LOCAL FOOD PRINT

AR2U086 Spatial Strategies for the Global Metropolis
MSc Urbanism Q3
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Local Food, Lower Foodprint

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MSc2 Urbanism

Spatial Strategies for the Global Metropolis (AR2U086)

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Abstract

In recent years the need for action against climate change has severely grown. Action is needed now and circularity can help to make sectors more sustainable. The agri-food sector plays a big role in this, as we need three times the surface area of our country to support the needs of the inhabitants.

The agri-food sector is putting too much pressure on space and resources and this pressure will only increase as the population continues to grow. However, by creating spaces that are used more efficiently this pressure can be reduced while also providing for a growing population.

Decreasing the pressure of the agrifood sector on space and resources will lead to a drastically new South Holland in 2050. To achieve this new South Holland, research will be done on several aspects. First the current situation needs to be analysed. Furthermore, research is needed on possible interventions and the future implications of these interventions. After extensive research is done, a vision of 2050 can be formulated:

By 2050, both the land and the sea are used in a space-efficient way, reducing the (carbon-) footprint of the province and providing more food for its own population. Buying and eating local food have encouraged people to become more aware of the process and where the food comes from. This has resulted in a shift in diet and the inefficient space for cattle farms is reduced.

This conversion provides space for nature, housing and agriculture while also leaving room for the plans of the next generation. By reducing the meat and the dairy industry, space opens up for more nature and some small scale housing in the green heart. To replace the loss of dietary protein, the province makes a shift towards seaweed and aquaculture. More circularity is achieved through the use of “waste” streams of the harbour, horticulture, arable farming and the meat and dairy industry.

Preface

The course Spatial Strategies for the Global Metropolis of the third quarter of the master Architecture, Urbanism and the building sciences focuses on the province of south Holland. Students are asked to look at the way global economic powers influence social, cultural and environmental development at a high level of scale. The regional design within this course is about steering development in the right direction and is seen as the exploration of plausible futures. It promotes and debates solutions to problems in given context. It is a reflection on prevailing spatial conditions, political agendas and planning regimes, meant to improve good (democratic) decision-making and to inform long-term strategic planning approaches to desirable spatial change (Quarter guide, 2021).

The core assignment of the course is to create a regional design for South Holland with a focus on circularity. Design proposals are formulated by groups of 4-5 students. The regional design process has two products: the spatial vision and the development strategy. The spatial vision in which the vision shows insights into current regional development trends and problems. It advocates for a desirable future that serves as a normative frame and guiding principle for development strategies. The development strategy consists of a series of spatial interventions in the form of key projects and/or spatial policies, a timeline that orders interventions chronologically and a description of actors and organisations that are involved in bringing about spatial change (Quarter guide, 2021).

This report focuses on the agriculture sector within the province of South Holland and its connection with the harbor of Rotterdam. In addition, this will be paralleled with other aspects concerning the province such as the densification, spatial justice and spatial quality. Within the focus of agriculture five different subcategories are defined: horticulture, meat & dairy, arable farming, aquaculture and densification.

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1. Introduction

Conceptualizing the project

1.1 Introduction area
1.2 Problem statement
1.3 Goals
1.4 Conceptual framework
1.5 The research
1.6 Methodology

In this chapter, the introduction, there will be provided a brief introduction to the plan location: South Holland. After that, the current problems of South Holland will be presented and the goals for the project. The conceptual framework, which is based on the problems and goals, will be explained afterwards. Subsequently, the main question will be addressed with its four sub-questions. Finally, the Methodology diagram will be presented, which summarizes the entire process of the project.

1.1Introduction area

South Holland is the most densely populated province of the Netherlands. It forms the core of society while it aims for a balance of common well-being and further prosperity. The challenge lies within the shaping of the living environment, infrastructure and economy in a sustainable and balanced way (Provincie Zuid-Holland, n.d.).

The province is very unique and as part of the Randstad it is a very well connected area. Other than the capital The Hague, Rotterdam and its harbor play a large part of the economy of the province. Lots of Agricultural products grown in the glasshouses of the Westland are of high quality and exported all over the world. Westland is at the top of the industry when it comes to innovation and new technologies within the horticulture sector (Glastuinbouw Nederland, n.d.). Apart from the province's top-functionality in the country's economy, lots of opportunities for future growth are within its reach.

Some of the main problems the province is currently facing, include a large housing shortage (Provincie Zuid-Holland, 2021) and trying to adapt the systems in the province to become more sustainable and meet the goals of the Paris Climate Accord (United Nations, n.d.).

In figure 2 important areas, places and cities in zuid holland are shown, such as the Green Heart, Goeree-Overflakkee and the North Sea. These areas, places and cities will recur in the rest of this report.

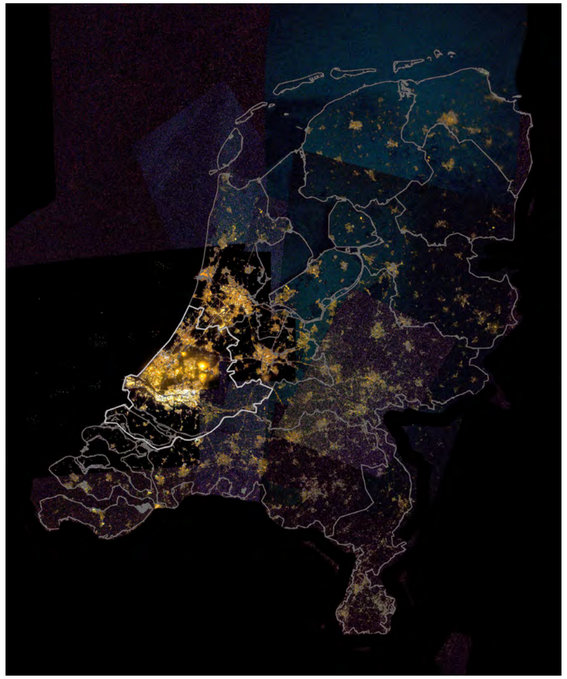

Figure 1: *Location South Holland in The Netherlands*
By author

1= Goeree Overflakke
2= The Green Heart
3= The North Sea
4 = Rotterdam
5= The Hague
6= Dordrecht
7= Leiden
8= The Port of Rotterdam

3.
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Figure 2: *Important places in South Holland*
By author

1.2 Problem statement

Currently the province and municipalities are dealing with some issues regarding the province. In this paragraph four of the most prominent problems will be clarified and explained further.

The pressure on resources is too high
The footprint of The Netherlands is currently as big as three times the surface of the country, and with South Holland being so densely populated, the province plays a big part in that large footprint. The way of living of inhabitants involves products of which the production causes a lot of emissions, uses a lot of water and/or creates a lot of waste. To meet the goals of the Paris Climate Accord, the way we produce and consume food needs to change drastically (United Nations, n.d.).

The housing shortage
The number of inhabitants within the province is growing. Therefore the government has decided that before the year of 2030, 230.000 new homes need to be realised within South Holland. One of the main issues making this goal difficult is the lack of space within the province. The current focus of the province lies with inner city densification, but the question remains if this will be enough to solve the housing shortage (Financieel dagblad, 2018).

Space is used inefficient
Within the province lies the Green Heart, which contains a lot of cattle farms. The ratio of soil to delivered products is very low, which means the space is used less efficiently than with other agri-food sectors. Due to the large amount of water that is used in the sector and the amount of water that is pumped out of the area to keep it dry, these spaces have a big problem with subsidence. Not only do the cattle farms harm the ground on which they are located , they also decrease the biodiversity.

When it comes to underutilized space, the North Sea is also a space with huge potential for the agriculture industry. However, it is currently only used for transport, windparks and fishing.

Low biodiversity and a lack of symbiosis with the land
The Green Heart is the part of the province that is filled with the most green, it is however severely lacking in biodiversity and is struggling with more issues like subsidence. Part of the problem is the amount of monoculture that takes place, causing land degradation.

These four main issues lead to the following problem statement:

'The agri-food sector is putting too much pressure on space and resources and this pressure will only increase as the population continues to grow. However, by creating spaces that are used more efficiently this pressure can be reduced while also providing for a growing population.'

1.3 Goals

Desired situations

Goals

Above the the desired situation and goals are shown. The disered situation are about the direct solvation of problems. The goals are working towards the vision of 2050.

Less pressure on resources in order to be able to produce our own products
It is desired to decrease the high pressure on resources in the province. This reduction of pressure must take place in different ways in different sectors through the reducing of resources needed, reuse of resource streams, reducing of the meat and dairy industry and introduction of aquaculture, creation of local chains, and overall creating more sustainability within the different agriculture sectors.

Less pressure on space by multi use of space
The second goal is to keep up with the expected growth and further ambitions of the province. In order to be able to provide this change with space, reducing inefficient land-use is necessary. Furthermore, implementation of more multi-use spaces like inner city farming and aquaculture in combination with fish and wind farms can help facilitate this change.

Meeting the densification needs and facilitate for future generations
The housing shortage plays a big part of today's discussion and will become a bigger problem in the future as we grow. It is South Holland's goal to produce enough houses within the next 30 years to accommodate the growing population and solve the current housing needs (at least 150.000 before 2030 and an additional 60.000 between 2030 and 2040 (Provincie Zuid-Holland, 2021).

Better symbiosis between agriculture and the land to lift the environment to a higher quality
Lastly, the goal is to create a better symbiosis between agriculture and the land. Different green spaces will be connected with higher quality green. This will make the biodiversity and symbiosis grow and enlarge the attractiveness of the different spaces for animals and the inhabitants. This can be done reducing the needed resources like water through innovative ways of farming and filtering and reusing wastewater, but also through introducing polyculture and polydomes and creating more space for nature with more biodiversity and open water.

1.4 Conceptual framework

The conceptual framework seen in figure 3. shows the process of this project and can be read from left to right. It starts from the current situation, goes into the transition and ends with the new situation. Some problems are identified from the current situation, these are further explained in the problem statement in paragraph 1.2. In the transition section there are four main goals, as explained in paragraph 1.3. These goals are based on tackling the problems and strengthening the beneficial initiatives. The new situation consists of the achieved goals and the desired situation in which the current problems are solved.

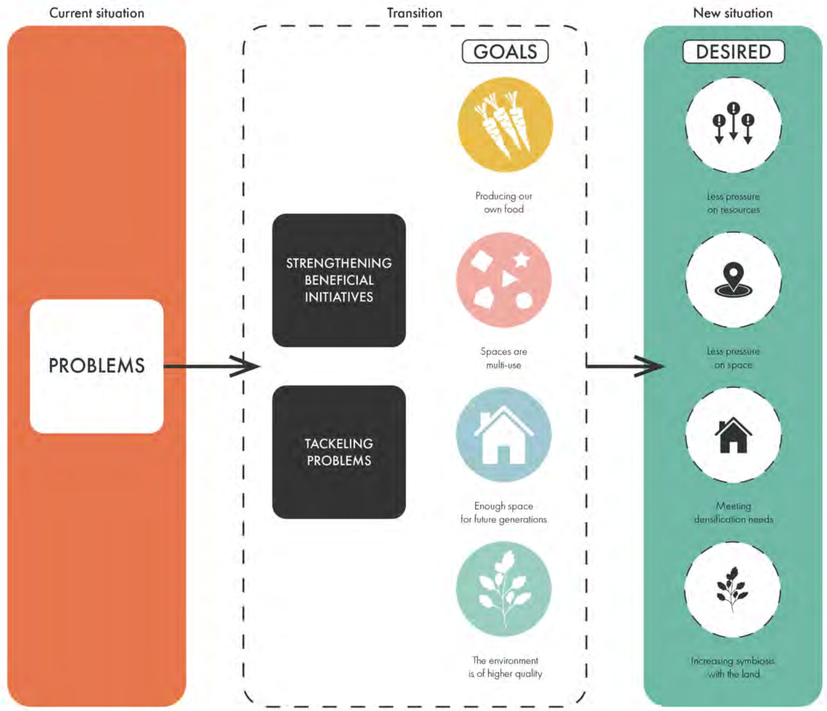


Figure 3: *Conceptual framework*
By author

1.5 The research

The main research question of this report is:

How can we decrease the pressure of the agri-food sector on space and resources while providing for a growing population?

