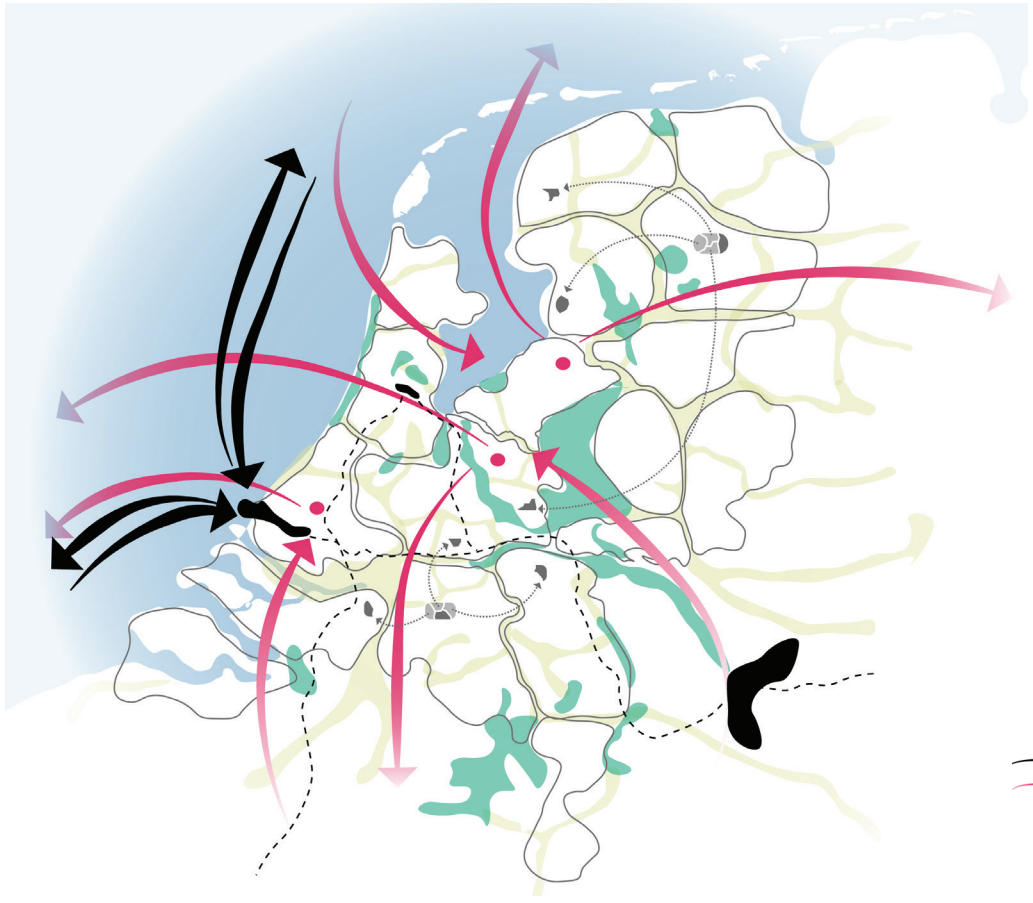


Figure 6.1 Strategy Map showing Importance of Import Flows in a climate that shifts towards more cold and dry

6.3 LIMITATIONS

With only nine weeks to design this project, we are aware that we have only touched on the elements related to the Niteogen crisis, leaving energy consumption, water, CO2, etc. largely out of the picture. We are also aware that our project only looks at the food and bio-based materials sector in terms of circular economy.

We have learnt a lot about policies and conflicts, but their impact on a specific community is not always transparent, making it difficult to develop a strategy that combines bottom-up and top-down processes.

A key part of the strategy and vision we have developed is to bring about a change of mindset in society at large. This would require a great deal of education. What that education would look like exactly, and whether it would be successful, remains to be seen.

It is also essential to get stakeholders on board and moving in the right direction. This includes giving more power to farming communities, but also making it attractive for large companies to practice nature-integrated production. We are proposing many new policies, but at the same time we are aware that in politics the most equitable or environmentally friendly argument does not necessarily win. Therefore, making the benefits visible to the companies that benefit from current agriculture would be a step that needs to be further developed.

This project in many ways points in a direction that could work, based on all the research we have done over the last few weeks, but the outcome if this project were to be implemented cannot be predicted. We have now planned for a climate that is changing towards a wetter, hotter climate. But what if the opposite happens and the climate becomes drier and colder? In that case, regional production using regenerative farming methods would probably no longer be possible, which would mean that imports would become increasingly important. That is why it is important to maintain a large part of the existing infrastructure, in order to remain flexible in the face of changing conditions. However, due to the short timeframe and large scope of the project, we were not able to develop another complete strategy to manage this change.

6.4 VALUES: ETHICAL REFLECTION

In our project, we set out to explore agricultural practices that prioritise conservation and social justice. Our analysis quickly revealed a glaring imbalance within the global production sector, where the Global South is often exploited for the benefit of the Global North, an imbalance that not only burdens the climate with emissions from the transport processes that fuel wealth in the Western world but also exacerbates social inequalities, particularly between developing countries and Northwestern Europe.

While local food production offers opportunities for environmental stewardship, economic resilience and community engagement, it also raises crucial questions about inclusivity, global access to nutritious food and the ethical treatment of animals. Embracing the principles of sustainability, social justice and animal welfare has enriched our project. However, it is important to emphasise that this transition can only be truly just and sustainable if we end exploitation and empower the countries on whose resources we have long depended.

Zooming to within The Netherlands, we propose quite a big shift from our current culture and food production. With the changes in the urban, peri-urban, and rural relationships, the built environment will look different for everyone. It will create a more equally distributed landscape of both benefits and burdens. The diet change will also reach everyone, but the diet is based on trends that are already happening around us and will form a logical result of a shift in the range of supply. Then, we are of course applying a lot of changes to one of our main stakeholder groups: farmers. One of the core values in this project is that farmers keep their livelihoods and maintain the opportunity to be a farmer, in the way they know the profession. With our new system for regenerative and collective farming, lots of farmers will have to adjust their business model, (partially) relocate, and get into business with other farmers, as still will all be promoted by legislation and policies. Currently, farmers in Europe are protesting similar large changes that they have to comply with. Our proposal still requires them to change, and to put in a lot of work for this transition. However, it is necessary to do so to maintain their livelihood for the generations to come.

Proposing policies to facilitate the transfer of knowledge, coupled with making climate-damaging processes more costly, could mark a first step towards a more equitable world. However, in just nine weeks we have only scratched the surface of issues of social and environmental justice. The realm of policies, interconnections, and power dynamics remains opaque and labyrinthine. While acknowledging the complexity of understanding the whole system, we remain committed to advocating for strategies that strive towards this overarching goal. Our aim is to demystify opaque processes and make them more accessible to all. Especially through the developed Pattern Language, in combination with the typology map of the land, we aim to unravel complex systems and pave the way for a more transparent and equitable future.

6.5 RECOMMENDATIONS FOR FURTHER RESEARCH

The nitrogen cycle and the agriculture system are both very systemic processes. In this project, we have attempted to address the topic as such. However, there are always limitations when looking at such big topics, therefore there are always infinitely more interesting and valuable research questions of connected systems, processes and locations. We have looked into the production part of nitrogen in agriculture in Europe, mostly focusing on the Netherlands. Our recommendations and solutions consist of a new food production system. An integral part is to make food production, processing, and consumption local. This means severely decreasing the export of agricultural products to international locations and diversifying the business model of farmers, as well as diversifying the farms themselves.

Further research, building upon this project, could include economic research about the feasibility of those plans. How many jobs are lost and created? How much funding is needed to build the collective infrastructure and realise the re-organsition of landownership needed for this proposal? And for countries connected to the Dutch agriculture system through export and import relations: what precise economic consequences to these changes to our export have?

More research on the proposal itself is also needed. The applied concepts themselves, collective farming, crop rotation, agroforestry etc., are not new. However, combining them all and on such a large scale is. Test cases with this system are needed, for example at the pilot project locations we identified.

6.6 PERSONAL REFLECTIONS

Figure 6.2 Group photo

REFLECTION
VAIBHAV BANSAL

Expectations and Learnings

My experience in this program at TU Delft has brought about a profound change in my perspective. Initially, I anticipated that the Netherlands' urbanism legacy would shape my learning journey. However, over the past quarter, my approach to regional planning has evolved significantly. As an architect, I was accustomed to working within strict confines, where limitations often dictated project scopes. Yet, I've come to realize that effective regional planning isn't a linear progression from territorial to neighbourhood and street levels. It's a dynamic process, requiring iterative adjustments and consideration of various scales. My perspective shifted significantly when we began the project and I focused narrowly on regional planning, overlooking the broader global impacts. For example, I didn't consider how our strategies might affect international trade or trigger protests. However, I quickly learned the importance of a holistic approach that considers societal, environmental, and economic implications. This experience taught me that regional vision requires a broader perspective beyond rigid boundaries to propose strategies.

Unifying Voices: Crafting a Vision Together

Collaborating within a group setting is an intricate process that demands not only individual commitment but also the ability to synergize diverse perspectives and skills. This collaborative experience has underscored the effectiveness of our teamwork and our collective ability to assimilate distinct concepts and transform conflicts into innovative solutions. An integral aspect of my role was to refine the graphics and make animations, ensuring the effective conveyance of our ideas in a clear and interactive manner. Initially, I believed my greatest strength lay in my communication skills, honed through my persuasive abilities during my bachelor's studies and professional experiences. Conversely, upon encountering a different context, I felt a significant gap in this aspect of myself. Expressing my opinions proved challenging, likely due to the lack of opportunities for open discourse in my previous educational setting. Surrounded by individuals with strong opinions, I often felt inferiority complex and struggled to assert myself effectively. Nonetheless, I am grateful for the unwavering support of my group, who have aided me in overcoming this weakness. Though I am still in the process of improvement, I have made considerable steps since the beginning of the quarter.

Theoretical Foundation: Nitrogen Control and Ethical Agriculture

From the project's outset, we focused on nitrogen emissions control while mitigating potential negative impacts on the general population, particularly farmers. Our vision aimed to promote a shift towards local and seasonal diets, reducing reliance on industrial processing and fostering sustainable and innovative solutions. Witnessing livestock reduced to mere production units instead of allowing animals to express natural behaviours was disheartening, especially as an Indian where cows hold cultural significance. As the project unfolded, it became evident that our vision aligned effectively with the project's theoretical framework, effectively justifying our efforts within the context. The focus on localising the diet, further validated the project's theoretical foundations, ultimately enhancing biodiversity and controlling nitrogen emissions.

REFLECTION
THIJS DE BOER

This quarter was very valuable for me as I learned a lot, and really enjoyed the group that I worked in. I divided my main takeaways into three sub-chapters:

Challenging scale
This quarter was definitely the most challenging for me in comparison to the previous quarter. I was used to working on smaller scales impervious education and the internship I did, so the scale we worked on in this quarter was completely new for me. It was very hard to get a grasp of what I should do because the scale was so big, especially in the first weeks. Once the subject got clearer through the research we did together it became much easier to analyse and spatialise it and also more fun, because the first weeks I did not enjoy it as much.
In the end I think I could contribute the most when things needed to be spatialised such as with the vision map and the pilot projects. Although I liked this quarter and I am happy with the end result, I realised that I prefer to work on a smaller scale because I prefer to work with something more graspable. I will keep this in mind when I will choose my topic for my graduation, and when choosing where to apply for offices to work for in the future.

Working in a group
Although in my previous education almost all subjects were in group-form, I got used to working on my own in Delft where all the subjects I followed were individual (which I did not mind because I really like working on my own). As every decision had to be discussed with the group, I experienced this quarter to be very intense. Especially at the beginning of the project, a lot of discussions tended to move away from the main point, thus making them unnecessarily long sometimes. After a couple group discussions I tried to take the role of keeping the discussions sharp, which proved to be helpful and also appreciated by other group members. This, with the new insight that it is sometimes better to agree to disagree, I felt like group discussions became much more to the point and less tiring towards the end of the quarter.

A better work-life-balance
Especially the first couple of weeks I noticed that I was more tired than usual, which affected my personal life as well. Normally, I tend to work long days and also on the weekend, but I noticed that this would wear me out in the long term. After some weeks I decided to work with clearly defined working hours, and not work past dinner on weekdays, and only if really necessary on sunday. This turned out to work well as I was able to establish a clear routine for myself, as well as a good sleeping schedule. Because of this, I felt that the last weeks were less tiring and that I was able to do more work in the time that I had. During my graduation I will make sure to create a healthier work-life-balance by maintaining the strict schedule I made for myself.

REFLECTION
JP BOERSMA

This quarter felt like a logical step in a series of three studio courses during the first year of the Urbanism masters: the neighbourhood scale (Q2), the city scale (Q1), and now, the regional scale. Each quarter has presented a learning point. In the first quarter, it was the big jump in scale and overseeing strategies on a much larger scale than is easily captured in one drawing or map. The second quarter came with an almost opposite challenge of zooming in after defining the main masterplan. This quarter has perfectly, and sometimes frustratingly, combined those two challenges: truly working through the scales.

The system approach that was so integral to this course, did not come naturally to me. I tend to focus and get stuck in one scale where I try to figure out all the details. When I finally do make the jump to a different scale, I have trouble connecting the scales and making them truly part of the same system. This course, however, together with my incredible teammates and tutors, finally caused an immense breakthrough in this process.

Assessing the nitrogen crisis in agriculture, a topic that is close to my heart since I come from a farmer's family, allowed me to see the topic from the perspective of the bio-physical cycle first. For me, this embedded the system thinking in the project unequivocally. By continuously cycling through our ideas, and iterating cycles of diverging and converging, we connected the different elements to our story more and more: the solution to the broken system became a system itself. We created maps of the different scales, and we saw our system grow into a network.

An important part of my role in the group was the background research on the (distorted) bio-physical cycle, political influences, and socio-economic effects. This pyramid of cause-and-effects showed me another layer of system thinking: not just through the scales, but holistic.

A part of the project that was very important to me, was keeping us in check with our pre-established values. The socio-ethical side of this project is large, as a lot of people's livelihoods directly and indirectly depend on our agriculture system. Continuously circling the topics within the project back to our core values helped me get a grip on the narrative of our project.

Even though the groupwork has been an extremely positive experience, there are always things you need to deal with. I am grateful for a group that, while hardworking and critical, was also open and patient. Issues with for example communication were openly talked about and addressed on time.

My communication changed and developed quite a bit during this quarter. I can be quite vocal quick to respond This can be quite irritating and come across as pushy and impatient. Especially in this group, where we found ourselves with cultural differences that mostly related to communication style, this had to change. I focused on being less impulsive and waiting for someone else to respond before I did. There are always more improvements to make, but I think I took important steps during these past few weeks. Throughout this quarter, my learnings of soft skills, urbanism theory, and regional planning have developed significantly.

REFLECTION
JELLE SCHOTANUS

I This quarter introduced us to the largest scale we have yet to work with and with that the challenges that come with vision and strategy making on this scale. The Capita Selecta lectures in the first week where a good introduction to some of these challenges and the lecture of Rien van der Wall started my interest of the policymaking related to the project.

Our project we are rethinking the food system of North-Western Europe by localising and diversifying the agricultural sector. This radical change in how we produce and consume food can only be reached by large scale spatial and societal changes. These changes will not just happen out of the blue and people need to adjust.

This is related to the governance of our project. We realised that this societal and spatial change could not just be realised with a single form of governance. We needed to change the mindset of society, financially incentivise small and large scale companies to make the change and use laws and policies to guide the whole process.

In this moment we came to the conclusion that this transition would need good coordination and governance because of the complexity of the food system and the many different stakeholders involved.

When we were discussing what kind of policies and actions we would need, I found it interesting that the first idea that were developed by the non-dutch students resembled policies that where introduced in the Netherlands in war time like the 'Ruilverkaveling'. We envision collective farming structure that leaves no room for large scale intensive farming. Thus these large companies would need to split up their departments.

During this discussion, I realised that this transition was not just complex but could also be a sensitive one. This lead us to including a large educational part. By not just forcing people to change, we educate people to the urgency and they would want to change. This way we could implement policies from top-down and motivate people from the bottom-up.

JP and I sat down to come up with a policy that could financially stimulate large scale farmers to splinter, small scale farmers to form collectives and be not to similar to the 'Ruilverkaveling' policy. In the end we came up with a solution that would help implement our strategy, but was still some what controversial.

All in all, this specific part of our project, how to implement good governance in regional design and planning was a very good learning curve. Starting with the understanding of the complexity of national spatial planning in the Netherlands, to interesting workshop related to good governance and stakeholders and ending with trying to implement it all ourselves in the project. This project and course has of course it's limitations in the sense that we couldn't integrate essential stakeholders in the process, but I feel like that I have gotten a much clearer idea of how this would work and what forms of good governance actually are.

REFLECTION
WIEBKE STADTLANDER

This quarter I wanted to work with nitrogen because I was aware of the farmers' protests in north-west Europe and I wanted to understand the community side of the story, coming from a consumer perspective. In my previous projects I was already very involved in social and environmental sustainability and knew how important those topics are, but I quickly realised that the changing climate is also putting a lot of pressure on the economy. I believe that economics is a crucial part of people's wellbeing and always needs to be considered, especially when working with different stakeholders. It was the first time in my academic life that I worked at a regional level and the subject of agriculture helped me to think more about the political, environmental, social and spatial implications and their connections across all scales.

However, I am still curious to see if the Donut Diet we are proposing can actually appeal to policy makers and convince them of all the benefits we have discovered over the past nine weeks through research through design and displayed in this report.

I chose the profession of urbanism in particular because I wanted to empower people who don't have the tools or the capacity to do it themselves. This is partly why we came up with the idea of creating a set of hard policies aimed at local authorities rather than farmers. I think it was a valuable experience to look at this role in an academic context before doing it later in practice.

A very helpful method I gained was the pattern language that acts in this design as a communication tool to bring together top-down and bottom-up processes. In the previous quarter I had already created a set of action cards, which were intended to be a flexible tool within fixed zones. However, the actions did not fully address the complexity of the project. The pattern language, however, helped us to address this complexity while at the same time breaking down the actions and principles into an easily accessible language which is a helpful method of engaging the communities we were planning for. This method and my role in this project, displayed partly by the peer review, helped me to realise that working as a mediator that understands complex situations and makes them accessible and transparent to people is exactly the role I want to play as an urbanist in the future.

In doing so, I particularly enjoyed jumping through scales, working at different levels and finding important aspects to consider at each end. From regional to local, and from governance to small-scale bottom-up initiatives, always rethinking and adapting our vision according to the strategy, and strengthening it each time we found a new connection or a new way that seemed to be more logical.

It was a great experience to work in such a diverse team. Everyone had a different skill set which helped to bring the project together nicely. I enjoyed the fact that we discussed a lot and created space to be critical and sharpen the project. While I enjoyed working in this group, it also forced me to slow down and be more patient at times, trusting everyone's time management without taking on too many tasks. Looking back over the past few weeks, I am still impressed by how much material we were able to produce in such a short time. I have again gained so much new information, so many tools to work with in future projects, and especially the feedback from the peer review was a valuable experience that helped me to see my strengths in a group.