To answer this question, the following subquestions will be answered:

How can we use the space for agriculture more efficiently?
To be able to create a more efficient way of using the space, multiple aspects must be looked at. Two main aspects on how to increase this efficiency are developing more multi-use spaces and introducing more polyculture. Multi-use space allows for the creation of places that fill two needs on the same amount of land. Polyculture has the potential to increase yield and therefore increase food production on the same amount of space. The question remains on how to implement these ways of landuse into the current situation. The second part on how to make agriculture more efficient is the exchange of the meat and dairy sector with aquaculture. Within the current diet meat plays a large role, the upswing of seaweed can possibly be a more sustainable substitute for this. But how do we change the current diet of inhabitants?

How can we decrease import and produce more locally ?
One of the other aspects of the research question is about providing for the inhabitants. Nowadays the import-ratio of our consumption is relatively high. A large part of the food for cattle is now imported from brazil, which increases the footprint of the sector immensely. This means that when importing less cattle feed and producing more of it ourselves the meat and dairy sector will be less polluting. But how are we able to produce this cattle feed ourselves? Most of the fruits and vegetables in the supermarket also come from far away. How do we get supermarkets and people to pick out more local food into their diet?

How can we combine the spatial effect of the circular transition with an increase in housing?
The third part of the research question talks about the use of space. One main issue is how to fit all these aspects within the borders of the province. With the current need for housing and the need for even more housing in the future, multi-use spaces are desired. So the question on how to implement this multi-use into the current built environment remains.

How can people benefit from these changes?
Lastly it is important to look at the human aspect of all these changes, how do they impact the inhabitants of the province and how can we make sure no one is left behind in the transition? How do we create more high quality nature? How do we make healthy, local food affordable? And how do we take pressure off the next generation by creating a sustainable way of life with enough housing, space and resources for everyone?

1.6 Methodology

The whole process of this project and the cooperation with the methodology course is shown in figure 4. This process consisted of the following five phases:

Research
The first phase of this project consists of doing research into the different aspects of the assignment. This includes literature review, analysis of the area and analysis of the agri-food sector in general and in the province. It will also entail looking into current initiatives in the area that are trying to make a step towards sustainability and circularity and see what we can take away from these projects. This phase ends with a problem statement that emerged from the problems that were found throughout the analysis and literature review.

Setting up the research
When the problem statement is formulated, the set-up of the further research can begin. The first step here will be formulating the main- and sub research questions. Some further analysis will be done into the desired situation for each of the problems in the problem statement. This will lead to some basic measures to reach these desired situations.

Creating a vision
From the desired situation and the corresponding measures, some interventions and goals are formulated. These interventions and goals will be combined to create a vision statement. What follows is the creation of a vision for the future. What will 2050 look like if the goals of this project are achieved?

Forming a strategy
After the vision, the measures will be expanded upon through specific interventions and policies that will be implemented. Along with this a stakeholder analysis will show how the main stakeholders can be motivated and activated throughout the process. When the specific actions that are needed to achieve the vision are clear, a timeline can be created to plan out these interventions and policies over time. The end result of this phase will be a large timeline and maps for the different phases, with a detailed description of the actions in each phase and which stakeholders are involved.

Conclusions and reflection
The process is wrapped up with a conclusion and a reflection. Some of the following questions will be answered in this phase. Did the interventions and policies align with the goals and vision? What can be learned from this process? Are there things missing in the research? What can be investigated further?

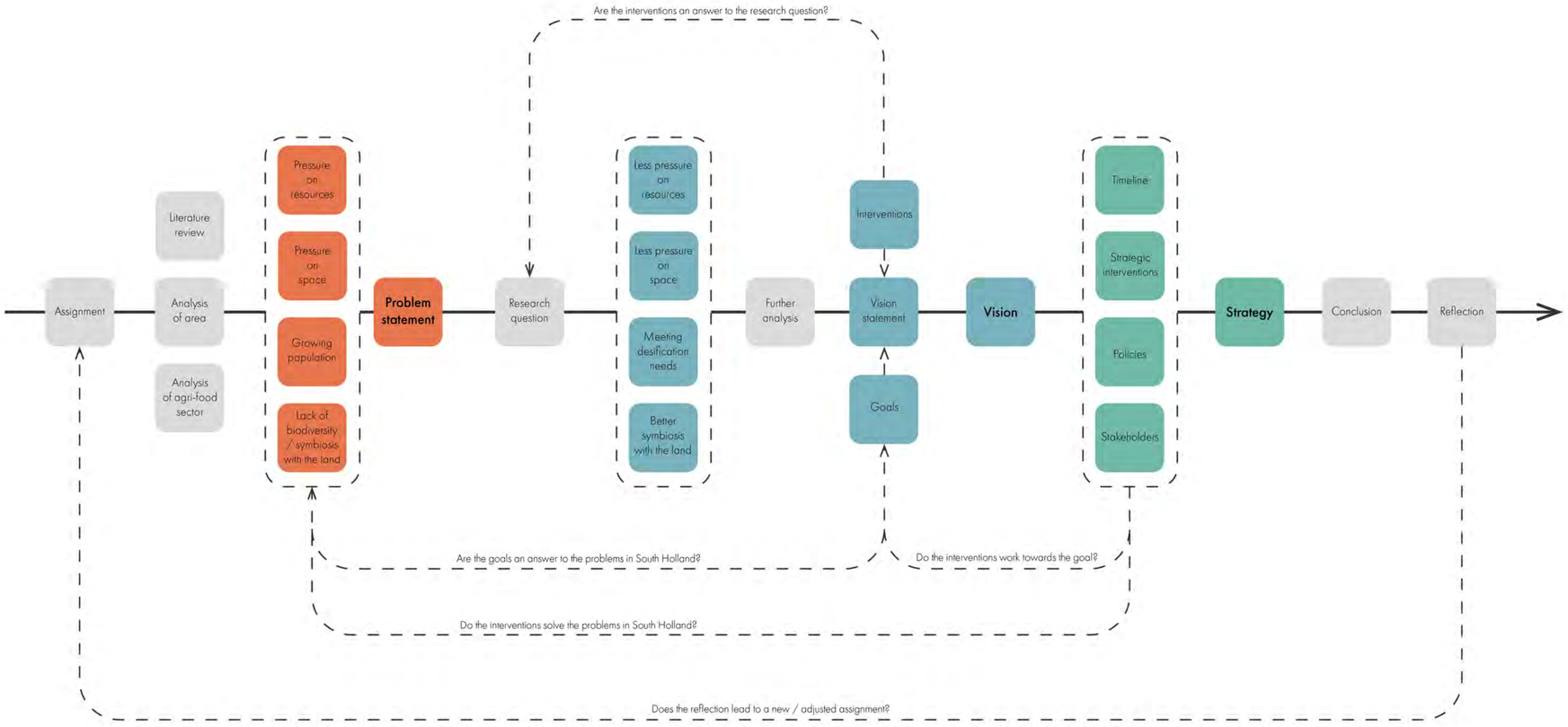
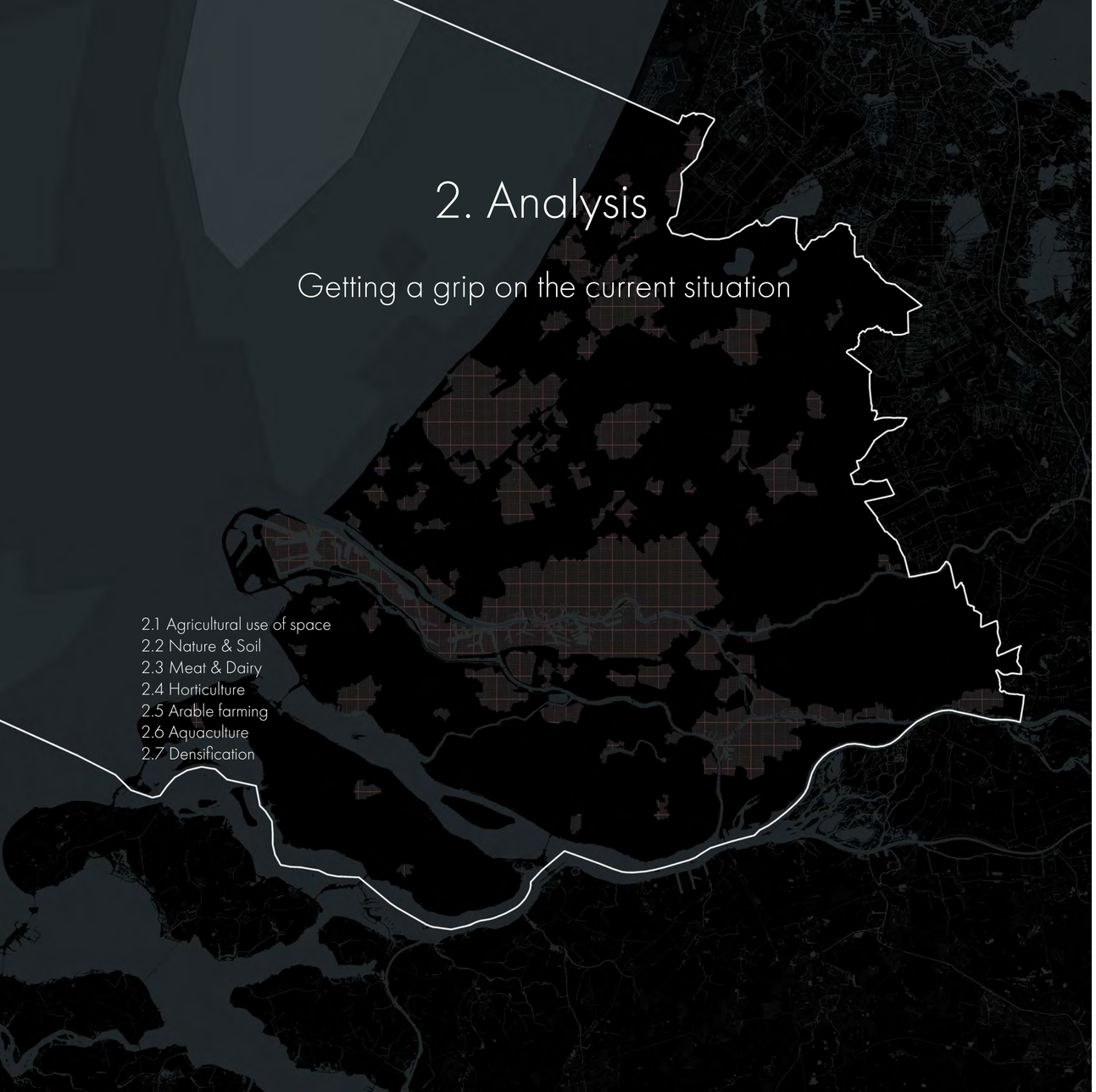


Figure 4: *Methodology*
By author



2. Analysis

Getting a grip on the current situation

2.1 Agricultural use of space
2.2 Nature & Soil
2.3 Meat & Dairy
2.4 Horticulture
2.5 Arable farming
2.6 Aquaculture
2.7 Densification

The second chapter of this report shows the analysis of the agricultural sector of South Hollland. The agricultural sector within this report is divided into five smaller sectors: meat & dairy, horticulture, arable land, aquaculture and densification. Different aspects such as important observations, the current process and stakeholders will be brought to light. Next to that, a reference project per sector will be shown, which contributes to sustainability and has potential to be used more in the future. And to conclude, a SWOT-analysis will be shown per sector.