7. SOURCES

7.1 REFERENCES - TEXT

Akkerwijzer. (2017, october). Vezelhennep stabiel bij gebrek stimulansen. https://edepot.wur.nl/428089

Basics of Agroforestry (By Nestlé & Bern University of Applied Sciences). (2021, October 19). [Video]. YouTube. Retrieved April 5, 2024, from https://www.youtube.com/watch?v=jLZ0Kt-Nx354

Beijers, O. (2019, 13 september). Vlas laat dit jaar mooie opbrengstcijfers zien. Nieuwe Oogst. https://www.nieuweoogst.nl/nieuws/2019/09/13/vlas-laat-dit-jaar-mooie-opbrengstcijfers-zien

Bertrand, S., & Roberts, A. S. (2022, March 11). Adding trees to farms can mitigate climate change and increase resilience. Environmental and Energy Study Institute. Retrieved April 5, 2024, from https://www.eesi.org/articles/view/adding-trees-to-farms-can-mitigate-climate-change-and-increase-resilience

Bestman, M., Geurts, J., Egas, Y., Van Houwelingen, K., Lenssinck, F., Koornneef, A., Pijlman, J., Vroom, R., & Eekeren, N. (2019). Natte teelten voor het veenweidengebied. https://edepot.wur.nl/503232

Bmwsb . (2024). Bundesministerium für Wohnen, Stadtentwicklung und Wohnen [Federal Ministry of Housing, Urban Development and Housing]. https://www.bmwsb.bund.de/Webs/BMWSB/DE/themen/stadt-wohnen/stadtentwicklung/neue-leipzig-charta/neue-leipzig-charta-node.html

Bouwgroep Dijkstra Draisma. (n.d.). LISDODDE: CIRCULAIR ISOLATIEMATERIAAL.van https://bgdd.nl/wat-we-bedenken/lisdodde/

Bürmann, S. (2024, February 26). Landbouwministers willen dat Brussel meer doet om boeren tegemoet te komen. NOS. https://nos.nl/artikel/2510506-landbouwministers-willen-dat-brussel-meer-doet-om-boeren-tegemoet-te-komen

CAP at a glance. (2024, March 27). Agriculture and Rural Development. https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en

Cohen, A. (2023). Verified Market Reports. Von Green Gold: Navigating Trends in the Algae Market: https://www.verifiedmarketreports.com/blog/top-7-trends-in-algae/ abgerufen

Cradle Crops. (n.d.). Olifantengras (Miscanthus giganteus) opbrengst. https://cradlecrops.nl/olifantengras-miscanthus-giganteus/opbrengst/

Deutsche Gesellschaft für Ernährung. (n.d.). DGE-Ernährungskreis. https://www.dge.de/gesunde-ernaehrung/gut-essen-und-trinken/dge-ernaehrungskreis/

De Natuurwetenschappen, N. N. V. V. H. O. I., & Bouwens, R. (2013). Binas: havo/vwo: informatieboek havo/vwo voor het onderwijs in de natuurwetenschappen.

EUFIC. (2018). eufic food facts for healthy choices. Food technologies: securing our future food supply: https://www.eufic.org/en/food-production/article/food-technologies-securing-our-future-food-supply

EUFIC. (2023a). eufic food facts for healthy choices. 5 trending alternative protein sources to meat in Europe: https://www.eufic.org/en/food-production/article/5-trending-alternative-protein-sources-to-meat-in-europe

EUFIC. (2023b). eufic food facts for healthy choices. Lab grown meat: how it is made and what are the pros and cons: https://www.eufic.org/en/food-production/article/lab-grown-meat-how-it-is-made-and-what-are-the-pros-and-cons

EFSA. (2020). The 2020 European Union report on pesticide residues in food. https://multimedia.efsa.europa.eu/pesticides-report-2020/chapter-one/

European Commission. (2021). The European Green Deal. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

European Environment Agency [EEA] & PBL Netherlands Environmental Assessment Agency [PBL]. (2017). Food in a green light: A systems approach to sustainable food. In https://www.eea.europa.eu/en. Publications Office of the European Union. https://doi.org/10.2800/884986

European Environment Agency. (2021). European Environment Agency. Air pollutant emissions data viewer (Gothenburg Protocol, Air Convention) 1990-2021: https://www.eea.europa.eu/data-and-maps/dashboards/air-pollutant-emissions-data-viewer-5

European Environment Agency. (2023a). The Natura 2000 protected areas network. https://www.eea.europa.eu/themes/biodiversity/natura-2000

European Environment Agency. (2023b). How pesticides impact human health and ecosystems in Europe. In https://www.eea.europa.eu/en. Publications Office of the European Union. https://doi.org/10.2800/760240

European Green Deal. (n.d.). Consilium. https://www.consilium.europa.eu/en/policies/green-deal/

FBFS. (202). Farm Bureau Financial Services. 4 uses of agricultural waste that can save farmers money: https://www.fbfs.com/learning-center/4-uses-for-agricultural-waste-that-can-save-farmers-money

Ghi, T., Webster, P., Monzon, D., Kolk, M., Cheng, W., Srisaard, P., & Lim, S. (2022). Arthus Little. why the bio-based materials market is finally poised for growth: https://www.adlittle.com/en/insights/prism/why-bio-based-materials-market-finally-poised-growth

Gomstyn, A., & Jonker, A. (2023). IBM. Von What is smart farming?: https://www.ibm.com/topics/smart-farming abgerufen

Government of the Netherlands. (2024). Nature and Biodiversity. National Ecological Network (NEN): https://www.government.nl/topics/nature-and-biodiversity/national-ecological-network-nen

Google Earth. (2024) https://www.google.nl/maps/@52.0753413,4.7581878,10798m/data=!3m1!1e3?hl=nl&entry=ttu

Hill, Adrian V (ed.). (2020) Foundries of the Future: a Guide to 21st Century Cities of Making. With contributions by: Ben Croxford, Teresa Domenech, Birgit Hausleitner, Adrian Vickery Hill, Han Meyer, Alexandre Orban, Víctor Muñoz Sanz, Fabio Vanin and Josie Warden. Delft. TU Delft Open, 2020.

Huysmans, M. (2021, September 21). Hoe komt het dat de vlees- en zuivelindustrieën overheidssubsidie krijgen? KlimaatHelpdesk. https://www.klimaathelpdesk.org/answers/hoe-komt-het-dat-de-vlees-en-zuivelindustrie%C3%ABn-overheidssubsidie-krijgen/

Leendertse, P., Lageschaar, L., Hees, E., Van Well, E., & Rietberg, P. (2020, april). Bijdrage van vlas en hennep aan milieu- en klimaatdoelstellingen van het toekomstig EU- landbouwbeleid. CLM Onderzoek en Advies. https://edepot.wur.nl/531064

Mast, J., & De Ploeg, C. (2021, September 8). De handel in emissierechten ondermijnt een effectiever klimaatbeleid. Follow the Money - Platform Voor Onderzoeksjournalistiek. https://www.ftm.nl/artikelen/emissiehandel-ondermijnt-klimaatbeleid?share=aYm%2FeoVx5V37%2FV1iKnt7%2BPk%2BK5jFnRt%2B76PtY%2BeISSkGeNukSvtZN360PH%2FuGlE%3D

NDFF & FLORON. (2022). Verspreidingsatlas. Verspreidingsatlas. https://www.verspreidingsatlas.nl/

Nederlandse Emissieautoriteit. (2023, February 20). Wat is emissiehandel? https://www.emissieautoriteit.nl/onderwerpen/wat-is-emissiehandel

NOS. (2001, February 28). Stikstofcrisis. https://nos.nl/collectie/13901-stikstofcrisis

NU. (2023, December 18). Duitse boeren demonstreren met tractors in Berlijn tegen landbouwbeleid. Retrieved February 20, 2024, from https://www.nu.nl/buitenland/6294554/duitse-boeren-demonstreren-met-tractors-in-berlijn-tegen-landbouwbeleid.html

NU. (2024, January 26). Franse boeren willen richting Parijs na week vol demonstraties. Retrieved February 20, 2024, from https://www.nu.nl/buitenland/6299196/franse-boeren-willen-richting-parijs-na-week-vol-demonstraties.html

Priva. (2024). Priva. Indoor Growing: https://www.priva.com/de/indoor-growing

Raworth, K. (2017). Doughnut economics: Seven ways to think like a 21st-century economist. Chelsea Green Publishing.

Rejcek, P. (2023). Frontiers. Microalgae could be the future of sustainable superfood in a rapidly changing world, study finds: https://www.frontiersin.org/news/2023/01/19/frontiers-nutrition-microalgae-future-sustainable-superfood

Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., ... & Rockström, J. (2023). Earth beyond six of nine planetary boundaries. Science advances, 9(37), eadh2458.

Schieland en de Krimpenerwaard. (2022). Hoogheemraadschap van Schieland en de Krimpenerwaard. Waterkwaliteitsrapportage: https://www.schielandendekrimpenerwaard.nl/kaart/waterkwaliteit/waterkwaliteitsrapportages/wklrap_2022/nutrienten.html

Schulte-Uebbing, L. F., Beusen, A. H., Bouwman, A. F., & De Vries, W. (2022). From planetary to regional boundaries for agricultural nitrogen pollution. Nature, 610(7932), 507-512.

Stephenson, H. (2023). Independent. What crops will we be growing in the future, as climate change alters the landscape?: https://www.independent.co.uk/life-style/french-jerusalem-pakistan-india-himalayan-b2434858.html

Timeline – Common agricultural policy 2023-2027. (n.d.). Consilium. https://www.consilium.europa.eu/en/policies/cap-introduction/cap-future-2020-common-agricultural-policy-2023-2027/timeline-common-agricultural-policy-2023-2027/#:~:text=The%20new%20CAP%20applies%20from%201%20January%202023&text=The%20reformed%20CAP%20for%20the,targeted%20support%20to%20smaller%20farms

United Nations [UN]. (2015). Transforming our World. In The 2030 Agenda for Sustainable Development Publication Year: 2015 (A/RES/70/1). United Nations. Retrieved April 4, 2024, from https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981

United Nations. (2016). United Nations Climate Change. The Paris Agreement: https://unfccc.int/process-and-meetings/the-paris-agreement

United Nations. (2023). United Nations. Department of Economic and Social Affairs: https://sdgs.un.org/goals

Wandl, D. A., Nadin, V., Zonneveld, W., & Rooij, R. (2014). Beyond urban–rural classifications: Characterising and mapping territories-in-between across Europe. Landscape and Urban Planning, 130, 50-63.

Wandl, A. (2024, February 12). Circular Economy Challenge [Slide show; Lectureslides]. Introduction to Spatial Strategies for the Global Metropolis, Delft, Netherlands. https://brightspace.tudelft.nl/d2l/le/content/594261/viewContent/3613933/View

WUR. (n.d.). Olifantsgras - Miscanthus. https://www.wur.nl/Formsession-expired-27.htm

7.2 REFERENCES - IMAGES

ANP. (2024, February 26). Een boer werpt hooi uit zijn tractor terwijl de politie traangas inzet. NOS. https://nos.nl/artikel/2510506-landbouwministers-willen-dat-brussel-meer-doet-om-boeren-tegemoet-te-komen

Centraal Bureau voor de Statistiek. (2023). 125 Centraal Bureau voor de Statiskiek. Wijk- en buurtkaart 2023 [Neighborhood and neighborhood map 2023]: https://www.cbs.nl/nl-nl/dossier/nederland-regionaal/geografische-data/wijk-en-buurtkaart-2023

European Environment Agency. (2021). European Environment Agency. Air pollutant emissions data viewer (Gothenburg Protocol, Air Convention) 1990-2021: https://www.eea.europa.eu/data-and-maps/dashboards/air-pollutant-emissions-data-viewer-5

Imago Stock & People GmbH. (2024, January 8). Boerenprotest in Berlijn. RTL Nieuws. https://www.rtlnieuws.nl/nieuws/buitenland/artikel/5428246/duitse-boeren-voeren-actie-ook-wegblokkades-bij-de-grens

NRC. (2022, February 19). Arrestaties bij Boerenprotest Den Haag. https://Https://www.nrc.nl/nieuws/2020/02/19/Arrestatie-bij-boerenprotest-in-den-Haag-a3990950

Reuters. (2023, December 18). Duitse boeren demonstreren met tractors in Berlijn tegen landbouwbeleid. NU. https://www.nu.nl/buitenland/6294554/duitse-boeren-demonstreren-met-tractors-in-berlijn-tegen-landbouwbeleid.html

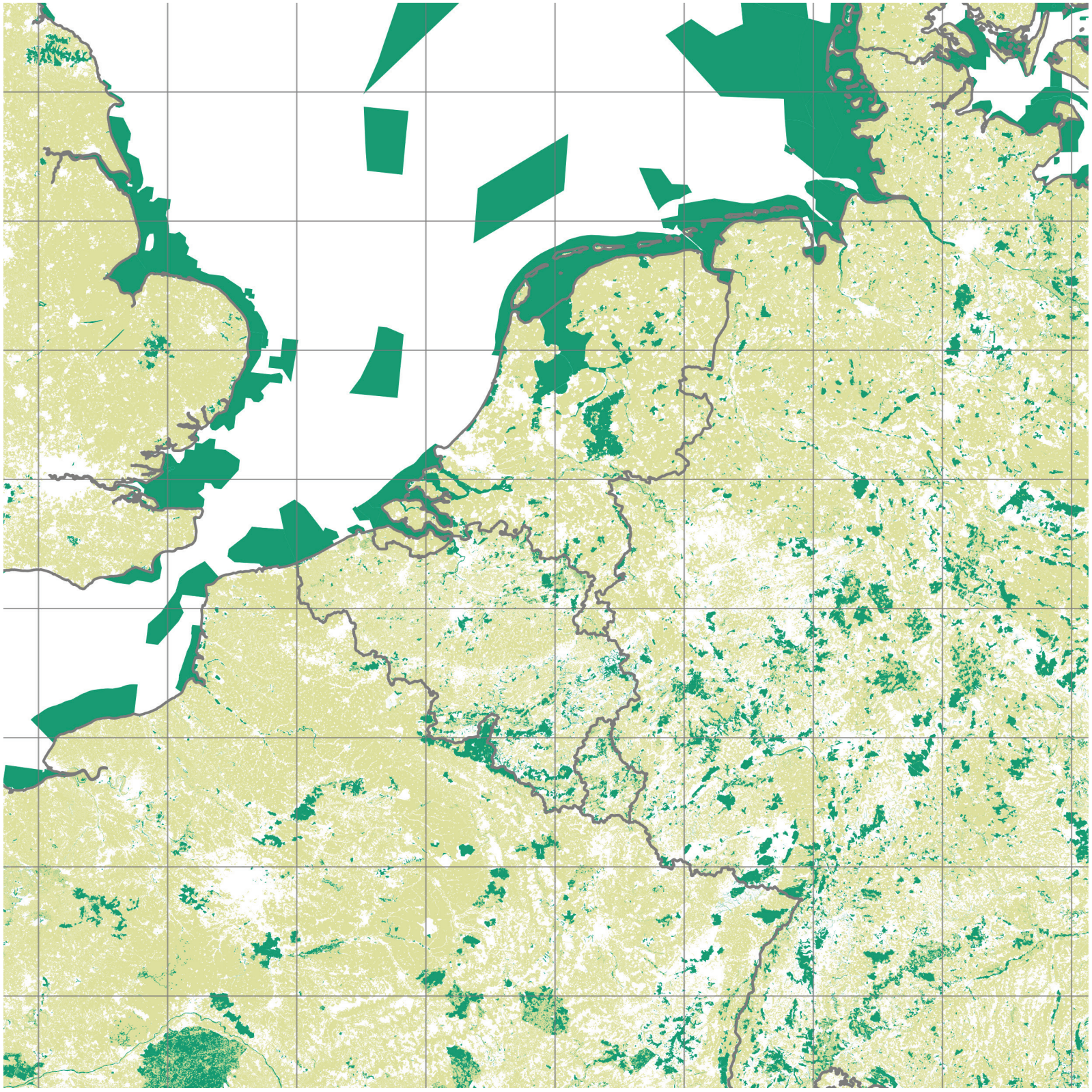
Virto, I. (n.d.). Research Gate. Land use in each country in Western Europe (as a percentage of total land area).: https://www.researchgate.net/figure/Land-use-in-each-country-in-Western-Europe-as-a-percentage-of-total-land-area_tbl3_271211775

De Waal, R. (2019, October 16). Een overzicht van het boerenprotest op het Malieveld. Indebuurt. https://indebuurt.nl/denhaag/nieuws/de-tofste-fotos-van-het-boerenprotest-in-den-haag-16-oktober-2019~106291/#slide-3