2.1 Agricultural space use

Apart from the large number of inhabitants in South Holland, 48% of the space is attributed to agriculture (figure 5).

The distribution of the agricultural soil is divided into three sectors: Arable land, Horticulture and the Meat & Dairy industry. The arable land, which takes place on 29% percent of the agricultural soil, is based mostly on the Islands Voorne and Goeree Overflakkee. The Meat and dairy industry contributes for 62% of the agricultural land and is mostly placed within the borders of the green heart and in between the cities of Rotterdam, The Hague and the Westland. The 9% left is contributed to the horticulture which is mainly focussed in the Westland and Boskoop.

Trends in agriculture
There are some trends that are playing in most agriculture sectors, one of them being aging. Only 10% to 30% (depending on the sector) of the farmers above 50 has a successor ready to take over the company. This is relevant as 60% to 80% (depending on the sector) of farmers is above the age of 50, and a significant number of these farmers in the arable farming and meat- and dairy industry is even above the age of 65 (Vogelzang, et al., 2016).

The import- and export ratio is another import factor to consider when looking at the overall production and land-use numbers. In figure 6 the ratio of import and own production per agricultural product is shown. In total, around 35% of the agricultural products from the Dutch consumption is imported. The dairy is a product that has a low import ratio. What stands out is that fruit had a very high import ratio (Scheer, Groot, Snels, & Simons, 2011). The import and export of agricultural products is economically very important for the province, in 2019 the export of agricultural products in the Netherlands reached a peak of 94,5 billion euros. A portion of 26 billion of this was from re-exporting imported products (Bouwmeester, 2020).

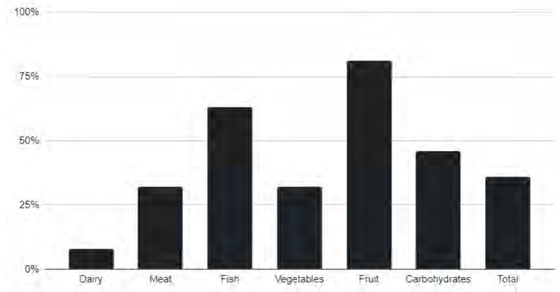


Figure 6: *Import ratio agricultural products in The Netherlands*
By author, (based on Scheer et al., 2011)

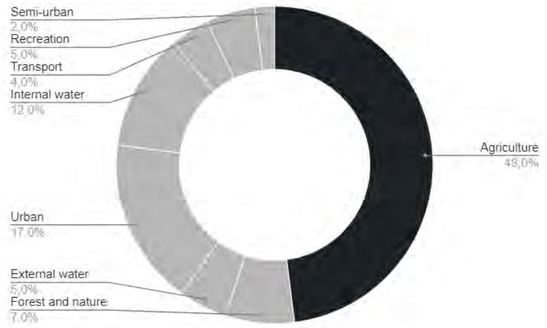


Figure 5: *Space use South Holland*
By author, based on (CLO, 2020)

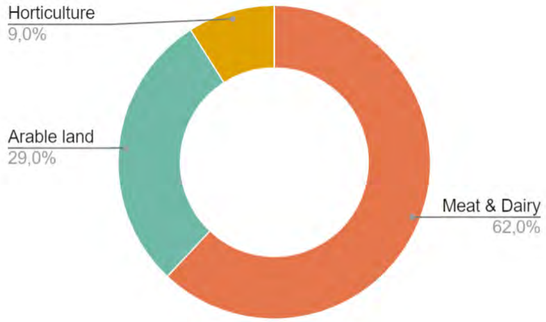


Figure 7: *Agricultural space use South Holland*
By author, based on (CLO, 2020)

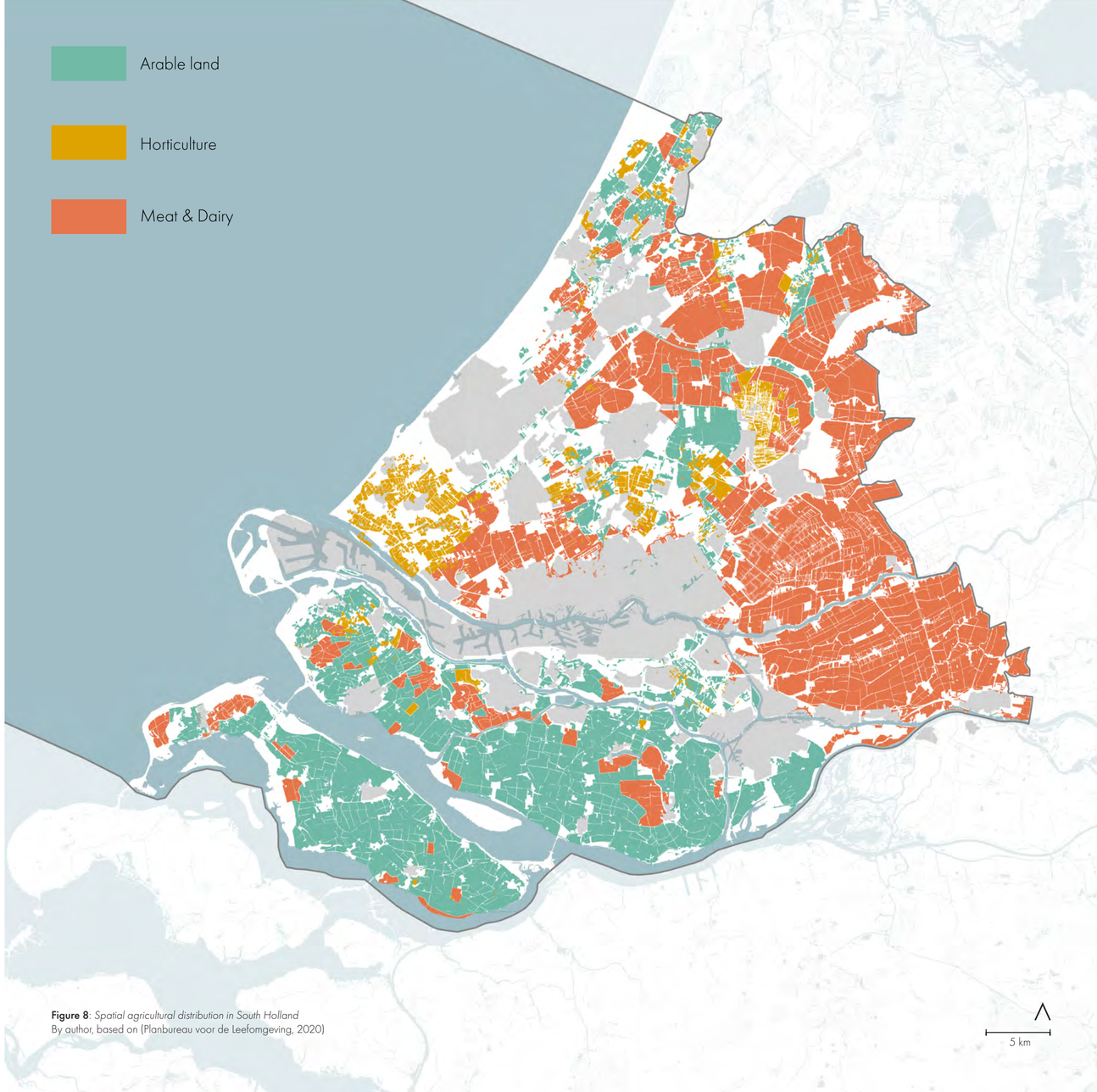


Figure 8: *Spatial agricultural distribution in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

2.2 Nature & Soil

Natura 2000

The Netherlands has 161 Natura 2000 areas. A Natura 2000 area is an area which is designated under the 'Birds Directive' and under the 'Habitats Directive'. Both European directives are important instruments for safeguarding European biodiversity. All sites have been selected on the basis of the occurrence of species and habitat types that need protection from a European perspective (Natura2000, n.d.).

Protection categories

In addition to the Natura 2000 categories, there are also several areas with a protection category. This is divided into two categories.

Protection category 1 includes areas of outstanding quality. These areas are so special, valuable or vulnerable that the preservation and possible further development of the values they represent has priority over all other developments. These areas contribute greatly to the identity, experience and biodiversity of South Holland. These are areas with the following qualities: High and specific nature values in South-Holland, cultural-historical crown jewels and the grassland from the Bollenstreek.

Areas of special quality belong to protection category 2. In these areas, values must be preserved because they are special and vulnerable in terms of landscape, ecology or utility value. In that capacity they make an important and specific contribution to the spatial quality of South Holland. Spatial developments in these areas are possible, but with due consideration for the preservation of the specific values. These are areas with the following qualities: Important meadow bird areas,

Soil

Within the province the kind of soil has influenced the placement of the type of agricultural production. Arable farming is, compared to the other sectors, most dependent on its type of soil. Therefore, arable farming takes place on clay soil, which is the most favourable soil for agriculture because of its fertility. Cattle is not influenced by the soil as much as the other sectors and is therefore placed on the least favourable soil: peat (Broeke, 2007).

Soil subsidence

To make peatlands suitable for grazing, they are drained with groundwater drainage. When the peat comes into contact with air, oxidation takes place and CO_2 is released. In addition, groundwater drainage leads to soil subsidence. In some areas this leads to subsidence of one meter by 2050. The oxidation of peat lands leads to almost one megaton of CO_2 per year (Drift Metabolic, n.d.).