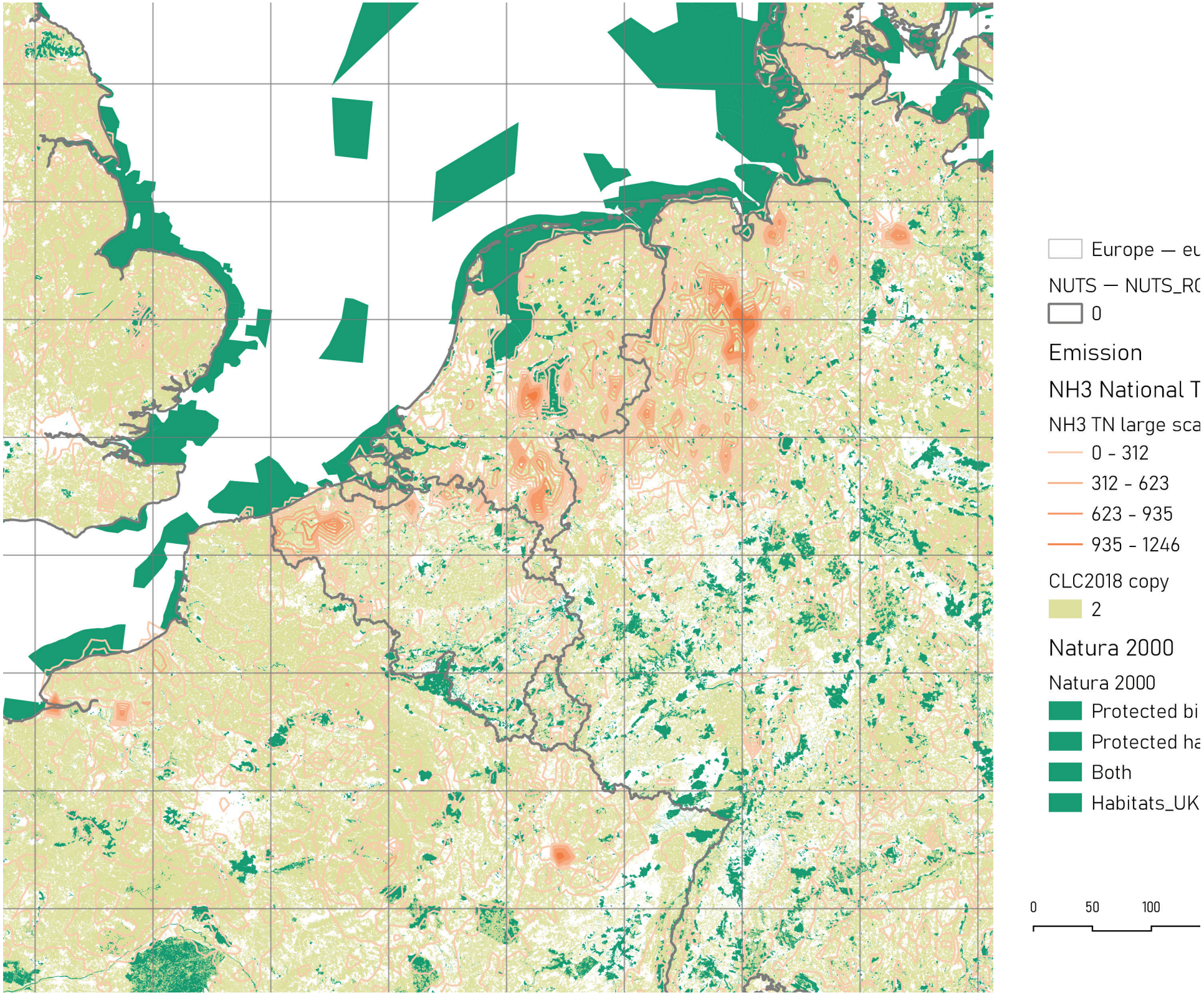
8. APPENDIX

APPENDIX 8.1
ANALYSIS MAPS

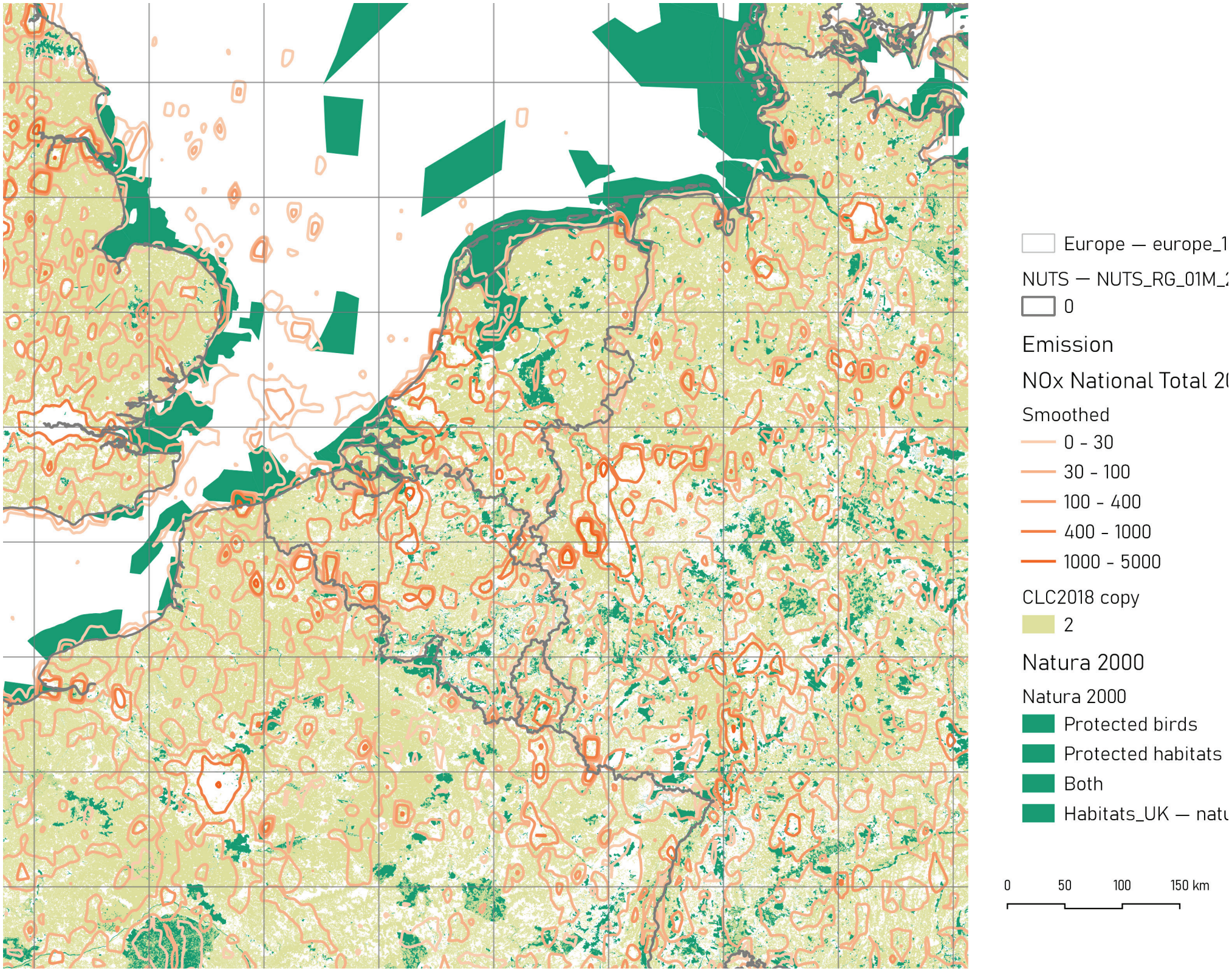
NATURA 2000 AND PROXIMITY TO AGRICULTURAL AREAS



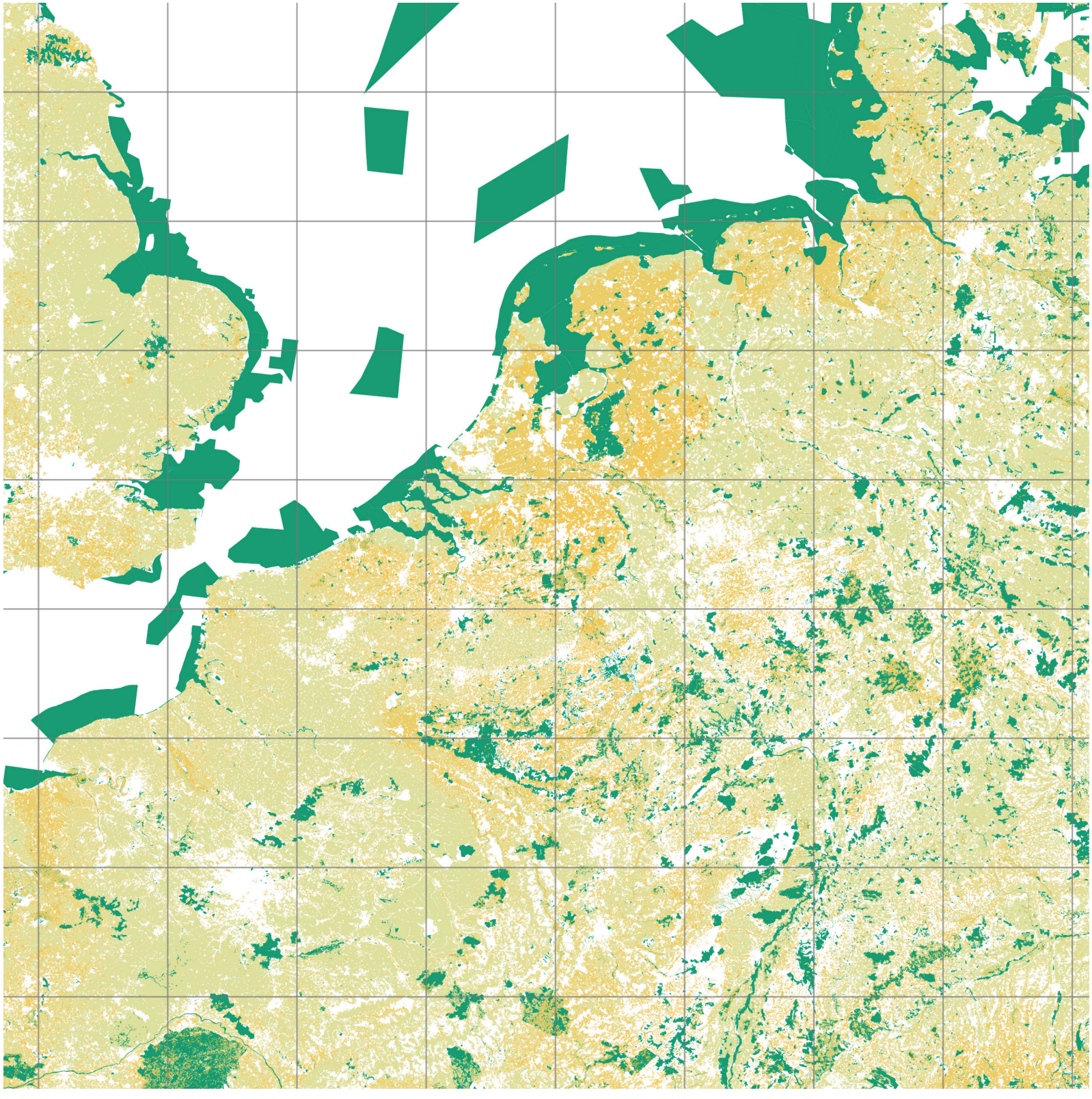
TOTAL NH3 EMISSIONS



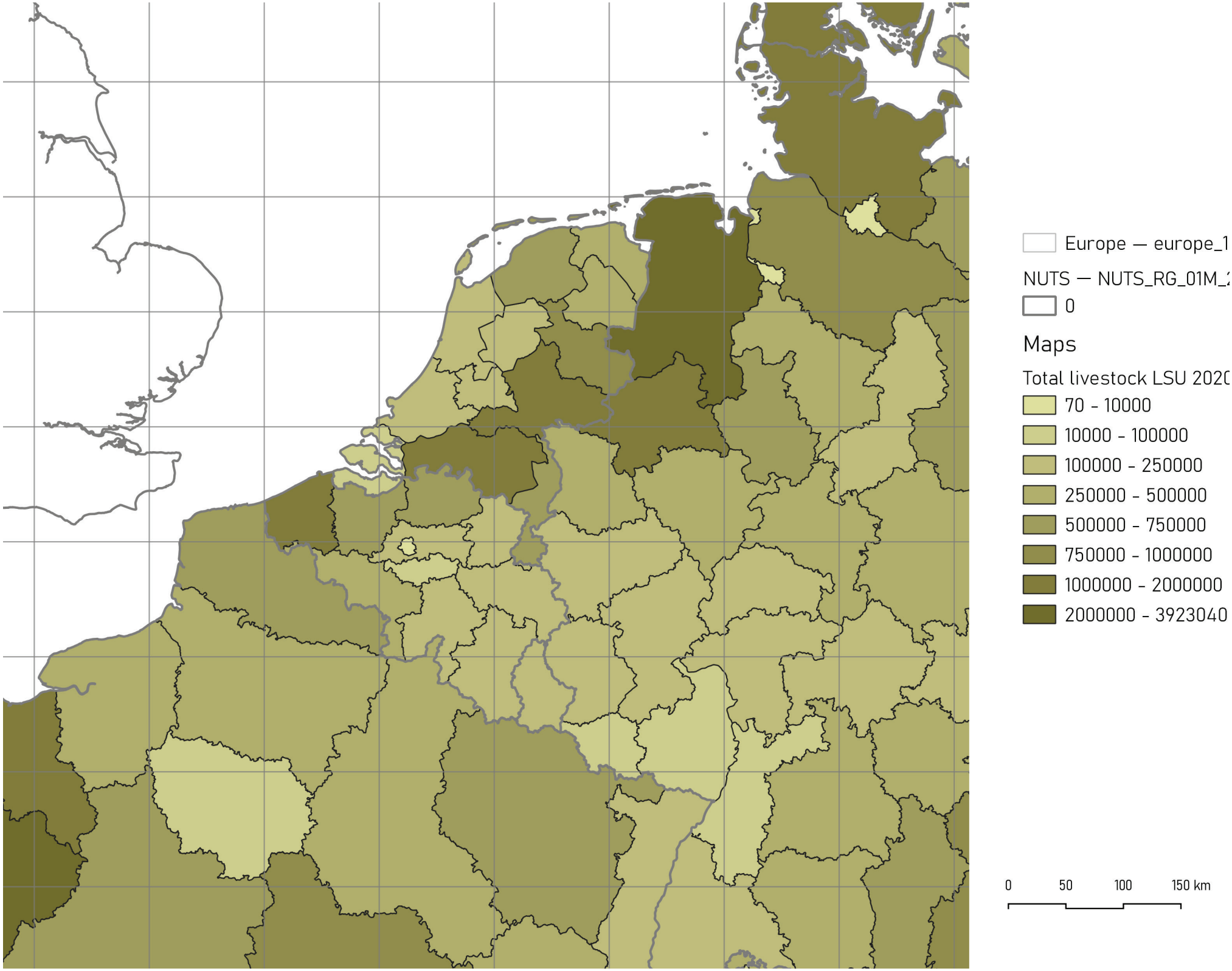
TOTAL NOX EMISSIONS



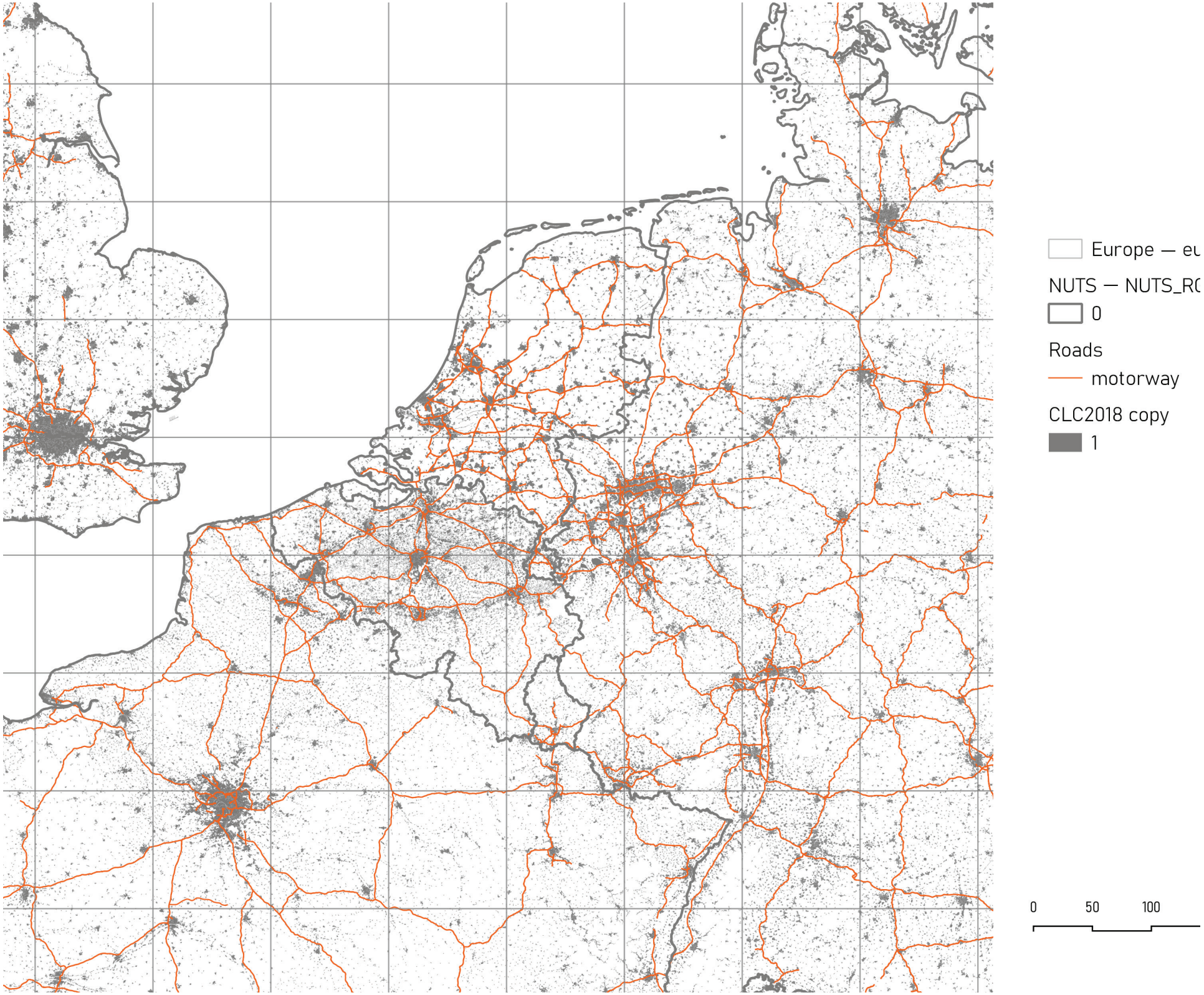
TYPES OF AGRICULTURE IN PROXIMITY TO NATURA 2000 AREAS



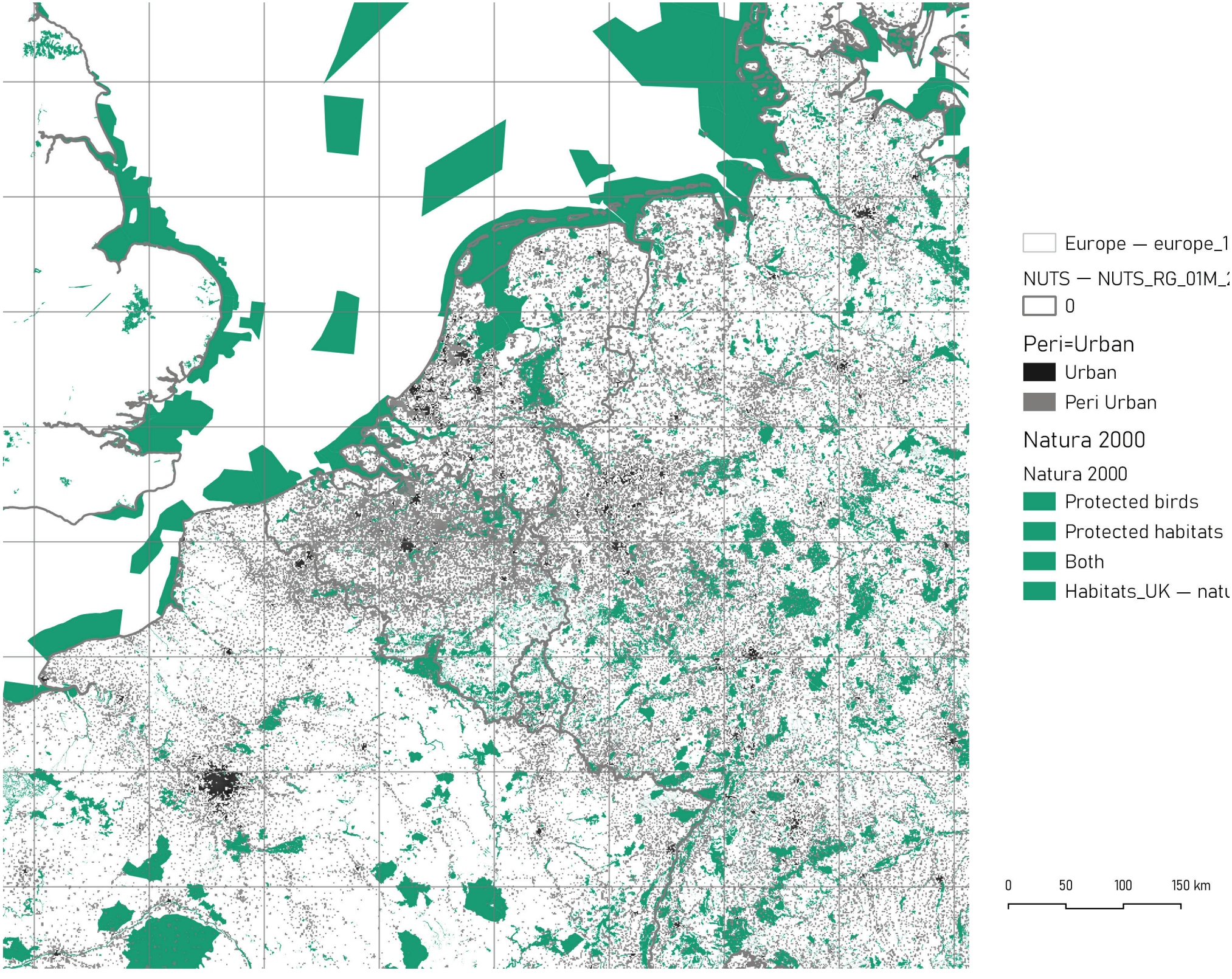
TOTAL BOVINE POPULATION PER NUTS2 AREA



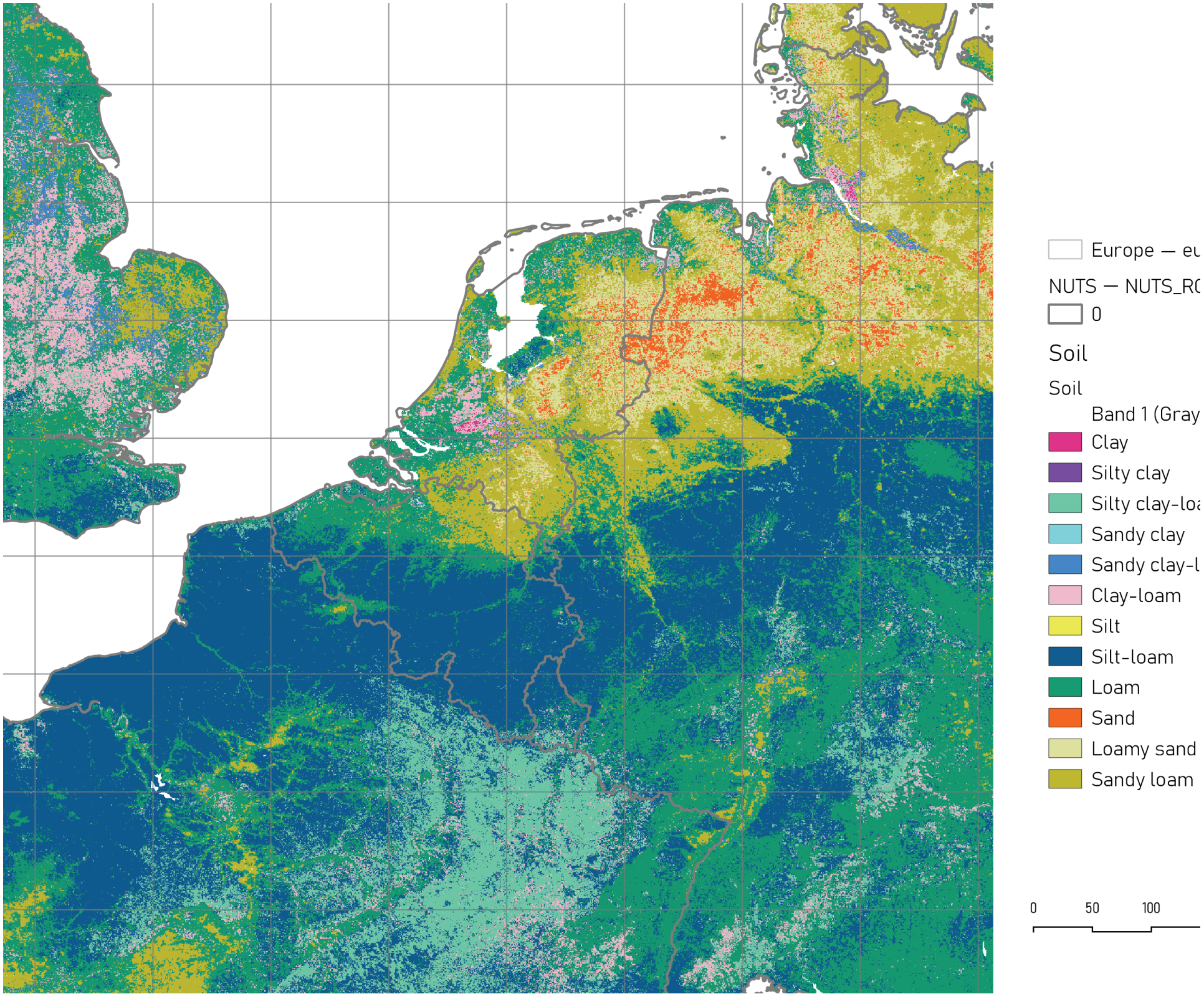
MAIN INFRASTRUCTURE NETWORKS



NATURA 2000 IN PROXIMITY TO URBAN AND PERI-URBAN AREAS



SOIL TYPES


Europe — eu
NUTS — NUTS_RG
0
Soil
Soil
Band 1 (Gray
Clay
Silty clay
Silty clay-loa
Sandy clay
Sandy clay-l
Clay-loam
Silt
Silt-loam
Loam
Sand
Loamy sand
Sandy loam
0
50
100

APPENDIX 8.2
AGRICULTURE EXPORT ANALYSIS

Product	Percentage	Classification	Description
Other live plants	4,22%	Luxury product	Horticulture plants and trees
Cut Flowers	4,10%	Luxury product	Cut flowers
Cheese	3,52%	Luxury product	Cheese
Animal feed	3,09%	Luxury product	Anifal feed, enhanced with protein (adding to nitrogen pollution)
Food preperations n.e.c.	2,98%	Luxury product	Highly processed and refined food products, such as baking powder, nutritional yeast etc.
Malt extract	2,35%	Luxury product	Sweetener extracted from barley grain
Beer	1,68%	Luxury product	Beer
Seeds used for sowing	1,62%	Raw product, basic ne	Seeds
Other vegetables	1,58%	Raw product, basic ne	Vegetables
Tomatoes	1,56%	Raw product, basic ne	Tomatoes
Chocolates	1,54%	Luxury product	Chocolate
Other vegetables, frozen	1,52%	Medium grade product	Frozen vegetables
Pork	2,29%	Meidum grade product	Cut meat
Beef	2,02%	Medium grade product	Cut meat
Poultry	1,98%	Medium grade product	Cut meat
Bakery products	1,80%	Medium grade product	Baked goods
Waters, flavored or sweete	1,69%	Luxury product	Soda's and juices
Milk, concentrated	1,41%	Medium grade product	Concentrated (processed and preserved milk)
Butter	1,24%	Medium grade product	Butter
Flower bulbs	1,22%	Luxury product	Flower bulbs
Fruit juices	1,20%	Luxury product	Fruit juices
Avocado, Mango, pineappl	1,19%	Medium grade product	Tropical fruits
Cocoa butter	1,13%	Luxury product	Cocoa butter
Trunks or cases	1,12%	Luxury product	Trunks and cases for food transport
Stearic acid	1,12%	Medium grade product	Acid used in production of soaps, detergents and cosmetics
Other fresh fruit	1,11%	Raw product, basic ne	Fruits, not mentioned in other categories
Ethyl alcohol >80%	1,09%	Luxury product	High percentage alcohol
Fish fillets	1,02%	Medium grade product	Processed and cut fish
Palm oil	0,98%	Medium grade product	Palm oil, harmful for environment
Solid soybean residues	0,96%	Medium grade product	Soybean process waste
Spirits <80% alcohol	0,95%	Luxury product	High percentage alcohol
Sauces and seasonings	0,93%	Luxury product	Condiments and seasoning mixes (no raw spices)
Toilet paper	0,84%	Luxury product	Toilet paper

Export basic need, raw product	
Seeds used for sowing	1,62%
Other vegetables	1,58%
Tomatoes	1,56%
Other fresh fruit	1,11%
Eggs, in shell	0,71%
Onions, shallots, garlic	0,70%
Potatoes	0,61%
Milk	0,61%
Apples&pears	0,50%
Whey	0,45%
Fish, excluding fillets	0,45%
Bananas and plantains	0,45%
Soy beans	0,40%
Cashewnuts and coconuts	0,25%
Cucumbers	0,45%
Melons and papayas	0,20%
Cabbages, cauliflower and	0,20%
Lettuce	0,20%
Rice	0,20%
Carrots and turnips	0,20%
Peanuts	0,15%
Total percentage:	12,60%
Total agriculture export The	124B
Total export of basic needs	15,6B

Export to Africa from N		3,19B
Poultry	6,42%	205M
Onions, sh	5,55%	177M
Potatoes	4,24%	135M
Seeds usec	3,27%	104M
Whey	0,70%	22M
Eggs, in she	0,24%	7,6M
Other vege	0,24%	7,6M
carrots and	0,20%	6,4M
Total		664,6M
Percentage of total agr		0,54%

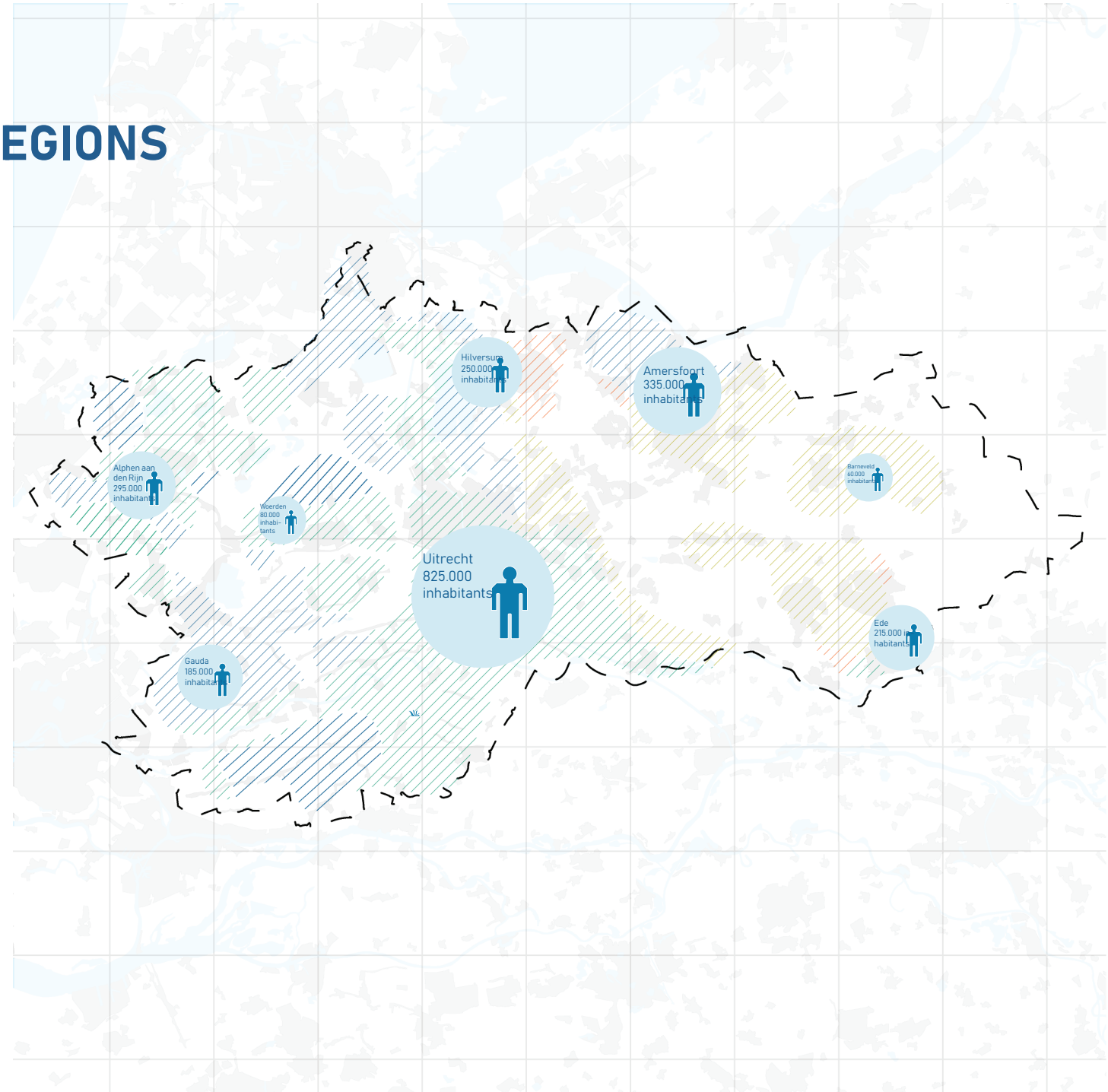
Export to Asia from Ne		12,8B
Seeds usec	2,17%	278M
Whey	1,96%	251M
Eggs, in she	0,98%	125M
Poultry	0,59%	75,5M
Other vege	0,77%	98,6M
Potatoes	0,71%	91M
Milk	0,40%	51M
Tomatoes	0,40%	51M
Lettuce	0,23%	29M
Other fresh	0,15%	19M
Total		1,07B
Percentage of total agr		0,86%

Export to South Americ		960M
Seeds usec	4,99%	19,2M
Potatoes	1,24%	12M
Onions, sh	0,67%	6,4M
Milk	0,15%	1,4M
Eggs, in she	0,12%	1,2M
Total		40,2M
Percentage of total agr		0,03%

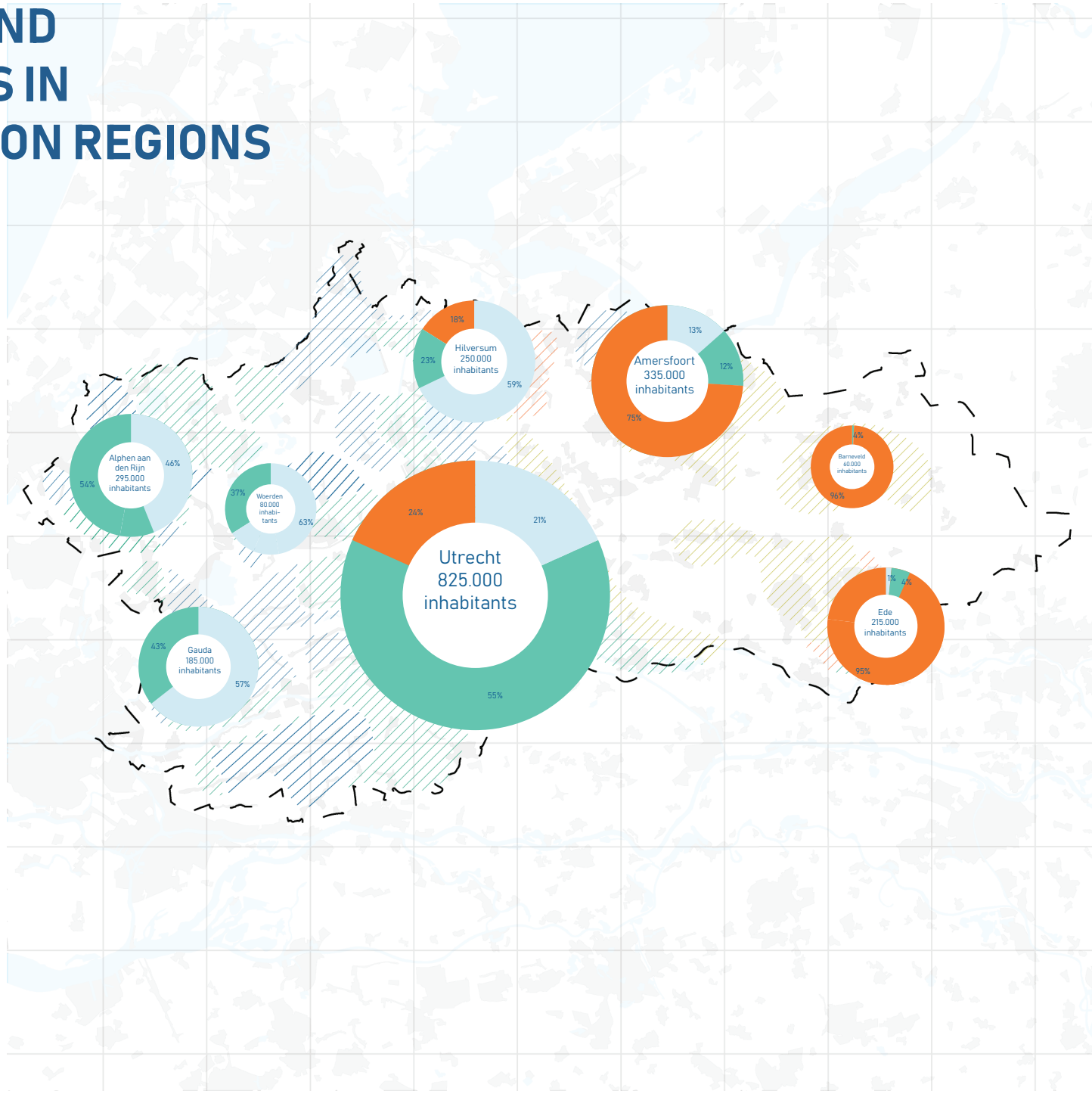
Export to Central Amer		589M
Seeds usec	22,16%	130,5M
Onions, sh	1,94%	11,4M
Potatoes	0,51%	3M
Whey	0,33%	1,9M
Total		146,8M
Percentage of total agr		0,11%

Source: Harvard Kennedy School, & Domingo, A. S. (2022). The Atlas of Economic Complexity by @HarvardGrwthLab. Growth Lab. Retrieved April 9, 2024, from https://atlas.cid.harvard.edu/explore?country=162&queryLevel=location&product=1&year=2021&productClass=HS&target=Product&partner=undefined&startYear=undefined

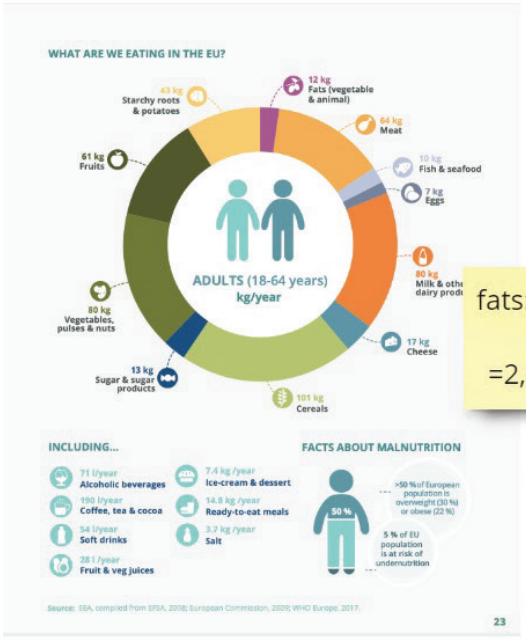
APPENDIX 8.3 PEOPLE AND SOILTYPES IN PRODUCTION REGIONS

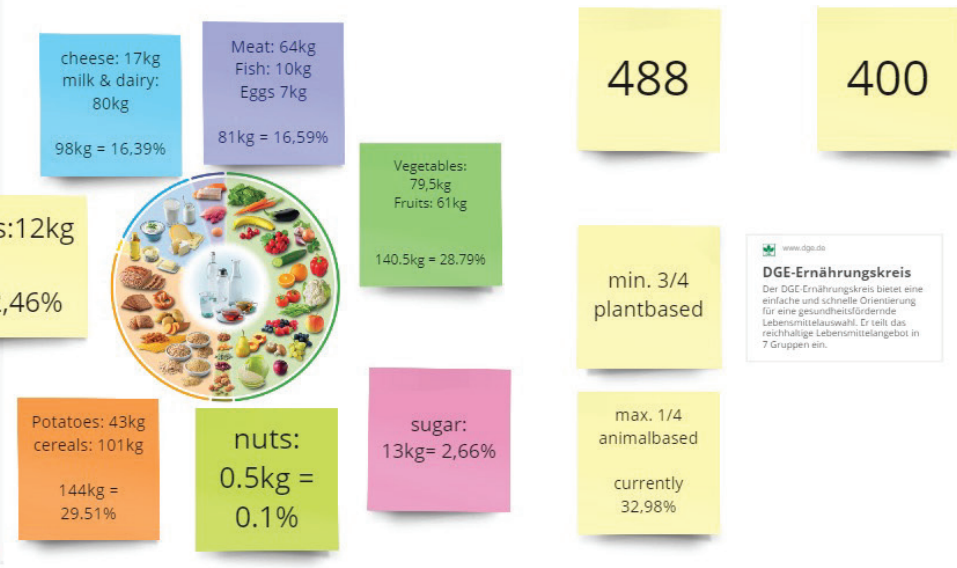


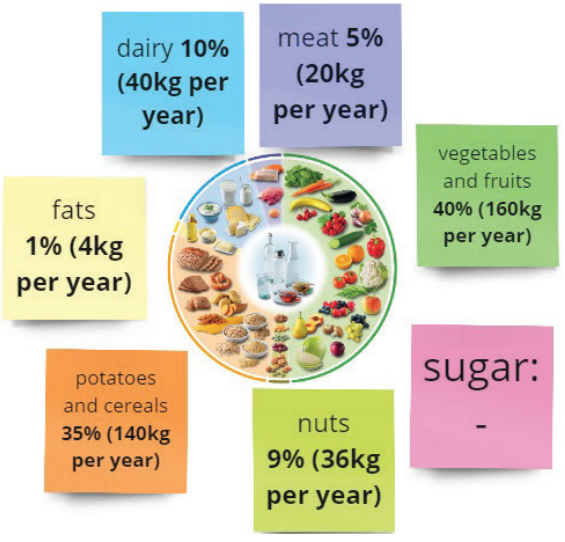
PEOPLE AND SOILTYPES IN PRODUCTION REGIONS