Figure 9: *Natura 2000 areas in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

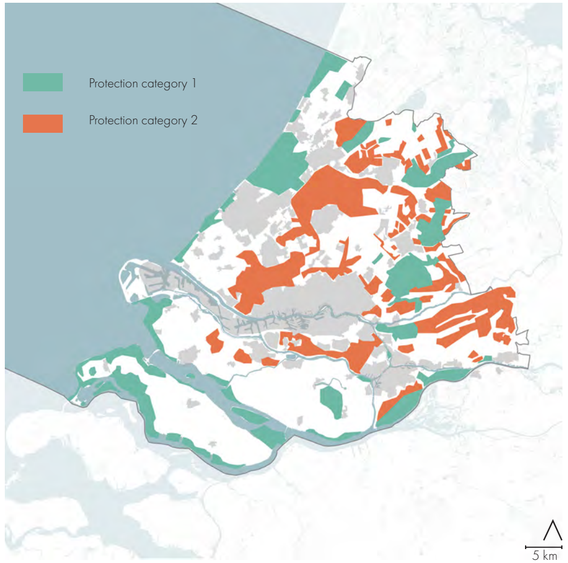


Figure 10: *Protection categories in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

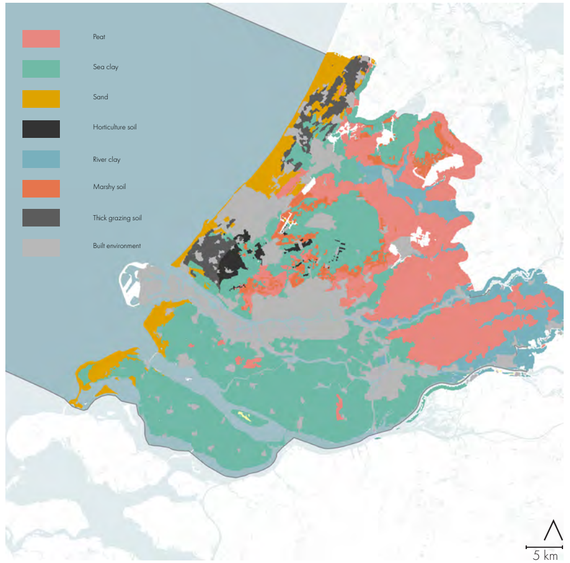


Figure 11: *Soil types in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

Figure 12: *Soil subsidence in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

Meat & dairy industry

2.3

62% of the agricultural land use in South Holland consists of land used for the Meat & Dairy industry (CLO, n.d.) The spatial distribution of the Meat and Dairy industry in South Holland is illustrated in figure 13. The industry is mostly placed in the eastern part of South Holland. In this area there is a lot of peat soil, which is less usable for other facilities.

Only 31% of the meat and 8% of the dairy is imported (Scheer, Groot, Snels, & Simons, 2011) Apart from the short transportation, the Meat and Dairy industry is one of the most polluting sectors within agriculture. As shown in figure 14, the meat production has the highest gas emission per product, even twice as much as the second most product, cheese (Hessels, n.d.).

Feed currently used for cattle contains soy. This soy is imported by the Netherlands from distant countries such as Brazil, which contributes to the large footprint of the meat and dairy sector (RTL Nieuws, 2020). In order to reduce this footprint, the Netherlands has started producing soy itself since 2010 (figure 12). However, the Dutch way of producing is not very suitable and profitable for soy due to the different climate. This meant that the soy production has been decreasing since 2018 and will possibly degree even more. Which results in an new goal to find other solutions as a substitute for the import of soja.

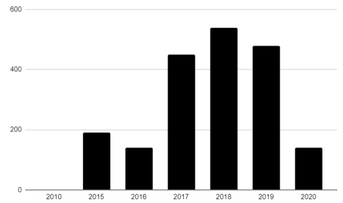


Figure 12: *Soja production in The Netherlands*
By author, based on (RTL Nieuws, 2020).

The process

Figure 15 shows the process of the meat and dairy industry as it is today. One of the main issues within this industry is the amount of waste it produces such as CO_2 and methane. Cattle produces 23% of the province's emissions within the agricultural sector. The main reason for thxat is the fact that the cattle food is imported from countries such as brazil. Because of this long distance, transportation causes a lot of emissions. In addition, waste streams are not reused, which make the sector lineair (Drift Metablic, n.d.).

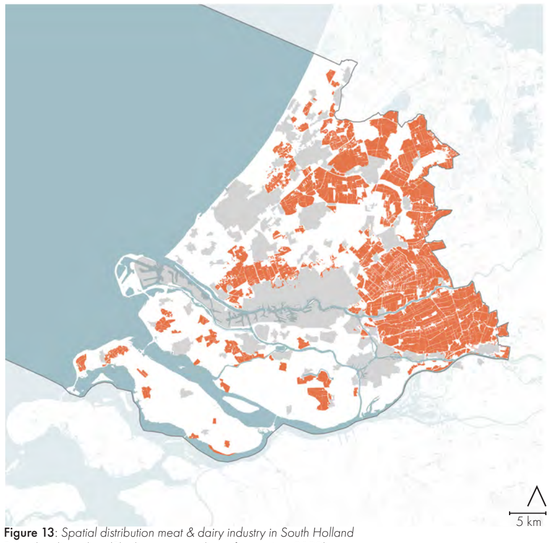


Figure 13: *Spatial distribution meat & dairy industry in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

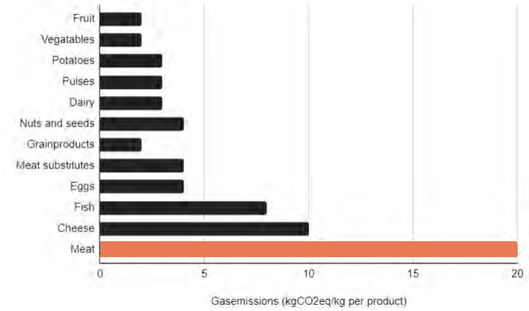


Figure 14: *Gasemissions (kgCO2eq/kg per product)*
By author, Based on (Hessels, n.d.)

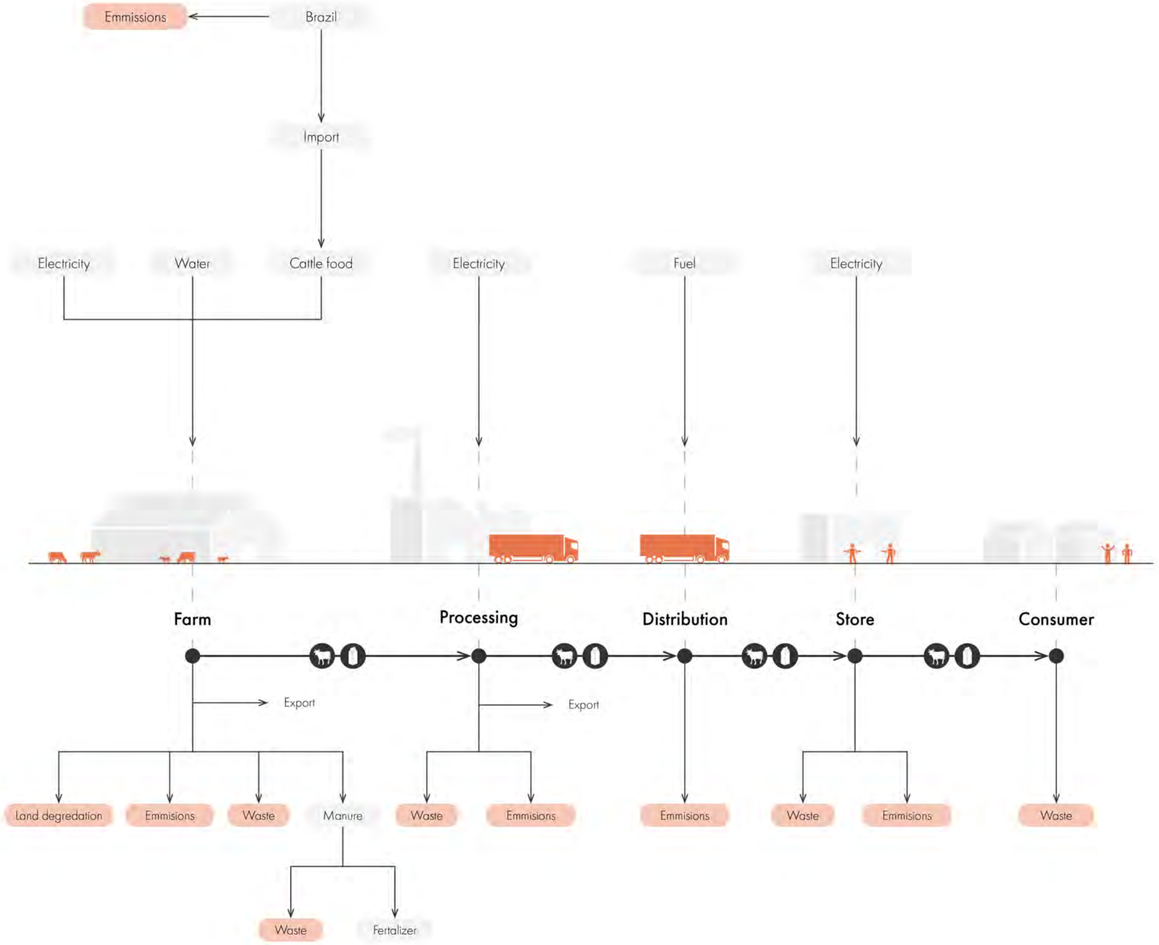


Figure 15: *Current process Meat & Dairy industry*
By author

ZUIDPLASPOLDER

location: Zevenhuizen, Moerkapelle, Waddinxveen, Gouda, Moordrecht and Nieuwerkerk aan den IJssel

In the middle of the Zuidplaspolder in South-Holland, municipalities are working together to create new housing while still maintaining the green and agricultural character of the area.

Stakeholders

Figure16 shows the most important stakeholders of the meat & dairy sector. Local farmers who are in the meat & dairy industry are of course an important stakeholder as well as the LTO, a farmers' organization. In addition, residents are also a stakeholder of great interest because they constitute the demand for meat. In any reduction of livestock, these parties will need to be motivated. In addition, agencies such as the national government and municipalities are important stakeholders.

Figure 16: *Stakeholders Meat & Dairy industry*
By author

Zuidplaspolder

In the municipality of Zuidplas there are plans for densification. In the middle of the polder, 8.000 houses will be realised, providing homes for 10.000 to 20.000 people currently searching for one. This is a project from both the municipality and the province of South-Holland and plans have been started as early as 2004. In this project, the land used for farming will be reduced to meet the housing demand. Because of its size, the town can be self-sufficient and does not have to rely on other cities. It will have supermarkets and other facilities to meet the demand of the people living there. But it is not only a place to live. The town will have a green environment with plenty of recreation possibilities. Green and water will play a significant role in this town to make sure people and nature can coexist.

When planning densification in areas that are currently used for agricultural purposes, it is important to keep in mind the green character of the place. It might not have much biodiversity, but the space itself looks green. In the Zuidplaspolder this has been taken into account to make sure that there is both a space for people to live as well as a conservation of the green and blue structure (Planbureau voor Leefomgeving, 2018).

SWOT

The SWOT diagram shows the sectors strengths, Weaknesses, Opportunities and Threats. Two strengths of the Meat & Dairy sector are the consumption on the local scale and the high demand. This means that products that are produced can easily be sold within small reach. The sold products are fresh and have a short transportation which costs less money and causes less emissions. The weaknesses of the sector are the amount of space it requires in contrast to other sectors, the high emissions the production itself and the transportation of cattle feed causes land degradation. Luckily, within reach of the sector is the opportunity to reduce the production, exchange this with other products and therefore open up spaces to other facilities. Different treats for this transformation can be the conflict with the farmers and the change in diet. Will farmers change and will inhabitants change and consume less meat?

SWOT

2.4 Horticulture

The horticulture sector consists of greenhouse horticulture and open air horticulture. The greenhouse horticulture is mainly focussed in the Westland. Westland forms an international example of innovation within horticulture. Westland proves that working on a large scale can easily be combined with small scale trade. Inhabitants of the westland and the province can profit from high quality of the products within small reach. The open air horticulture is mainly focussed in Boskoop. The horticulture of the province in total accounts for 4.672 acre, which is more than 50% of the country's total. However, the horticulture only accounts for 3% of the country's total space used for agriculture. This means that most horticulture is located within the province of South Holland (Drift Metabolic, n.d.).