APPENDIX 8.4 CALCULATIONS FOR THE DONUT DIET



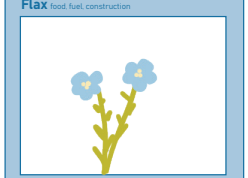




	Current diet (kg)	Current diet (%)	Future diet (kg)	Future diet (%)
Total	488	100,0%	400	100,0%
Dairy	80	16,4%	40	10,0%
Meat	81	16,6%	20	5,0%
Vegetables and fruits	140	28,7%	160	40,0%
Nuts	0,5	0,1%	36	9,0%
Potatoes and cereals	144	29,5%	140	35,0%
Fats	12	2,5%	4	1,0%
Sugar	13	2,7%	0	0,0%

APPENDIX 8.5 SUITABLE BIOBASED MATERIALS AND CROPS

Flax food, fuel, construction



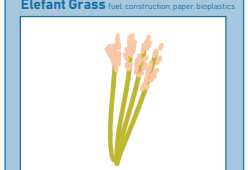
Soiltype
sand

Season
summer

kg/ha
8.000

Biobased

Elefant Grass fuel, construction, paper, bioplastics



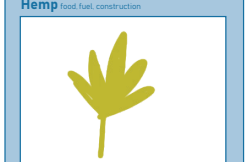
Soiltype
clay, peat

Season
spring

kg/ha
14.000-20.000

Biobased

Hemp food, fuel, construction



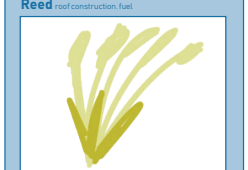
Soiltype
loamy

Season
summer - autumn

kg/ha
8.000

Biobased

Reed roof construction, fuel



Soiltype
moist, clay

Season
winter

kg/ha
14.000-20.000

Biobased

Lisdodde construction, food

Soiltype
peat

Season
winter

kg/ha
6.000-24.000

Biobased

Algae packaging, fuel, food

Soiltype
brakish, salty water

Season
summer

kg/ha
12.000-24.000

Biobased

Root Vegetables (carrots, radish)

Soiltype
sand, clay, loamy

Season
spring - autumn

kg/ha
-

Crops

Legumes (peas, beans)

Soiltype
sand, clay

Season
spring - autumn

kg/ha
-

Crops

Herbs (rosemary, thyme)

Soiltype
sand, loamy

Season
spring - autumn

kg/ha
-

Crops

Grains, Cereal (Barley and Rye)

Soiltype
sand, loamy

Season
autumn

kg/ha
-

Crops

Sunflowers

Soiltype
sand

Season
summer - autumn

kg/ha
-

Crops

Cranberries, Blueberries

Soiltype
peat

Season
summer - autumn

kg/ha
-

Crops

Potatoes

Soiltype
peat

Season
summer - autumn

kg/ha
8.000

Crops

Leafy green (kale, collard, greens)

Soiltype
clay, loamy

Season
summer - autumn

kg/ha
8.000

Crops

Brassicas (cabbage, broccoli)

Soiltype
sand, clay

Season
summer - autumn

kg/ha
8.000

Crops

Fruits (apples, pears, currants)

Soiltype
clay, loamy

Season
summer

kg/ha
8.000

Crops

Lupins

Soiltype
clay

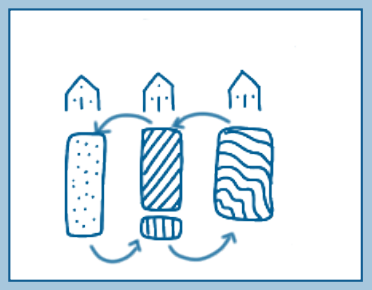
Season
summer - autumn

kg/ha
8.000

Crops

APPENDIX 8.6
PATTERN LANGUAGE

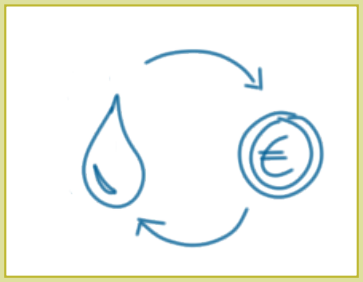
C.1 Regenerative Production



Regenerative practices such as aquaponics, including forest farming, silvopasture and alley cropping with crop rotation are used to improve soil fertility, optimise nutrients and prevent pests.

Connected to
C5 | P8 | P3 | P6 | E4 | E5 | R4 | R7 | R9

C.2 Value Water



Water can be used in a circular way by combining practices that complement each other (aquaponics, algae in wastewater, etc.).

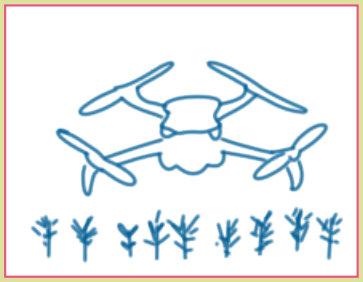
Connected to
C4 | P8 | P6 | E4 | E5 | R2 | R4 | R9

C.3 Digitalise

Digitalised material resources in a in a regionally and spatially linked database facilitate and optimise the local distribution of resources, such as tools, land, materials.

Connected to
C4 | C6 | C8 | P1 | P2 | P6 | E1 | E2 | E3 | E4 | E5 | R9

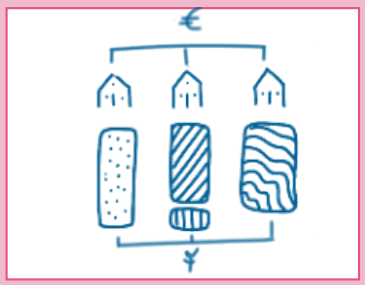
C.4 Automation



Automating agricultural processes can help save costs and preserve the environment.

Connected to
C2 | C3 | C8 | C9 | E4 | R2 | R4

C.5 Shared Risks & Benefits



Investment costs and risks due to unpredictable weather events can be shared by collectives.

Connected to
C1 | C6 | C8 | Co2 | P2 | P7 | P8 | E2 | E4 | R3 | R4 | R7 | R9

C.6 Land Lease

Farmers can lease land from the municipality, making the sector more flexible and inviting people from outside existing farming communities.

Connected to
C3 | C5 | P3 | E5 | R4 | R7 | R9

Co.1 Training Facilities

Low treshold programmes such as cooking classes and local/sesonal food in canteens teach about newly introduced foods and waste management.

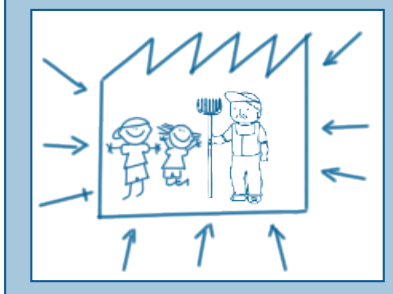
Connected to
C7 | Co2 | Co3 | P5 | P8 | R6

Co.2 Care Infrastructure

Farms will be diversified and care infrastructure such as schools, day-care centres, homes for the elderly and places for the disabled will be introduced.

Connected to
C5 | C7 | Co1 | Co3 | P8 | R4

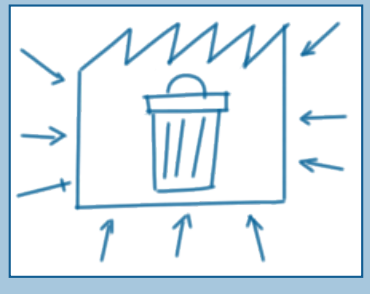
Co.3 Community Center



Community centres are being introduced to provide low-threshold meeting places where people can gather to cook, meet, share or use the care infrastructure.

Connected to
C7 | Co1 | Co2 | P5 | P7 | E3 | R1 | R4

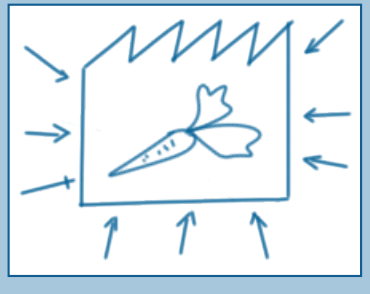
P.1 Biowaste Hubs



Establish facilities to implement closed-loop waste management. Storage capacity for collection in close proximity to shredding, washing and processing units is needed.

Connected to
C3 | C9 | P2 | P4 | P5 | P8 | E1 | E2 | R1 | R3 | R7 | R8

P.2 Food Hubs



Establish facilities to implement collective food sharing. Storage capacity for collection in close proximity to processing and prodcing units is needed.

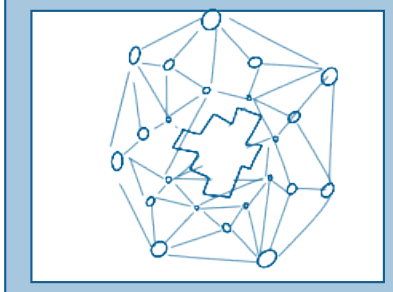
Connected to
C3 | C5 | C9 | P1 | P4 | P7 | P8 | E2 | R1 | R8 | R3

P.3 Natural Zoning

To extend the natural ecosystem, Natura 2000 sites will be connected and regenerative agriculture will be introduced in relation to the proximity of settlements.

Connected to
C1 | C6 | P8 | E5 | R1 | R2 | R3 | R5 | R7 | R9

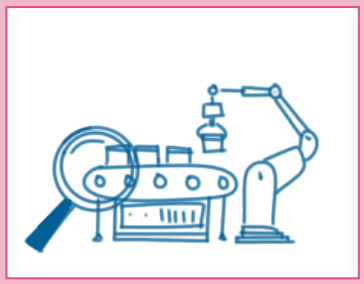
P.4 Cluster Complementary Production



A network of complementary production activities enables local processing and distribution.

Connected to
P1 | P2 | P6 | P8 | E1 | E4 | E5 | R1 | R3 | R8

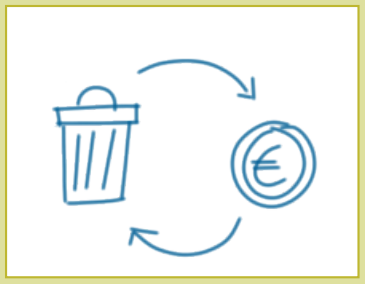
P.5 Making Processes Visible



Food and materials value chain activities need visibility to link their products and services to the local market, and to ensure that the general public recognises their importance to the community.

Connected to
C7 | C9 | Co1 | Co3 | P1 | P7 | P8 | R6

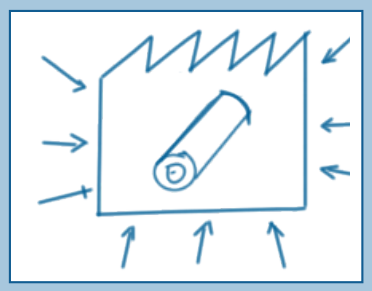
P.6 Value Waste



Food waste and agricultural by-products can often be collected and converted into bio-based materials. They can be used for packaging, buildings, etc.

Connected to
C1 | C2 | C3 | C4 | P1 | P4 | E1 | E3 | E4 | R4 | R8

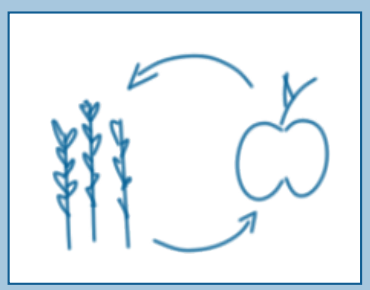
E.1 Material Collection Hubs



Establish facilities to implement collective (biobased) material sharing. Storage capacity for collection in close proximity to processing and prodcing units is needed.

Connected to
C3 | P1 | P4 | P6 | P8 | E2 | E3 | R1 | R3 | R8

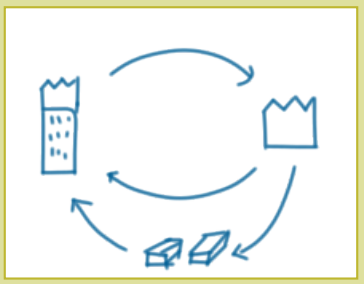
E.2 Material Exchange



Suitable areas specialise according to soil type and then exchange materials and food with each other.

Connected to
C3 | C5 | C9 | P1 | P2 | E1 | E3 | E4 | R3 | R8

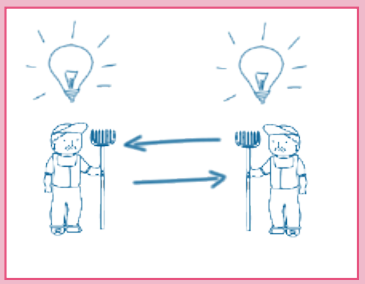
E.3 Urban Mining



The built environment must be preserved and only necessary changes adapted. Material from demolished buildings must be reused and new building material must be introduced only as bio-based material.

Connected to
C3 | Co3 | P6 | P10 | E1 | E2 | E4 | E5 | R3 | R8

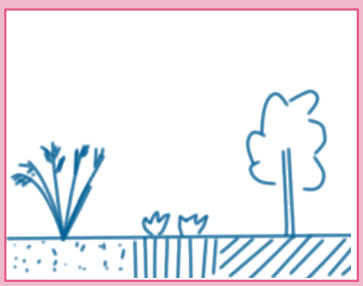
E.4 Knowledge Exchange



Farming collectives have the opportunity to specialise in a way of farming that works well under local conditions, and this knowledge is shared between communities to enable a resilient farming system.

Connected to
C1 | C2 | C3 | C4 | C5 | P4 | P6 | P10 | E3 | E5 | R2 | R4 | R6 | R7 | R8 | R9

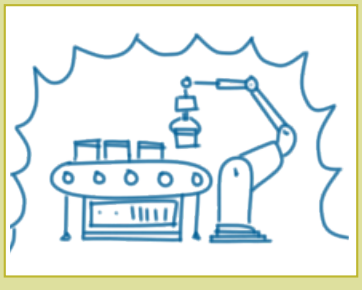
E.5 Soilrelated Farming



Different types of soil are suitable for growing specific foods or bio-based materials. Agriculture will be developed in proportion to the benefits.

Connected to
C1 | C2 | C3 | C6 | C8 | P3 | P4 | P8 | E2 | E4 | R4 | R7 | R9

R.1 Keep Infrastructure | Land for Production



Redundant infrastructure and buildings will not be demolished or simply converted into housing, but will be converted for advanced manufacturing industries.

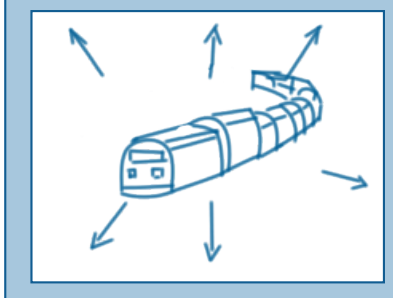
Connected to
C9 | Co3 | P2 | P3 | P4 | P10 | E1 | R3 | R4 | R5 R8

R.2 Depave & Regreen

Soil compacted by extensive use of heavy machinery is regenerated into healthy soil with high water storage capacity.

Connected to
C2 | C4 | P3 | P8 | E4 | R3 | R4 | R5 | R7 | R9

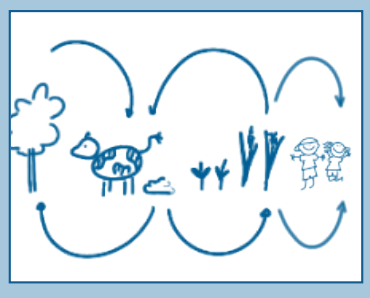
R.3 Links to Infrastructure



Production and processing units benefit from their proximity to the relevant infrastructure linking the distribution networks.

Connected to
C1 | C2 | C5 | C8 | C9 | P3 | P4 | P7 | E1 | E2 | E3 | R1 | R2 | R4 | R5

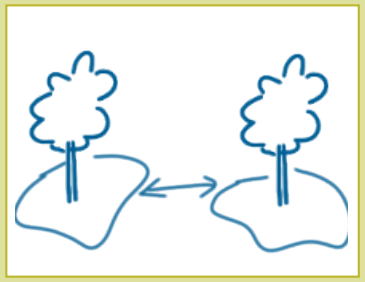
R.4 Diversify Landuse



Combining different land use purposes, such as livestock, crops, forests and care infrastructure instead of large scale intensive farming

Connected to
C1 | C2 | C4 | C5 | C6 | C9 | Co2 | Co3 | P5 | P6 | P8 | E4 | E5 | R1 | R2 | R3 | R7 | R8 | R9

R.5 Regenerative Corridors



Natura 2000 sites will be expanded and connected through regenerative corridors such as wetlands or forests that can be harvested after a few years.

Connected to
P3 | P8 | R1 | R2 | R3 | R4 | R7 | R9

R.6 Education Campus

Production and knowledge must be combined and made transparent and thus accessible to the public to trigger a mindset change.

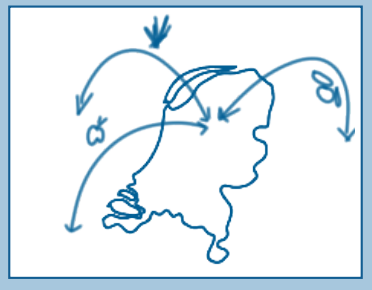
Connected to
C7 | Co1 | P5 | E4

R.7 Regenerative Farming

The aim of regenerative farming is to strike a balance between an economically viable business model and ecosystem and spatial qualities.

Connected to
C1 | C5 | C6 | P1 | P3 | P8 | E4 | E5 | R2 | R4 | R5 | R9

R.8 Reshape Import & Export



A shift in our current import-export system is crucial. Instead of trading luxury goods, we should be exchanging knowledge and essential products such as raw materials.

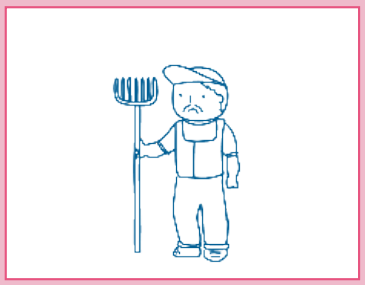
Connected to
C9 | P1 | P2 | P4 | P6 | P7 | E1 | E2 | E3 | E4 | R1 | R4

R.9 Healthy Soil

Healthy soil is essential to the donut diet. Soil regeneration is a top priority to increase water holding capacity and biodiversity. Once restored, it can be used for production again.

Connected to
C1 | C2 | C3 | C5 | C6 | P3 | E4 | E5 | R2 | R4 | R5 | R7

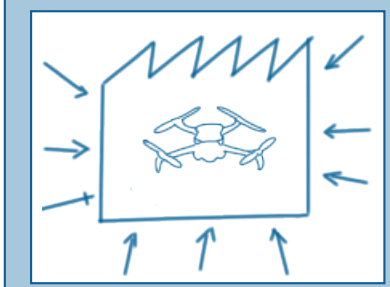
C.7 Community Engagement



Involving local initiatives and communities in a fair transition process is crucial for the transition to work.