When looking at the import ratio of horticulture products as vegetables and fruit (figure 18), it strikes that fruit has a very high import ratio. Almost 80% of the fruit consumed in the Netherlands is imported from outside the Netherlands. In terms of vegetables, 'only' 30% of dutch consumption is imported (Scheer, Groot, Snels, & Simons, 2011).

Horticulture is the most efficient sector within agriculture when looked at the production per square meter (Drift Metabolic, n.d.). The demand for high quality and quantity causes that the sector to pollute relatively much emissions. In contrast to the 23% of the emissions the meat and dairy industry causes, horticulture causes 73% of the emissions. This means that this small sector still pollutes relatively lots of emissions (Drift Metabolic, n.d.). In order to achieve the targets agreed in Paris (aiming for a temperature rise of a maximum of 1.5 degrees and well below 2 degrees by 2100), significant reductions in greenhouse gas emissions are required. In the 2017 coalition agreement it was agreed to reduce greenhouse gas emissions in the Netherlands by 49% in 2030 compared to 1990 which is in line with the ambition of the Paris Agreement (2016) (Planbureau voor Leefomgeving, 2018).

The process

The horticulture process begins with a lot of inputs to ensure the quality of the products. Inputs such as CO_2, heat and pesticides have a negative impact on the environment. Next to that, a big part of the waste streams in the beginning of the process, in the greenhouses, is not reused. This makes the process a linear process. Only a part of the waste in the greenhouses is currently used as feed for animals. During the distribution and processing there are also a lot of emissions and non-reuse of waste streams (Stichting Innovatie Glastuinbouw, 2019) .

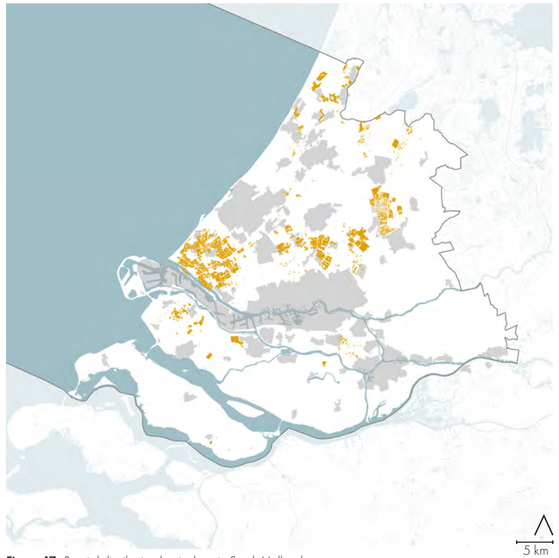


Figure 17: *Spatial distribution horticulture in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

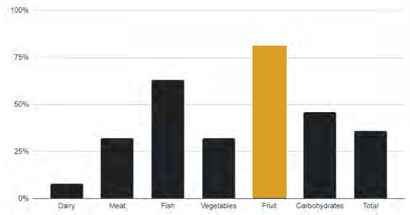


Figure 18: *Percentage of Dutch consumption volume consisting of import*
By author (Based on Scheer, Groot, Snels, & Simons, 2011)

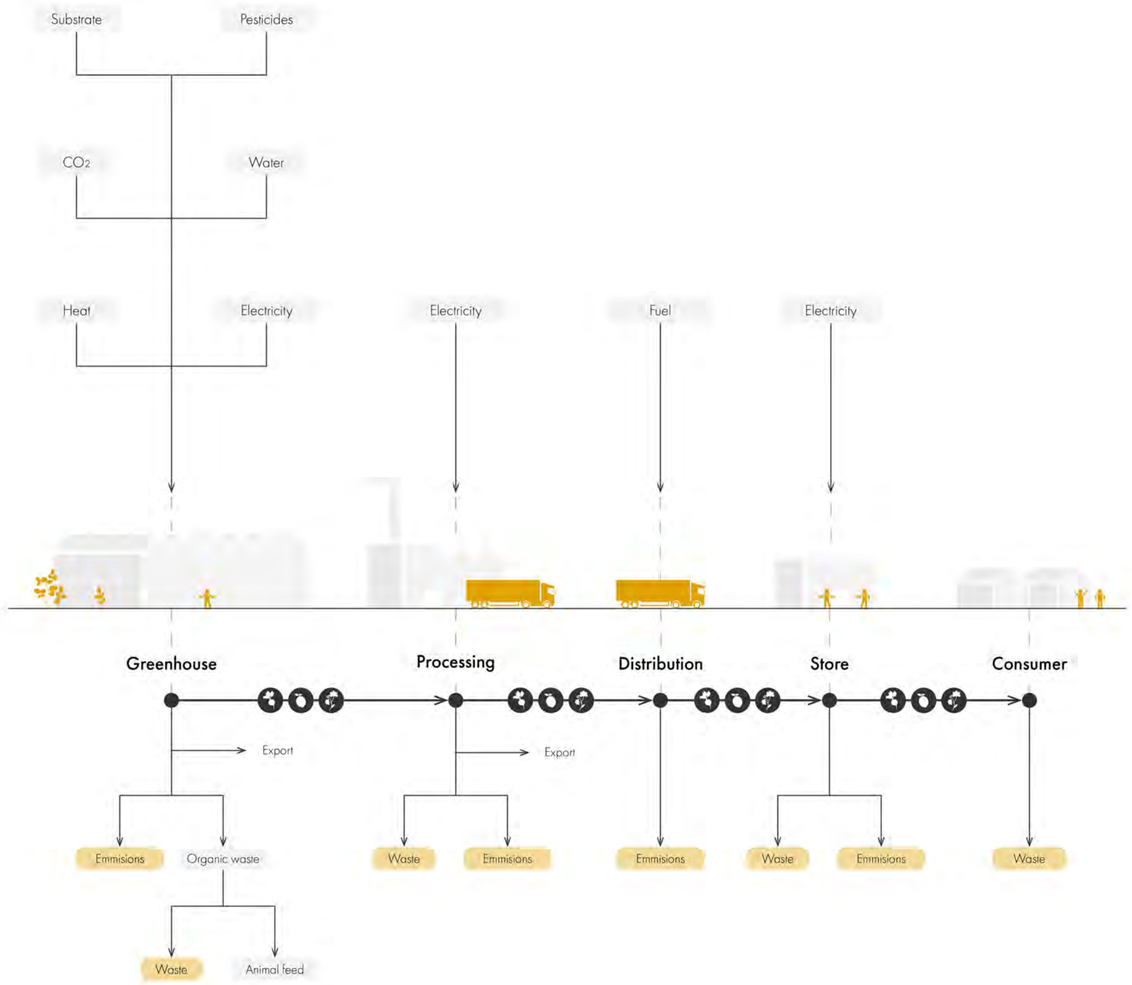


Figure 19: *Current process horticulture*
By author

BOEREGOED

location: Den Haag, 's-Gravenzande, Maasland, Maasdijk, Rijswijk and Naaldwijk

Boeregoed is a foundation that wants to promote short local food chains and they have multiple stores throughout the Westland area. They also aim to educate people on innovative chain models where equality is promoted for all actors in the chain. Participation of consumers is highly encouraged.

By having this multiply faceted goal they not only create a shorter local food chain, but they also educate people about the value of having that shorter, local food chain.

Stakeholders

In the horticulture sector, greenhouse owners are obviously an important stakeholder. Another important stakeholder is the municipality of Westland, the area where the most horticulture is located in South Holland. Royal Flora Holland, the largest flower auction in the world, is also located here. In addition, the national government is a stakeholder with a lot of power.

Figure 20: *Stakeholders horticulture*
By author

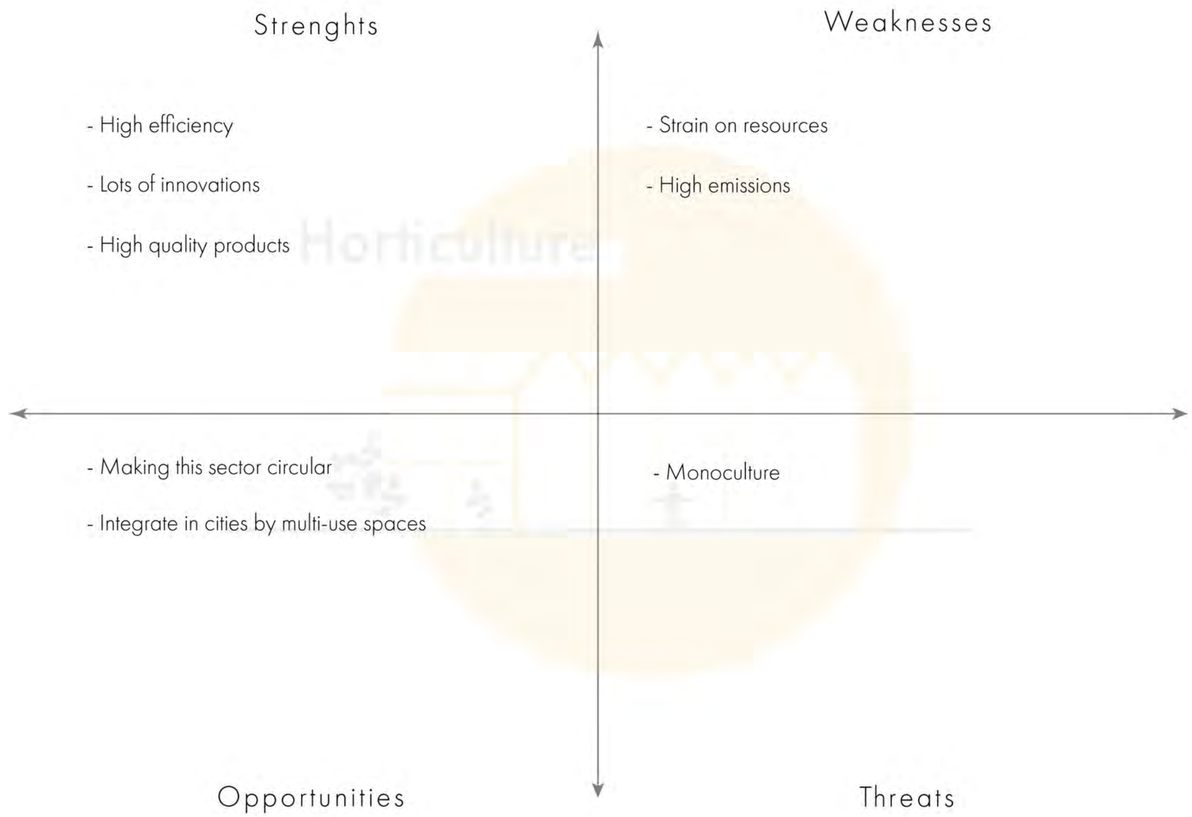
Boeregoed

Boeregoed is an excellent example of the small scale trade aimed for. Boeregoed offers different stores within cities such as Rotterdam, The Hague and the Westland and sells different local products. Each product comes from a farmer nearby. This means that all products are fresh and reach the high Dutch standard. Because of the wide differentiation in products Dutch agriculture offers, stores of Boeregoed are able to offer a complete product range to the wishes of the consumer while still being affordable.

SWOT

The quality and efficiency form two of the biggest strengths of the province. Because of the large scale of the horticulture within the westland lots of innovations are made as well. A weakness of horticulture is the fact that there is a strain on resources. Next to that, the current process produces high emissions. The innovative character of the sector opens an opportunity to make this sector more circulair and integrate the sector more within the city by making use of the multi-use of space strategy. The threat of horticulture is that there is currently a lot of monoculture. A negative aspect of monoculture is the depletion of soil fertility. In addition, plant diseases can develop more easily in the crop, requiring the use of more crop protection products, which are bad for the environment (Drift Metabolic, n.d.).

SWOT



Arable farming

2.5

The Arable farming is mainly focussed on the southern islands of the province (figure 22), Goeree overflakkee and Voorne, because of the dependency of this sector on soil type. The soil on these islands is sea clay, the most favourable soil for arable farming (Broeke, 2007). This soil can be found on some other small places in the province as well.

The main arable crops in the Netherlands are grains, potatoes, sugar beets and vegetables. The largest portions of land in the arable farming sector are used for grain (33%) and potatoes (32%) (figure 21) (Smit & Jager, 2018). In addition, we see that these products also have a relatively high import percentage, of about 47% (figure 23). Vegetables (16%) take up less land and also have a lower import percentage (30%).

Arable farming in the Netherlands has by far the largest use of plant protection products in the entire agrifood sector; It consumes more than twice as many kg of crop protection products as the rest of the agrifood sector combined (Rijksoverheid, 2019). Plant protection products, or pesticides, are substances used to protect crops from diseases and pests. They are needed within food production to produce enough good quality food. But when pesticides are used, some of them end up in the water and soil, causing damage. This can manifest itself in pollution of soil and water, as well as being harmful to biodiversity (Natuur en Milieu, 2019).

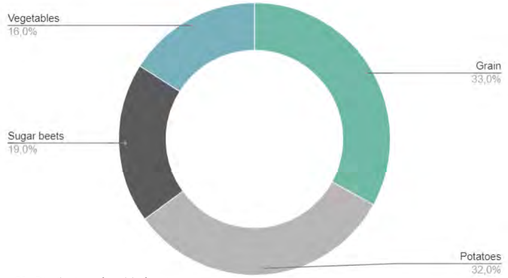


Figure 21: *Distribution of arable farming sector in percentages*
By author, based on (Smit & Jager, 2018)

The process

Because of the direct production on the soil the input differs from the horticulture. Less water, heat and electricity are needed which makes the industry more sustainable. However, this does make the industry dependent on the weather. Next to that, there is currently no reuse of waste streams which makes the process a linear process (Bondt, Janssens, & de Smet, 2010) .

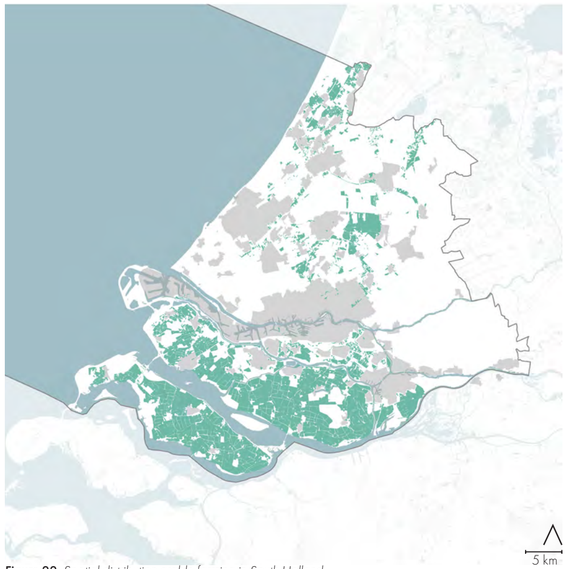


Figure 22: *Spatial distribution arable farming in South Holland*
By author, based on (Planbureau voor de Leefomgeving, 2020)

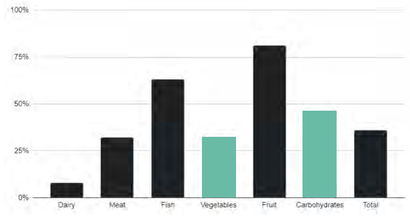


Figure 23: *Percentage of Dutch consumption volume consisting of exports*
By author, based on (Based on Scheer, Groot, Snels, & Simons, 2011)

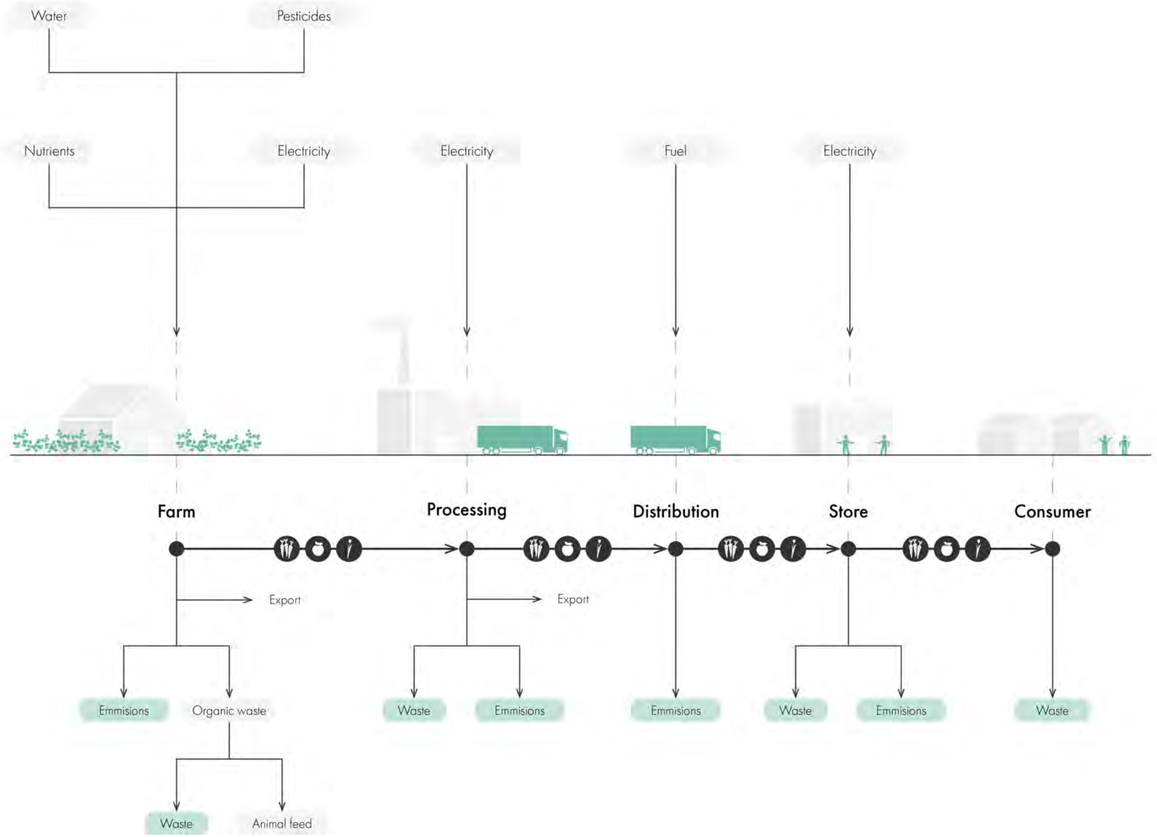


Figure 24: *Current process arable farming*
By author

SALT FARM TEXEL

location: Texel

The availability of local fresh water will decrease in the coming decades so the challenge will be to also produce crops that can grow with less fresh water. Salt Farm Texel is looking to produce crops in salt affected land.

In this business, science and agronomy come together. They want to develop methods to produce in soil with a high degree of salt by identifying salt tolerant crops. This will be combined with specific irrigation, fertilizers and strategies to deal with the properties of the soil. The project is based in Texel but has implemented the idea in other places of the world as well.

Stakeholders

In the arable farming sector, both large farmers and small farmers are important stakeholders. These stakeholders may be reluctant to change to, for example, polyculture. The farmers' organization, the LTO, supports these large and small farmers. In addition, the province of South Holland, the national government and the various municipalities are the stakeholders with the most power in this sector.

Figure 25: *Stakeholders arable farming*
By author

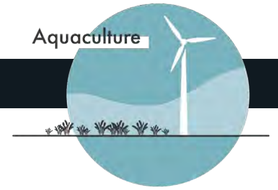
Salt farm texel

Over 125,000 hectares of land in the Netherlands will become increasingly saline in the near future. Salination has made many areas worldwide unusable for agriculture because salt water has a negative impact on many agricultural crops. Agriculture is therefore trying to prevent salination as much as possible. However, this is becoming increasingly expensive and there is little fresh water available. As a result, other solutions must be looked at. Salt farm texel is a project in which crops are produced on saline soil (Zilt Proefbedrijf, 2019). This could be a solution for the future in this sector.

SWOT

Because of the lower demanding production of arable farming the emissions causes are relatively low, which forms the strength of the sector. This way of producing also facilitates the weaknesses of vulnerability of the production. Other weaknesses of the sector are the spatial distribution of this sector South Holland and the monoculture. Next to that, this sector is relatively vulnerable because it depends on the weather. Opportunities for this sector are the easy implementation of polyculture, and implementation of circular systems. And because of the sea clay soil which can be found on closer to the cities as well the multi-use of space combination of space can easily be integrated. The threat of the sector is the lack of flexibility of the farmers themselves. They are not that willing to change their way of production for the greater good.

SWOT



2.6 Aquaculture

Aquaculture is a relatively new form of agriculture for the Netherlands. Aquaculture is already visible within the province but not yet on a large scale. Aquaculture, especially the production of seaweed, has the potential to be a useful addition to the current sectors in the agri-food sector.

Even though the seaweed sector in the Netherlands is very small, this has not been the case in many coastal areas around the world, especially in Asia. Europe does play a role in the seaweed market, but a large part of this is from wild harvest, which can be detrimental to the ecosystems present in the sea (Zalig Zeeland, n.d.). It is expected that the seaweed sector in the Netherlands, and Europe as a whole will grow. Within this growth it would be desired to implement more cultivation of seaweed and reduce the proportion of wild harvest (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2018).

Implementation in the Netherlands

One of the possible implementations of seaweed is as feed for cattle, studies have shown promising results when it comes to the reduction of emissions this diet change causes in cattle (Kraaijvanger, 2021). The use of seaweed produced in the North sea as cattle feed would also be beneficial in terms of cutting out transportation emissions, as most cattle feed is currently imported from other countries. Seaweed can also function as a new product within our own diet as it has a very high nutritional value (DiMaio, 2019). Next to that, it can also be combined with windparks, therefore using the space at sea more efficiently while also not infringing on sea routes and fishing areas (Sharma, Pati, & Nayak, 2016).

Another strength of seaweed is the unique capability to combat climate change as it is incredibly efficient in capturing carbon dioxide from the air. It is 20 times more effective per acre of land than a forest (Hurlimann, 2019).