Connected to
Co2 | Co3 | Co3 | P5 | P7 | P8 | R6

C.8 Shared Tools



Equipment can be purchased jointly and then shared between farmers. This reduces costs and the amount of tools and equipment needed.

Connected to
C3 | C4 | C5 | C9 | E5

C.9 Production in Cities

Food and material production, such as vertical farming, aquaponics, algae-, fungi-, insectfarming and trees, must be increased within urban boundaries.

Connected to
C4 | C8 | C9 | P1 | P2 | P7 | E2 | R1 | R3 | R4 | R8

P.7 Local Markets

Opportunities to purchase locally produced goods will be introduced to strengthen the local food chain.

Connected to
C5 | C7 | C9 | Co3 | P2 | P5 | P8 | R3 | R8

P.8 Reshape the Peri-Urban| Rural

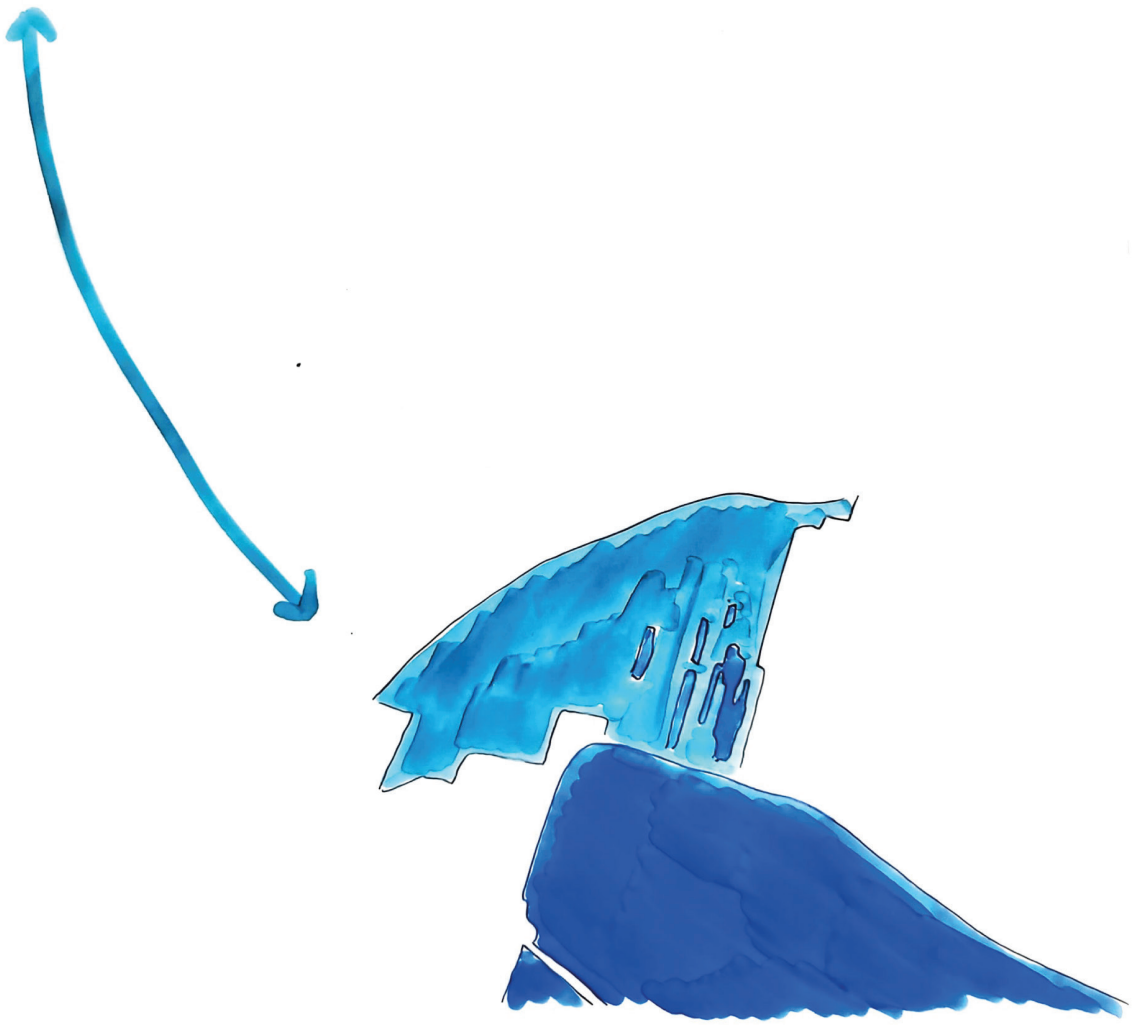
The Peri Urban area will be transformed into a link between nature and the city.

Connected to
C1 | C2 | C5 | C7 | Co1 | Co2 | P1 | P2 | P3 | P4 | P5 | P7 | E1 | E3 | E5 | R2 | R4 | R5 | R7

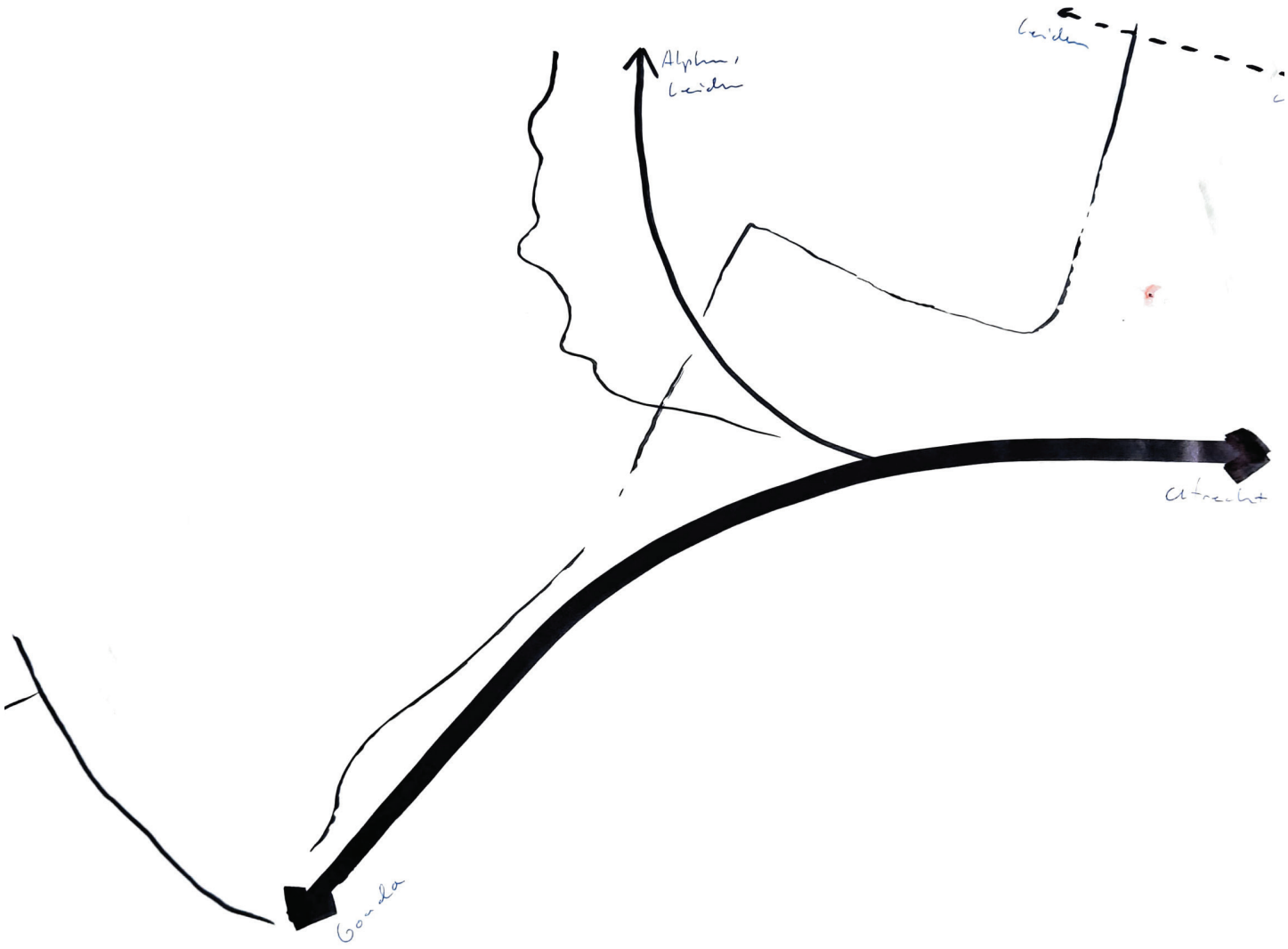
Figure 5.3.2
Pattern Language original Size, created by Authors

APPENDIX 8.7
PILOT PROJECTS

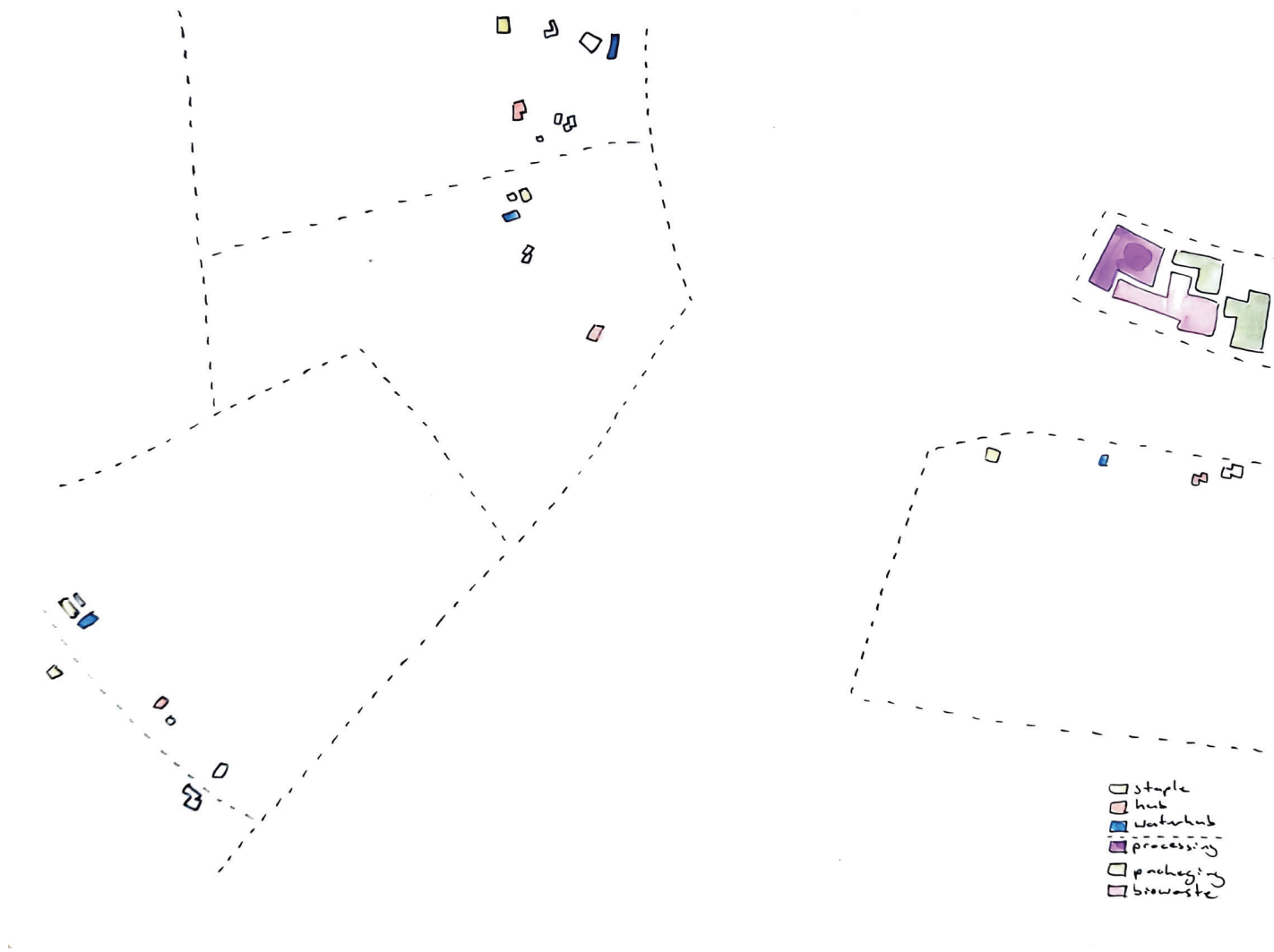
ANALYSIS BODEGRAV-EN NATURE



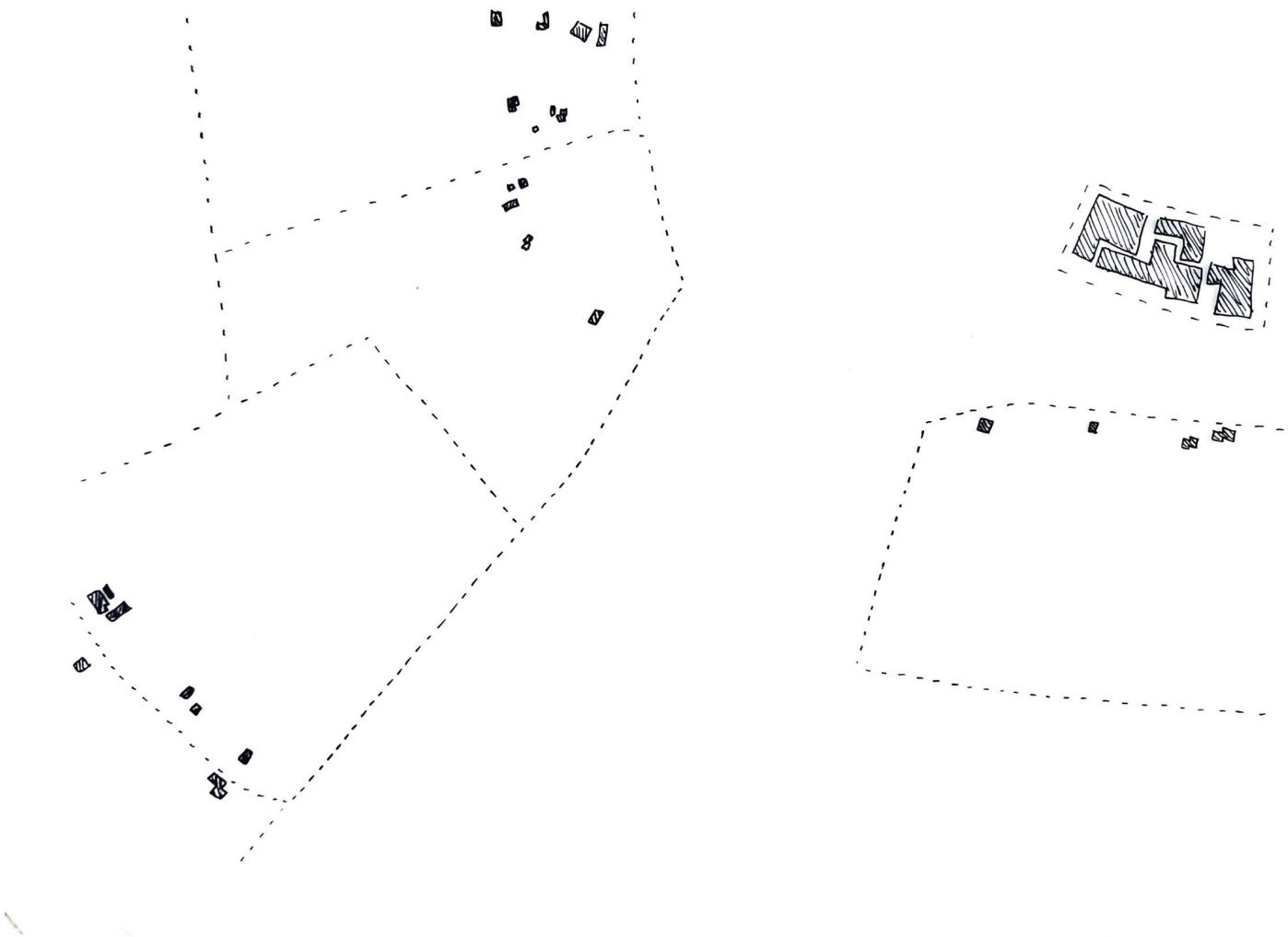
ANALYSIS BODEGRAV-EN INFRASTRUCTURE



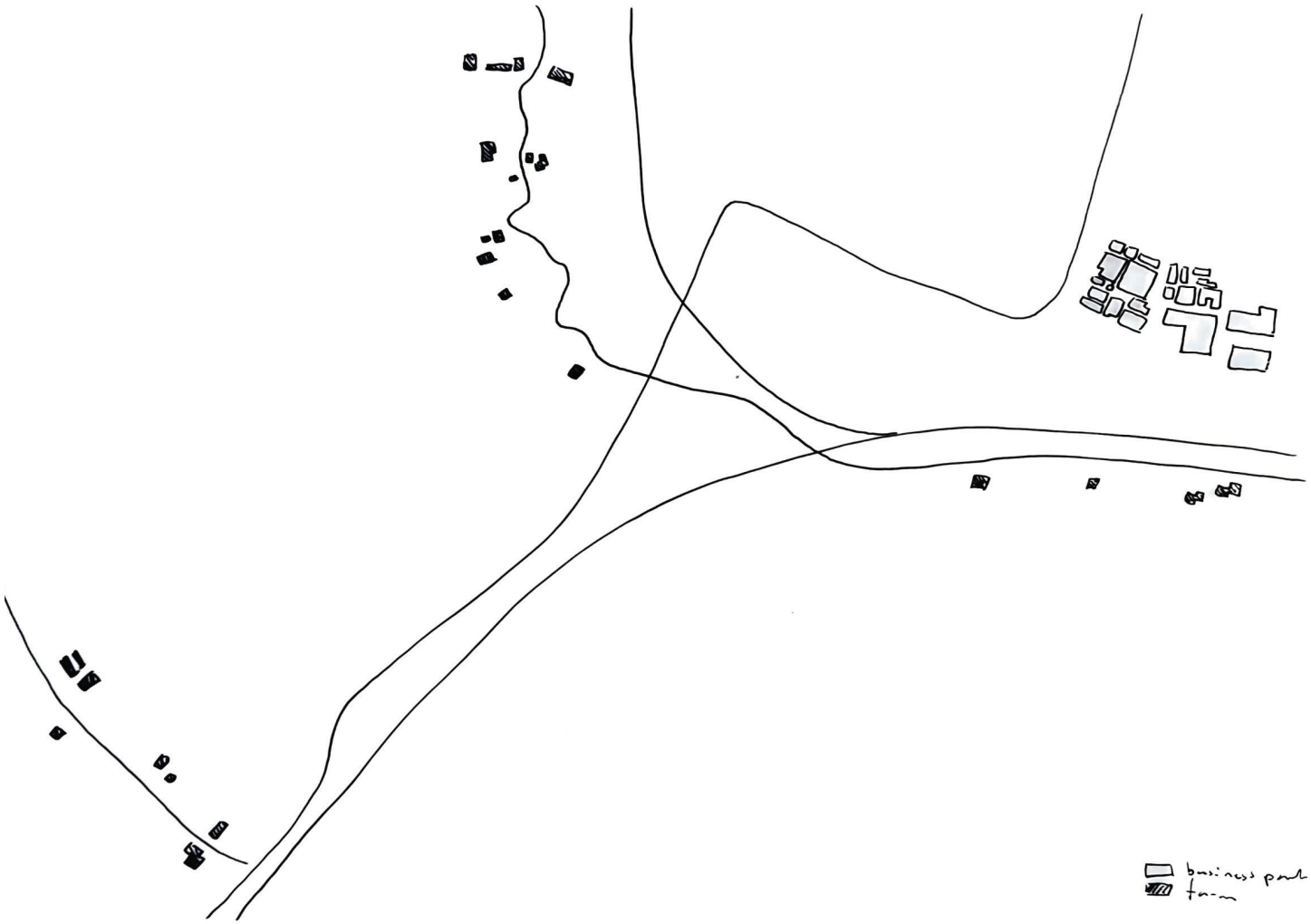
ANALYSIS BODEGRAV-
EN PROGRAMME



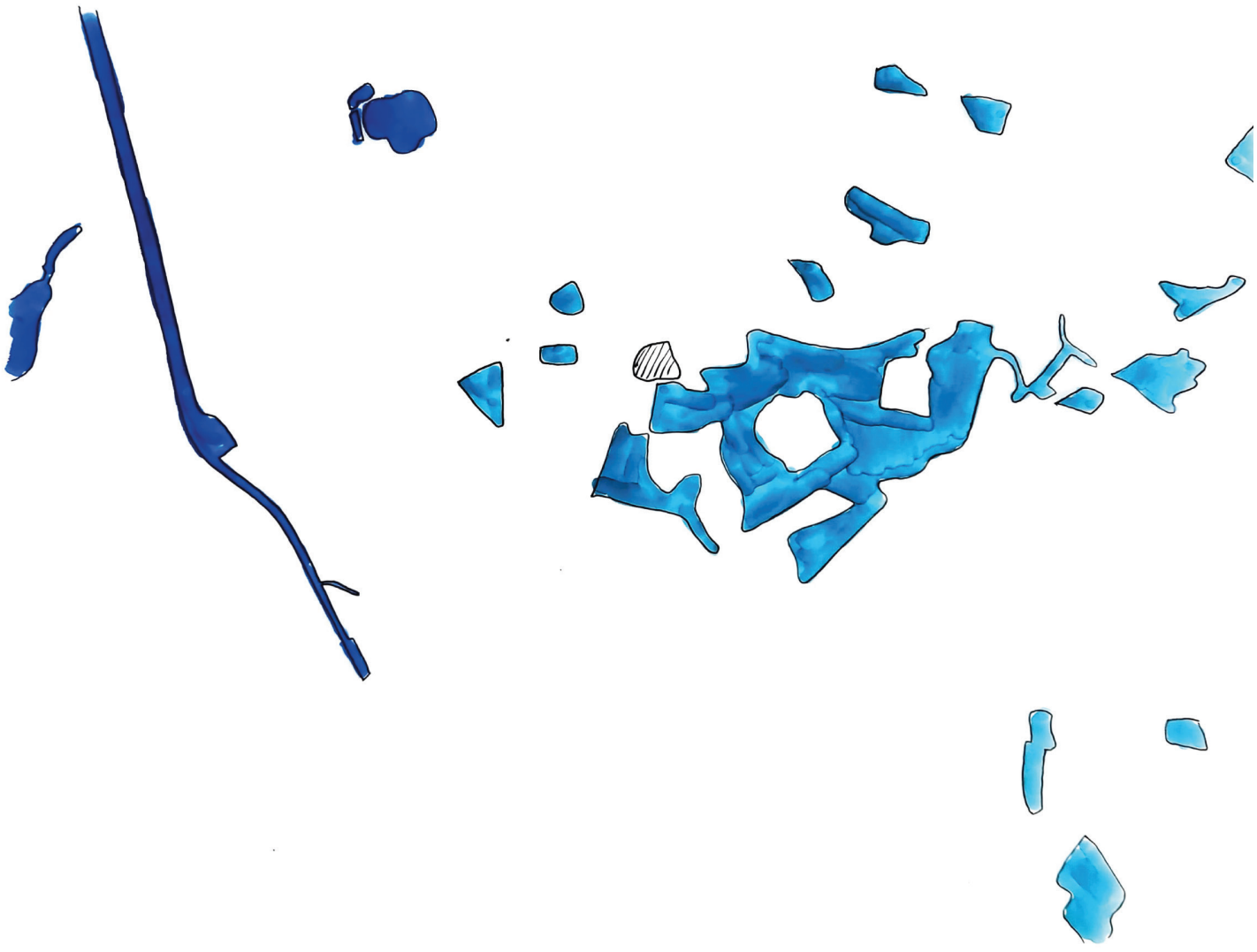
ANALYSIS BODEGRAV-EN BUILDINGS



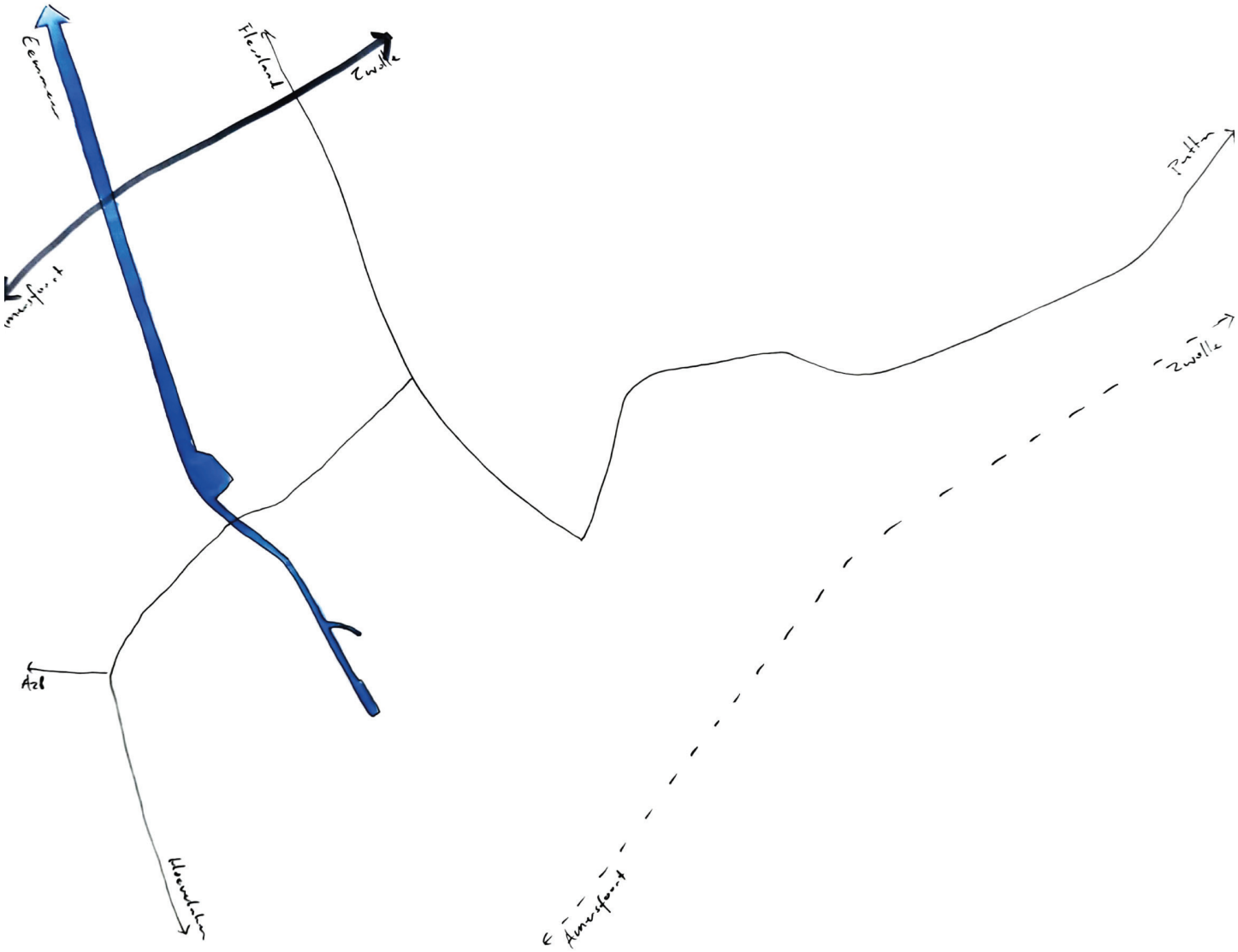
ANALYSIS BODEGRAV-EN INFRASTRUCTURE + BUILDINGS