Figure 26: *Example Seaweed farm*
(Source: Farmer, 2009)

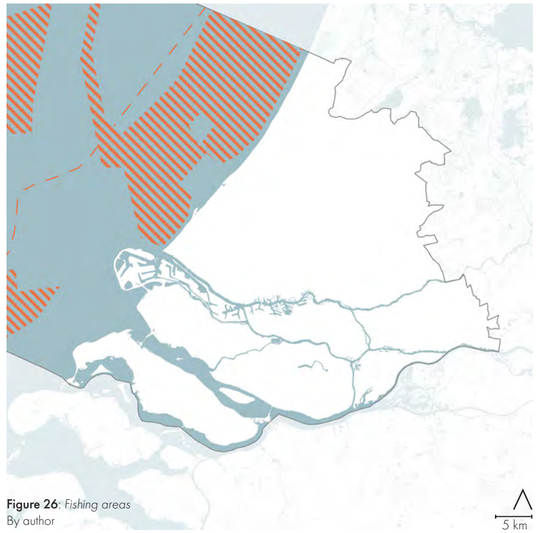


Figure 26: *Fishing areas*
By author

Figure 27: *Windparks*
By author

Figure 28: *Protected areas*
By author

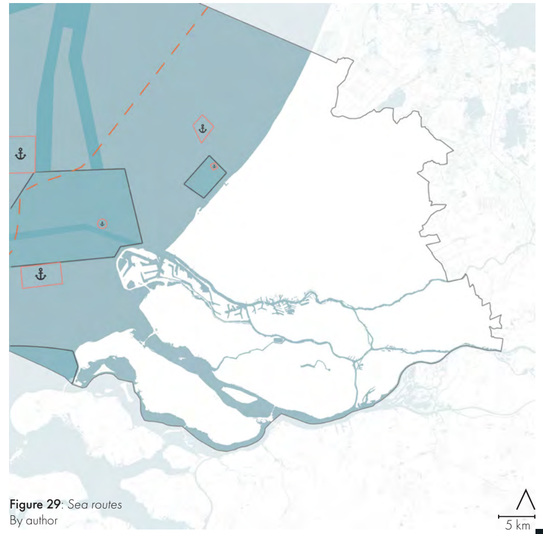


Figure 29: *Sea routes*
By author

NOORDZEEBOERDERIJ

location: Den Haag, Scheveningen

Eating seaweed is nothing new to some people in the world, but in the Netherlands it's not a widespread meal option, yet. This seaweed farm off the coast of Scheveningen hopes to sea that changed in the near future. They promote this crop for its benefits to health, the climate and nature.

They grow the seaweed on lines that can be put anywhere in the ocean, giving it the perfect opportunity to be combined with windmills for example. So far the seaweed grown on the farm in Scheveningen is only used for research, but its uses reign from food for people and animals to maybe even packaging.

Stakeholders

As stated, the aquaculture sector is a new industry in the agrifood sector. Many stakeholders will not be negative to this, except the current farmers of the meat & dairy sector. With seaweed, aquaculture has a potential replacement for meat. Important stakeholders who are positive about this sector are the province of South Holland and Rijkswaterstaat. The national government is also a stakeholder with a lot of power, same as Vattenfal, the company that owns the wind farms in the North Sea.

Figure 30: *Stakeholders aquaculture*
By author

The Noordzeeboerderij

The Noordzeeboerderij is one of the existing examples of seaweed production within the Netherlands and it is located 12 kilometers off the coast of Scheveningen. Although the harvest is currently only used to test the implementations and possibilities of seaweed farming in the North Sea, these experimental farms do have the capability to grow out to a full scale seaweed farm in the future (Haven in zicht, n.d.).

SWOT

One of the strengths of this sector is its sustainability, and capacity to assimilate CO_2. It can also offer an escape of the lack of space the province has to offer. Because of the easy combination with windmills the placement is very undemanding. The harbor offers a close connection with other sectors as well. The weakness of the sector is the newness of it. The production of seaweed has not been put to a large scale yet which makes it unpredictable. An opportunity in this sector lays in its multi-use opportunities. At first, it can be used as cattle feed, but it can also be implemented within our own diet. The threats are the infringing of the already quite difficult sea routes. The build of the sector can also be quite expensive and it is still unsure whether people are willing to implement seaweed into their diet.

SWOT

2.7 Densification

The province of South Holland is the most densely populated province of the country and has the goal to grow even further in order to reach the extra housing of 230.000 within the next few years. This is, compared to the large city of The Hague who offers almost 260.000 houses quite an extension.

Figure 31 shows the expected need of housing until 2040. Municipalities such as The Hague, Westland and the Westland have an expected need of 20% more housing. Next to that, the eastern part of the province also has an expected need of housing of 10% or more. This again shows the great task in terms of housing need in the province (Provincie Zuid Holland, n.d.).

Different municipalities have already started planning these extensions. Rotterdam for example has the goal to reach 50.000 new houses before the year of 2040, in which 20.000 should be placed in the inner city. Rotterdam, and other municipalities see the densification as an opportunity to create a higher quality living environment. (OD205, 2019). The Hague states the goal to create a healthy environment which goes hand in hand with the densification. They aim to create spaces where densification is combined with areas of sport, build better networks of green and further attractivate the public transported with more public green spaces (Platform Stad, 2019).

Figure 31: *Urban areas in South Holland*
By author

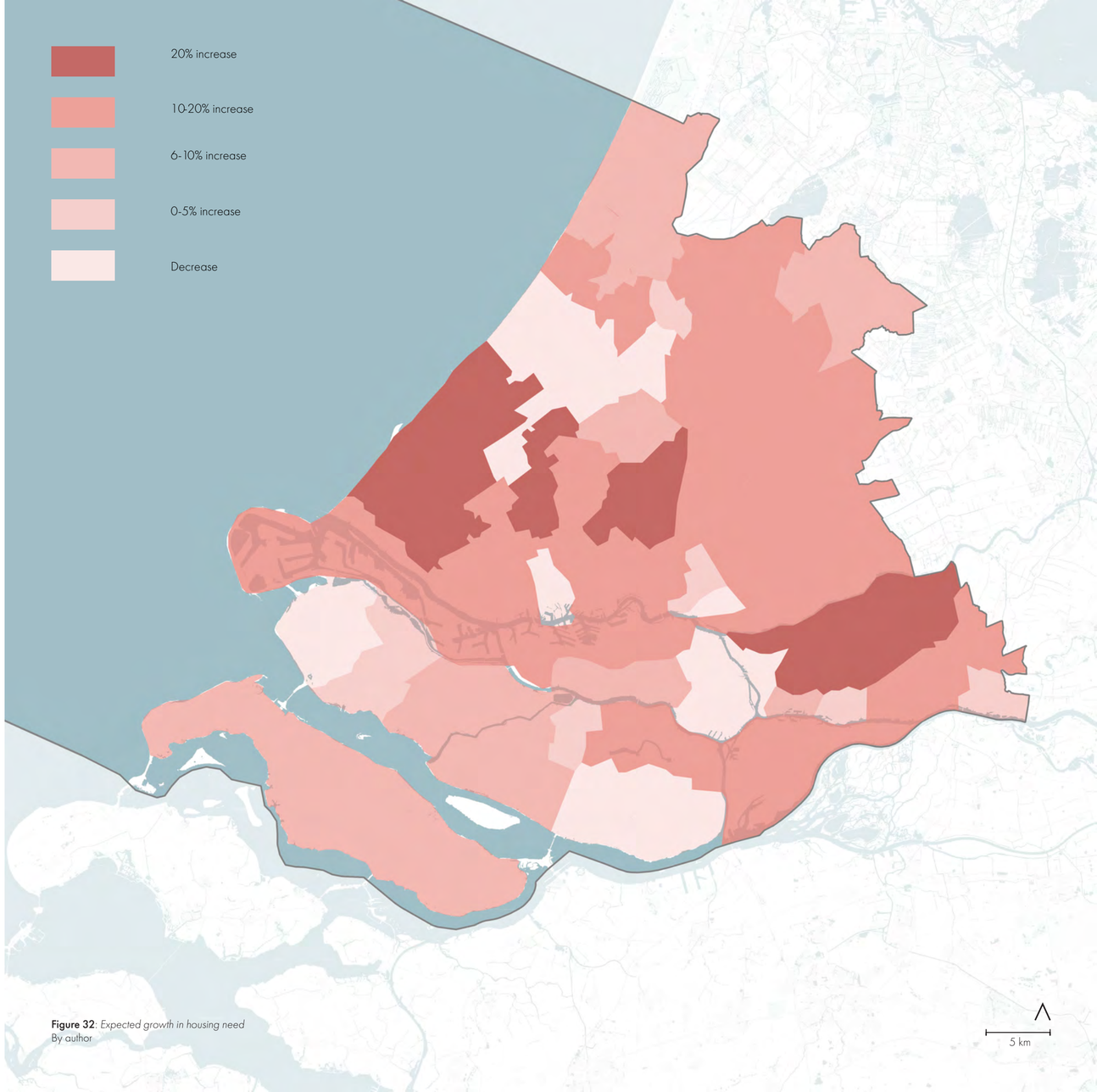


Figure 32: *Expected growth in housing need*
By author

DAKAKKER

location: Rotterdam

In Rotterdam the initiative of the Dakakker, which means agrable roof, was started in 2012. This is currently the largest roof farm of Europe. This roof has many types of farms, including bee hives, herbs and various vegetables and fruits.

The climate can be compared to the mediteranian because of the rocky soil combined with sometimes strong winds and heat. Because of this, the roof farms different crops than other urban farms do.

This is all done in a sustainable way, without using pesticides and with the re-use of rainwater.

Stakeholders

In this sector, organisations like the municipalities, the central government and the province are of a high power because they ultimately determine where densification will occur in the province. Next to that, the real estate developers and housing corporations will ensure the realization of the houses. Finally, the demand for houses is formed by the inhabitants

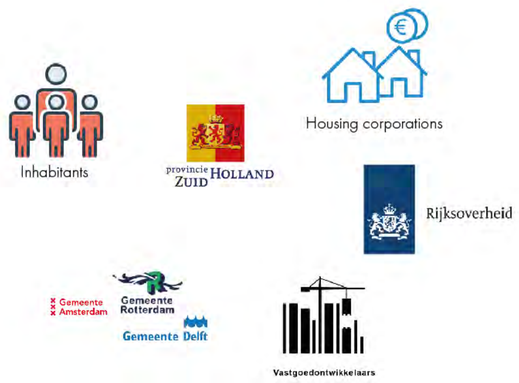


Figure 33: *Stakeholders densification*
By author

Dakakker

The dakakker is the first large harvestable roof of the Netherlands and constructed by Binder Groenprojected based on the idea and design of design agency ZUS (Zones, Urbanes Sensibles). The project is part of the City initiative De Luchtsingel. The Dakakker, which is located on one of the Schieblock buildings of Rotterdam, offers an opportunity to grow vegetables, fruits and herbs. The Dakakker forms the largest rooftop farm in Europe where work is done directly with soil on the roof (De luchtsingel, n.d.).

SWOT

The SWOT analysis shows that the connectivity and facilities are two strengths of the potential densification need in South Holland. This is positive for the densification throughout South Holland, as all areas are relatively easy to reach. The weakness of the goal to densify within the province is that it is already quite dense, especially in the urban parts of the province. These urban areas are the popular areas to live in, which makes this a difficult task. The opportunities of the densification goals lie within the Green Heart. A threat is the need for space to grow food which conflicts with space needed for densification. Also the risk of the lack of focus on circularity and sustainability in new houses due to time and pressure can form a thread.