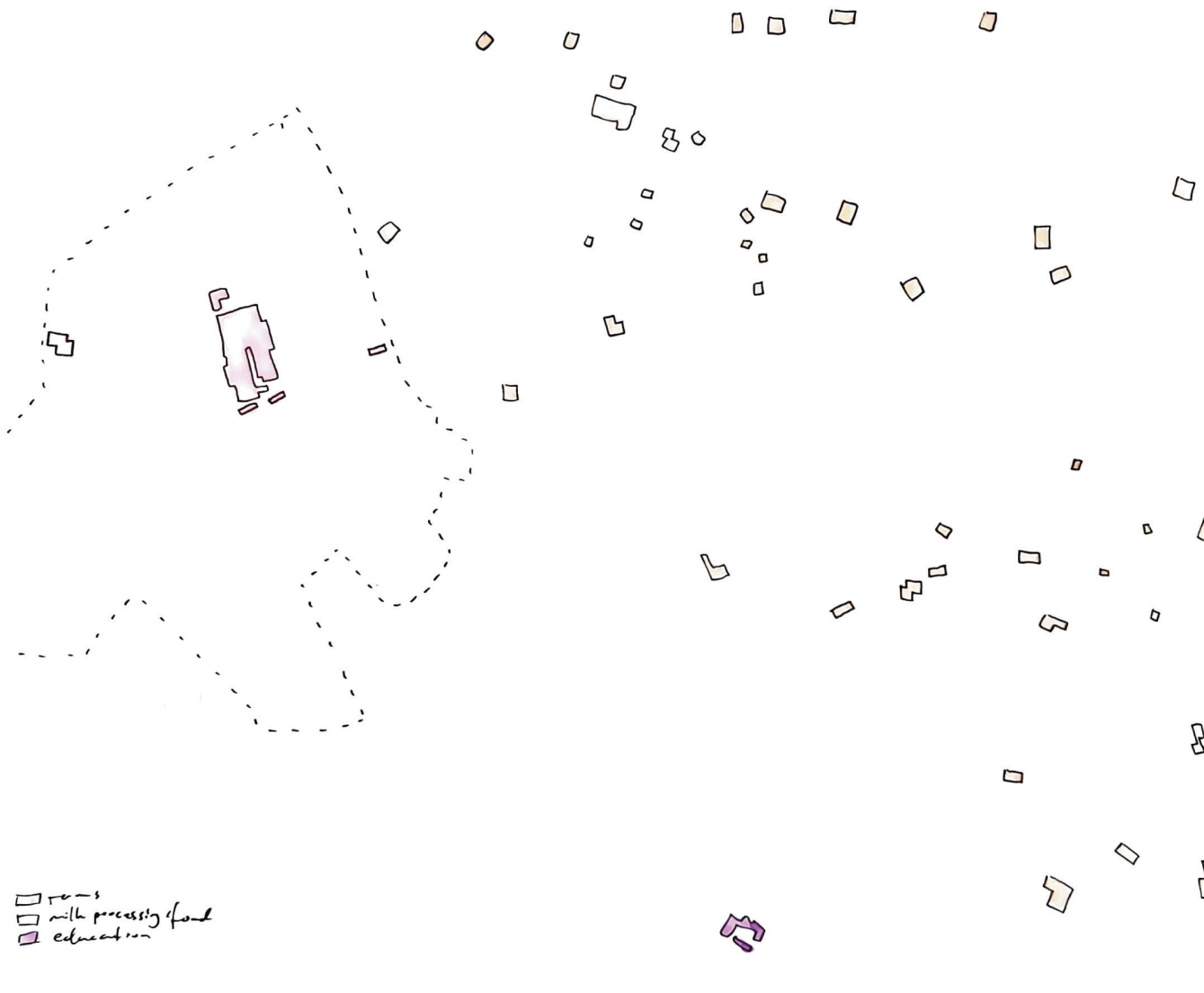
ANALYSIS NIJKERK
NATURE



ANALYSIS NIJKERK
INFRASTRUCTURE

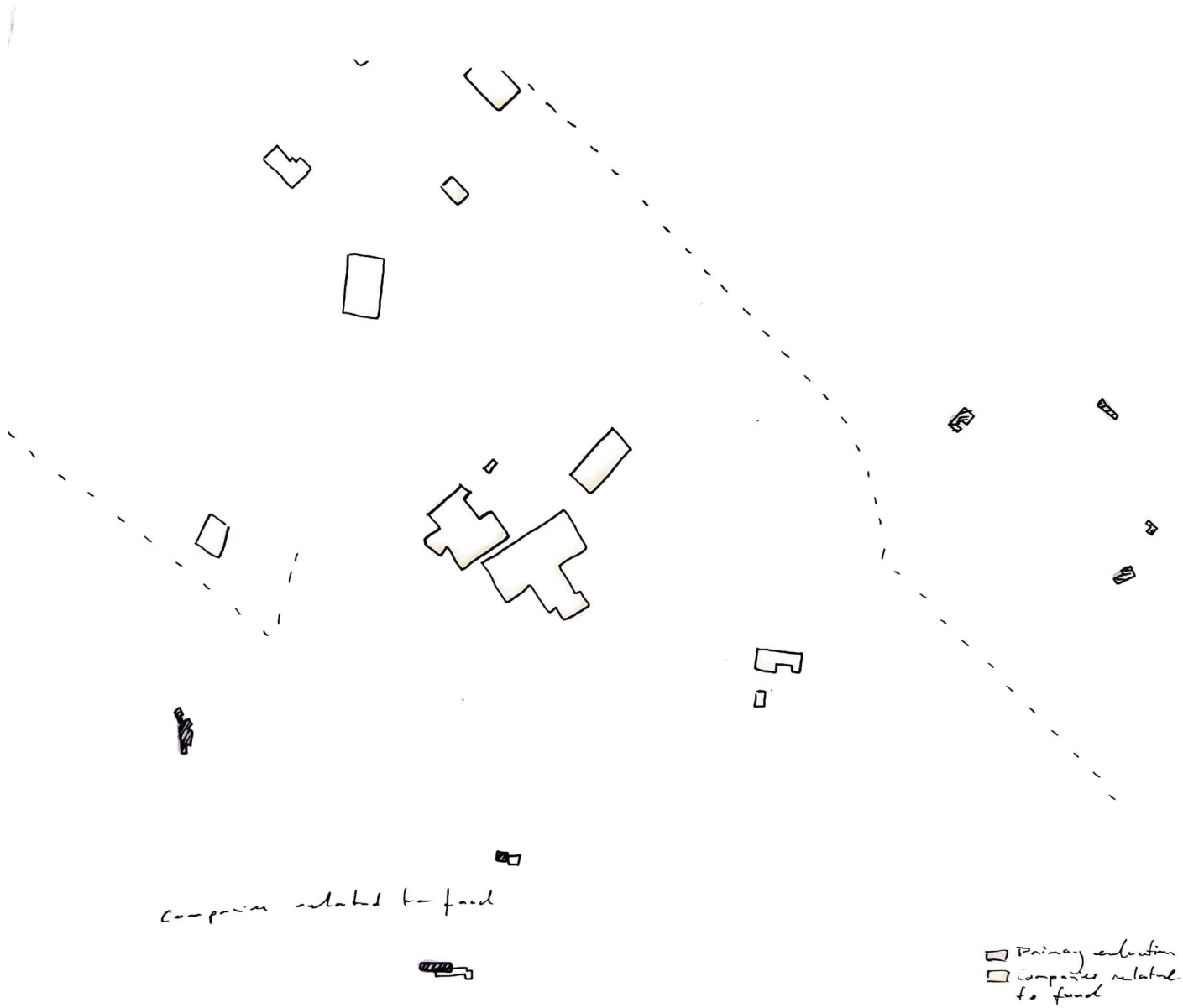


ANALYSIS NIJKERK
BUILDINGS

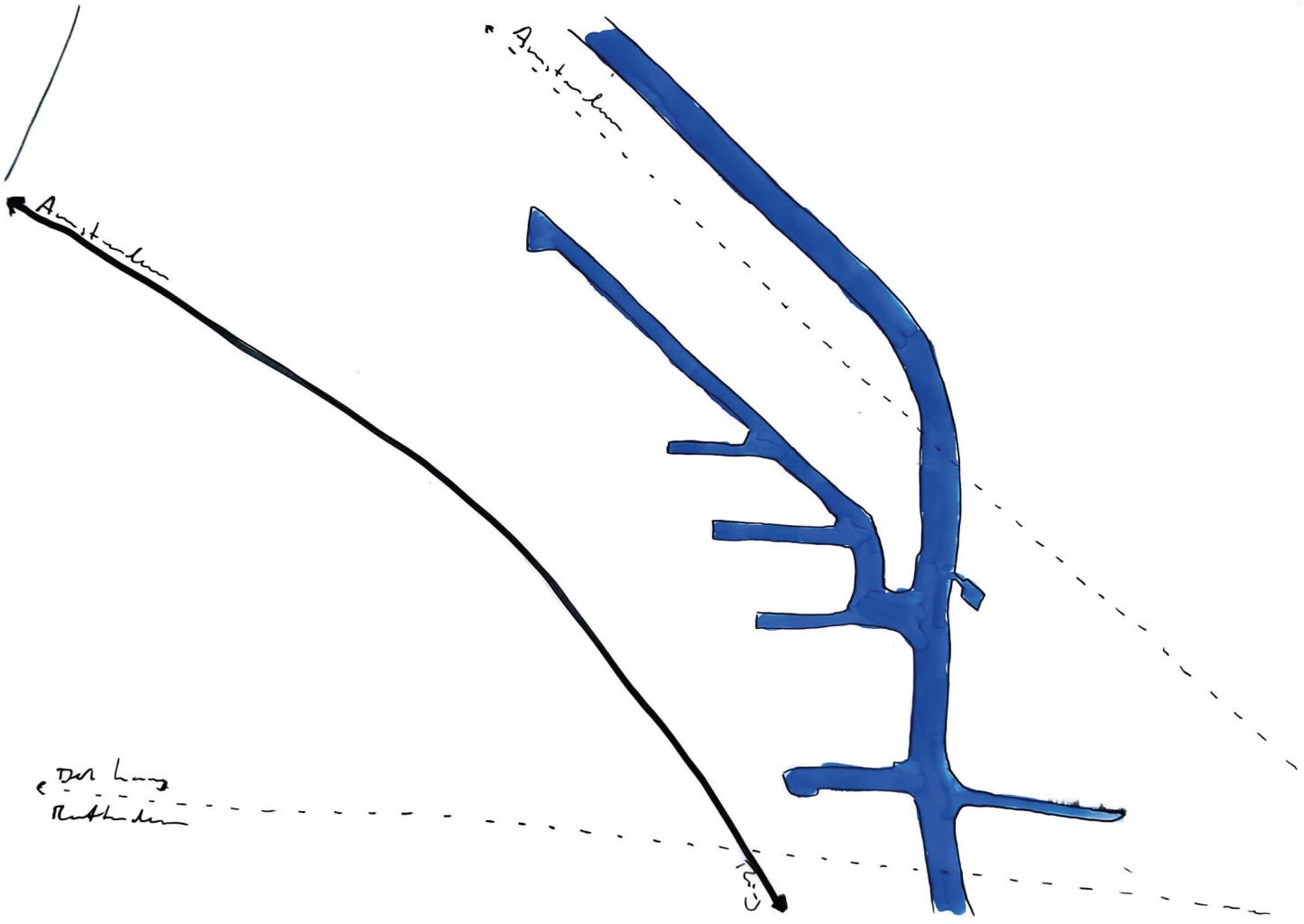


ANALYSIS UTRECHT
OPEN AREAS

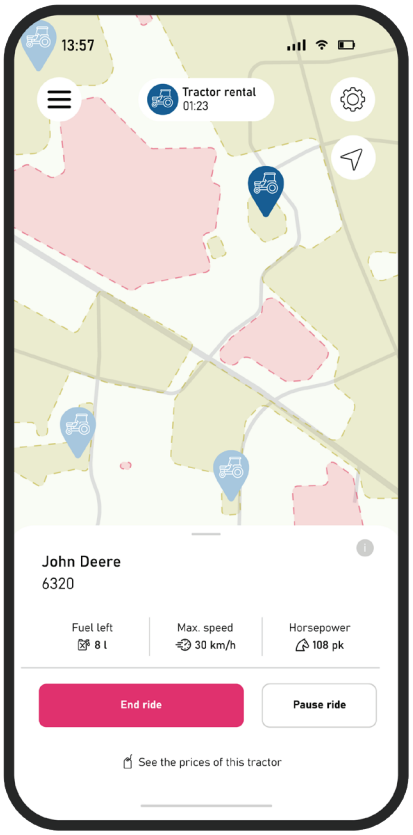
ANALYSIS UTRECHT
BUILDINGS



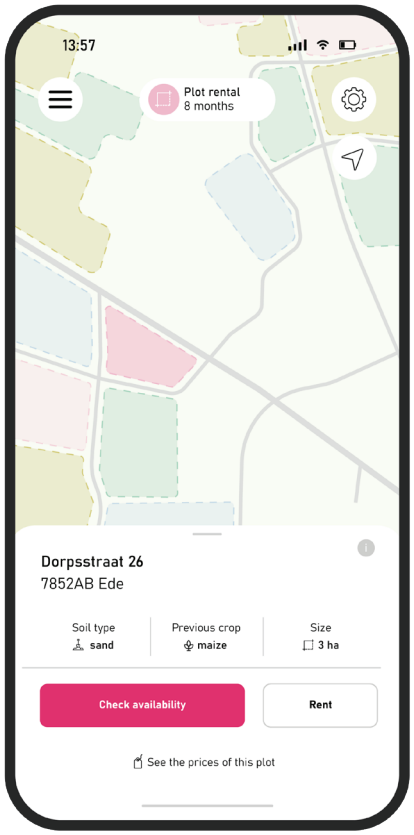
ANALYSIS UTRECHT
INFRASTRUCTURE



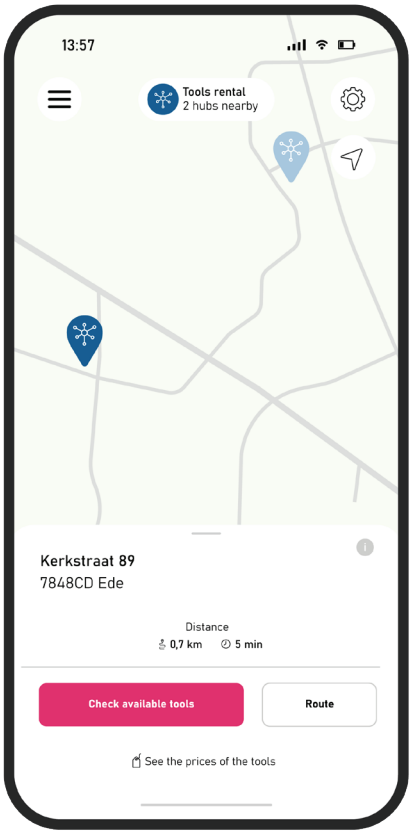
APPENDIX 8.8
DIGITALISED SHARING



Tractor rental



Plot renting

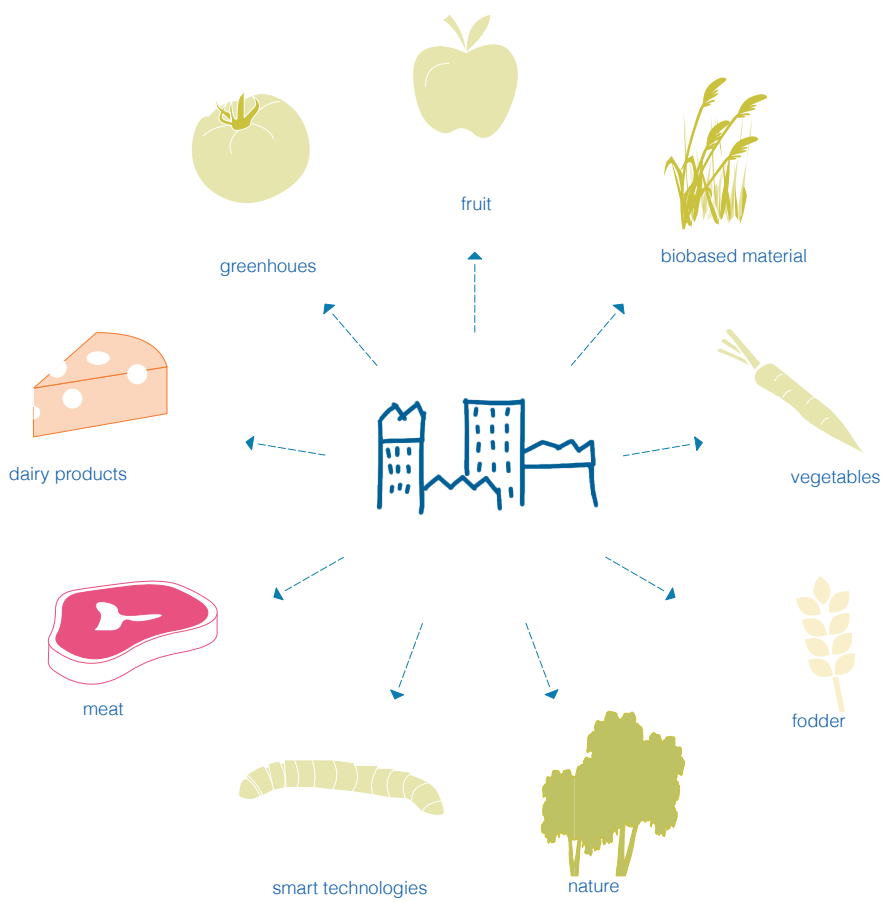


Tools rental

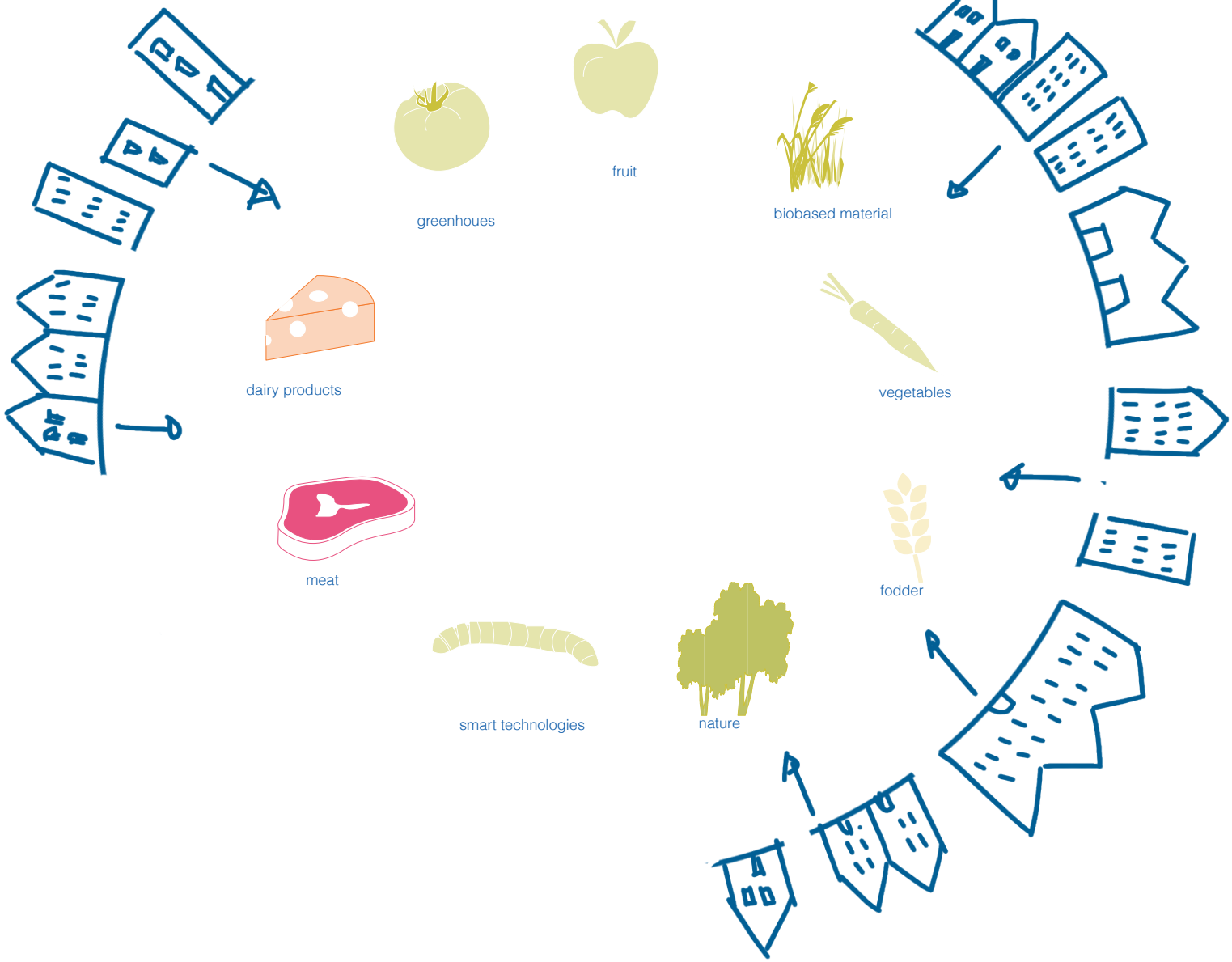
Figure x.x Learning from Practice, transforming sharing apps to agriculture, created by Authors

APPENDIX 8.9 CONCEPTUAL DI-AGRAMS OF MAIN CHANGES

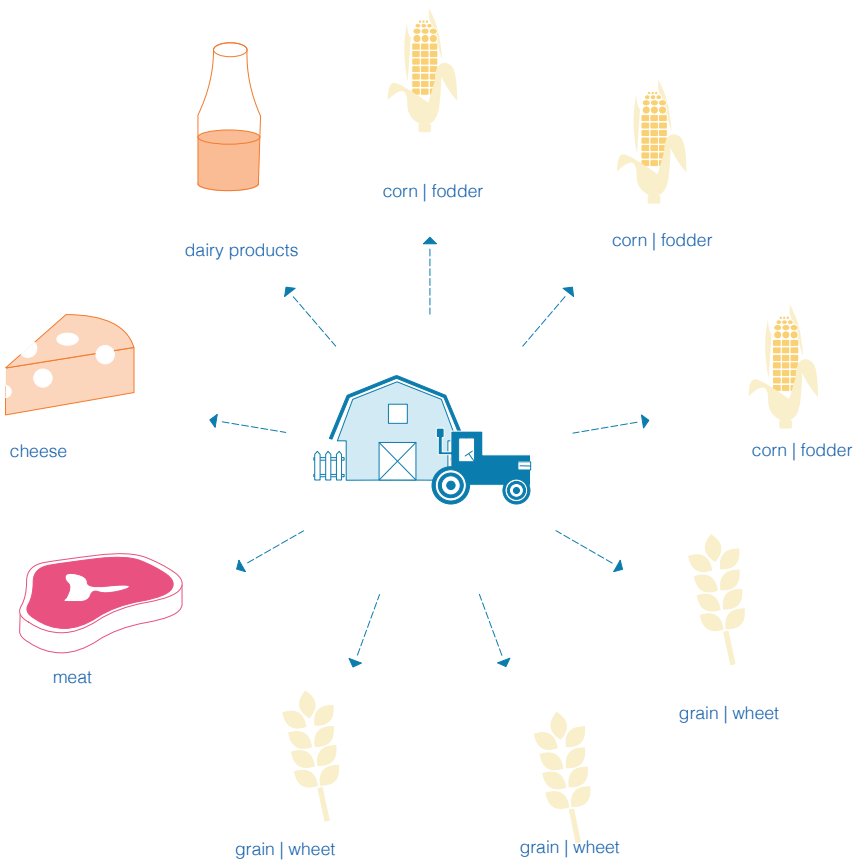
RESHAPING THE PERI-URBAN



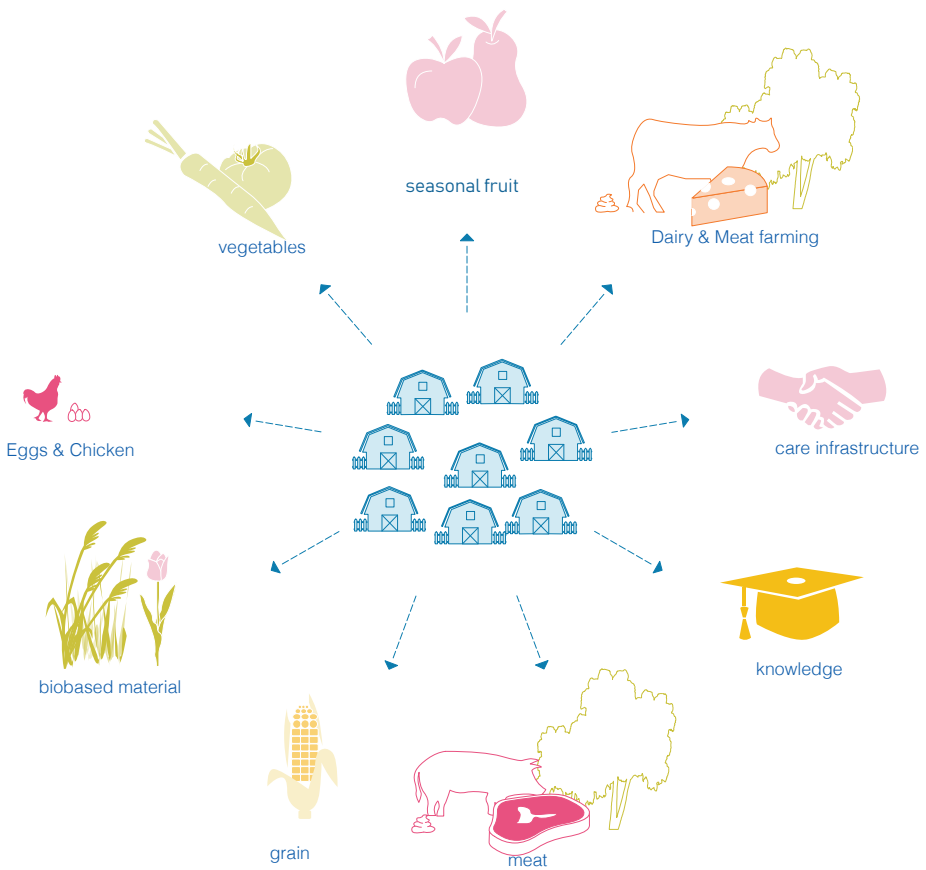
RESHAPING THE PERI-URBAN



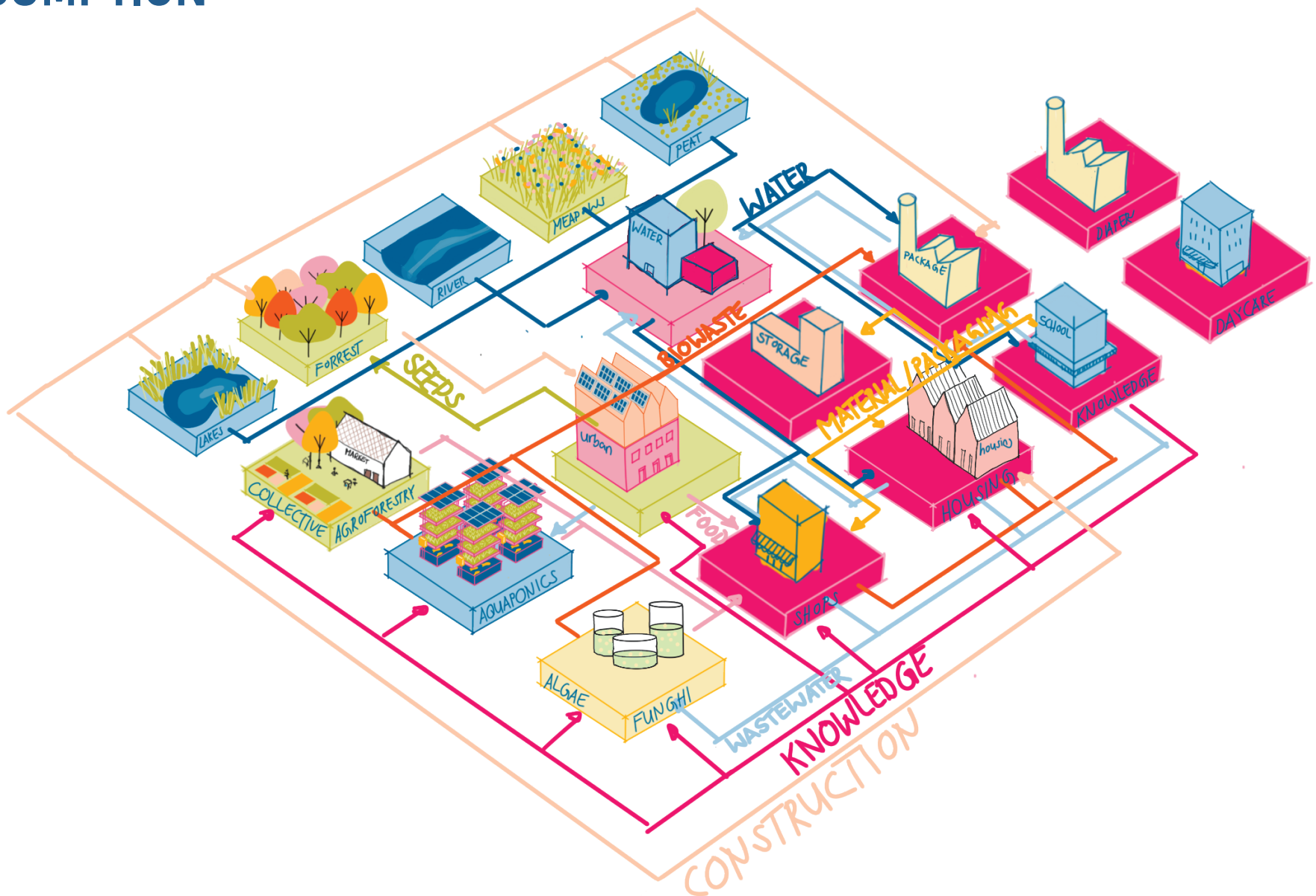
FROM MONOCULTUR-
AL FARMING



TO A DIVERSIFIED MODEL



APPENDIX 8.10
THE FULL SYSTEM: FROM PRODUCTION TO CONSUMPTION



Thank you.

Figure 6.2 Group photo

Vaibhav Bansal
5735904
Thijs de Boer
5893569
JP Boersma
4992970
Jelle Schotanus
4856619
Wiebke Stadtlander
6049249