SWOT

3. Vision

Local Food, Lower Footprint

3.1 - Goals and objectives
3.2 - Vision statement
3.3 - Main transitions
3.4 - Vision map

The third chapter of this report contains the vision of the project: Local Food, Lower Foodprint. First, a scheme will be shown which reflects the goals and objectives of our vision. Next, a vision statement will be displayed, which summarizes our vision in a short text. After that, three sub-vision maps will be shown. These are divided into three focus areas: the reduction of the meat & dairy sector, the Green Heart and the sustainability of horticulture with polyculture. In conclusion there is a final vision map which includes our entire vision.

3.1 Goals & objectives

In this scheme the connection between the different sectors is shown and how the actions within the different sectors relate to each other. Some of the transitions and shifts are closely linked together. The most prominent example of this is the reduction of the meat- and dairy industry. This reduction not only requires actions in other sectors to happen (the introduction of seaweed is necessary to partially replace the protein from meat and dairy), but actions in other sectors are also dependent on the change in the meat and dairy industry (the space that this reduction opens up is used for green connections and housing projects). This makes it key to this project that the reduction of the meat- and dairy industry takes place in the right way.

Some of the interventions in other sectors open up opportunities for each other, like the combination of an increase in housing and agriculture by creating multi-use spaces.

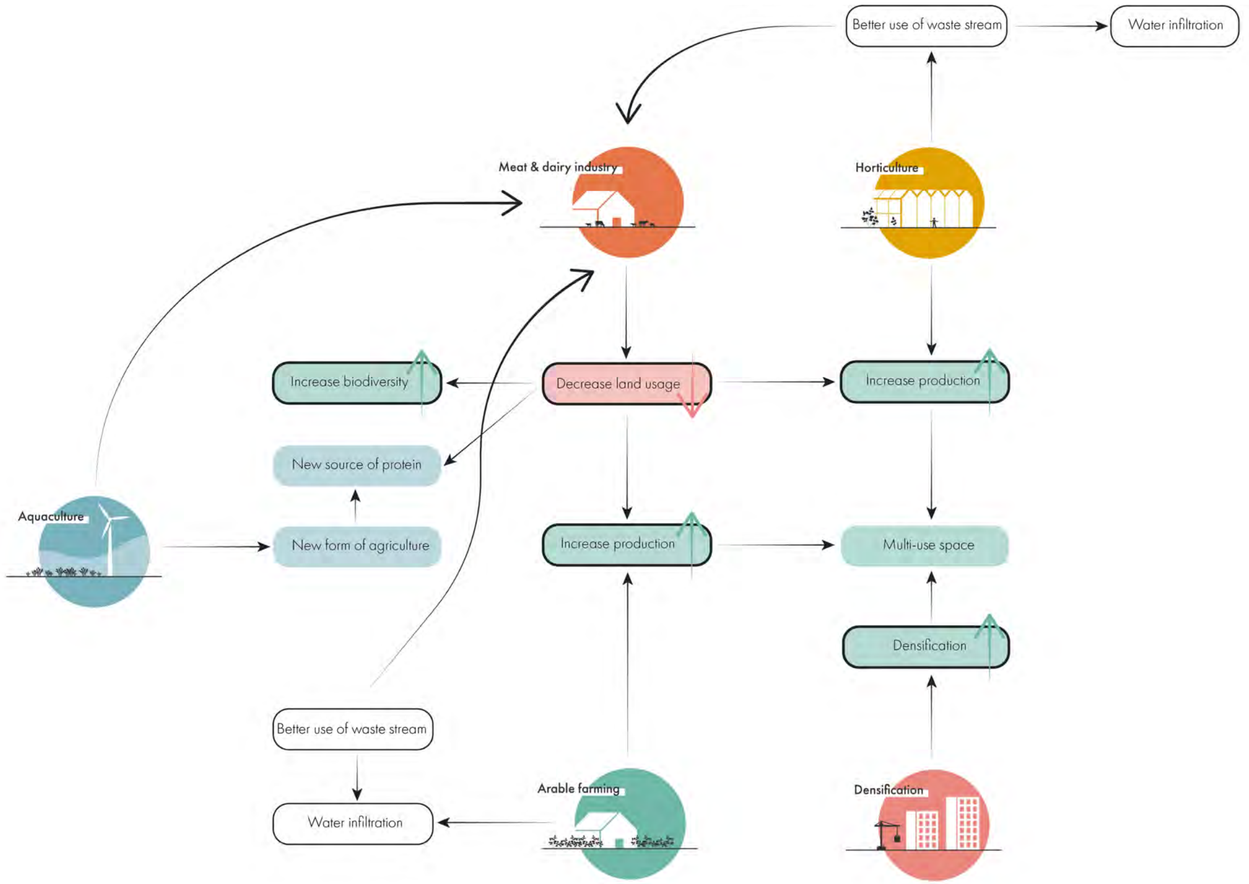


Figure 34: *Scheme with goals & objectives*
By author

3.2 Vision statement

By 2050, both the land and the sea are used in a **space-efficient** way, reducing the (carbon-) footprint of the province and providing more food for its own population. Buying and eating **local food** has encouraged people to become more aware of the process and where the food comes from. This has resulted in a **shift in diet** and the inefficient space for cattle is reduced.

This conversion provides space for nature, housing and agriculture while also leaving room for the plans of the next generation.

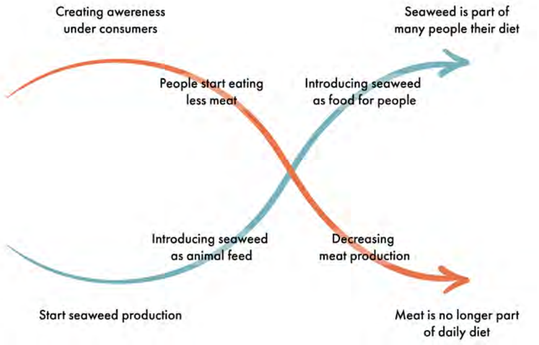
Figure 35: *Impression section 2050*
By author

3.3 Main transitions

3.3.1 Towards a more plant based diet

The meat and dairy sector can never become 100% circular, because of the emissions caused by the cattle themselves. Because of this, a reduction of this industry is required. This reduction will go hand in hand with the introduction of aquaculture in the north sea. Wind Farms can be combined with seaweed farms while simultaneously providing alternative proteins to meat. By changing the diet of cattle to seaweed, the industry will emit less, resulting in a more sustainable meat and dairy sector. Using seaweed as feed for cattle also results in a reduction of the import of soja, which is currently used as cattle feed and imported from countries such as Brazil. Reducing this import decreases the pressure on resources. Not only can seaweed be used as cattle feed, it can also be introduced for human consumption. Shifting this diet of people can result in a reduction of meat consumption, which can follow by a decrease of land used for cattle.

To make sure that farmers can still keep their job or get a similar but more fitting jobs, it is important to invest in other methods and locations for farming. The next generation of farmers can be brought to inner city farms and polydomes to make sure that farming will be possible for the next generation as well. By investing in education in future farming early in the process, the transition will run smoothly.
The reduction of the meat- and dairy industry will create opportunities in other areas as well. Infrastructure currently used for the meat and dairy industry like slaughterhouses can be reused for as infrastructure for the seaweed industry. Besides this, space opens up on the sites currently used for the cattle. Because of the reduction of the land use, there will be more space for both this and the next generation.



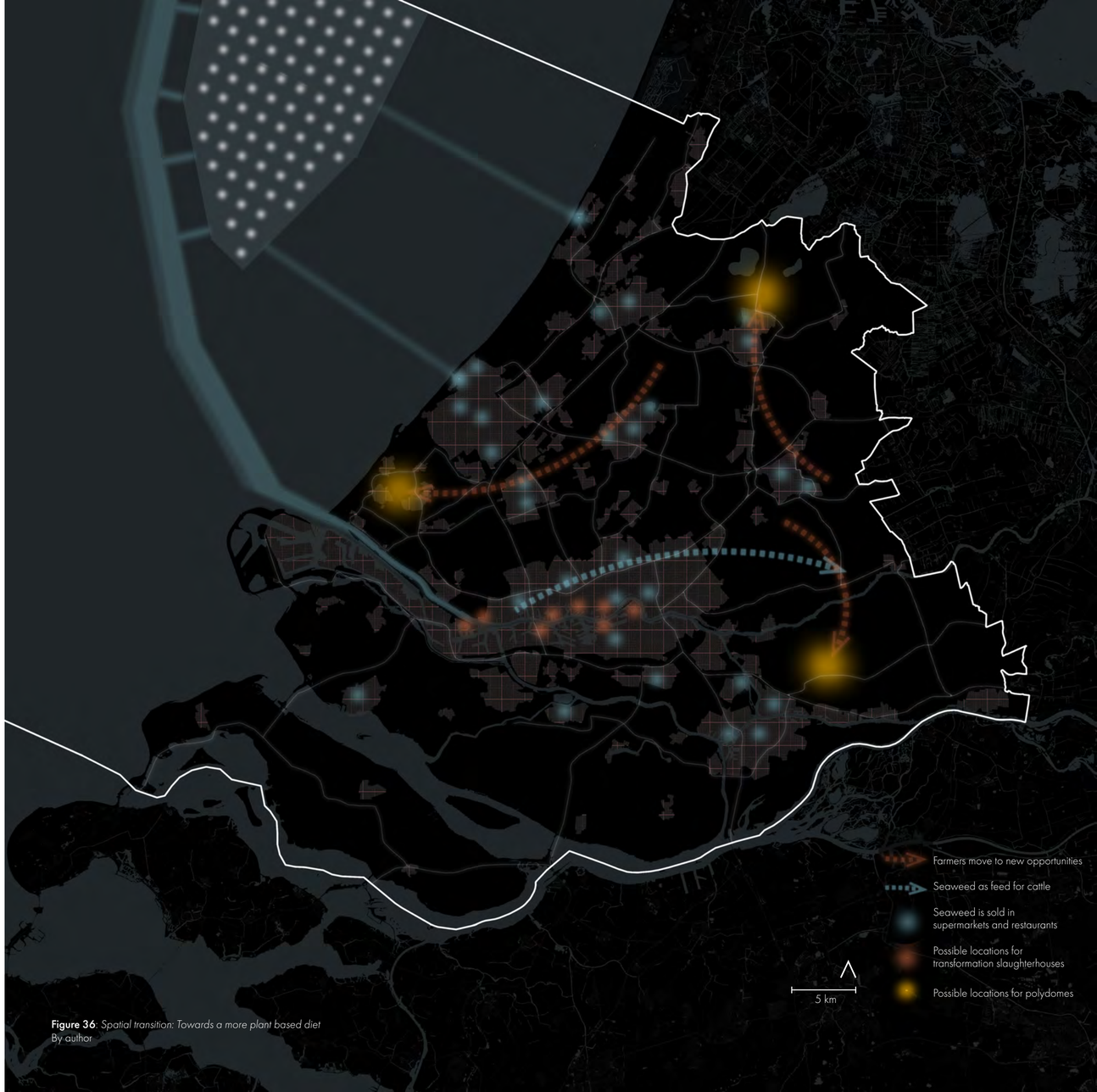


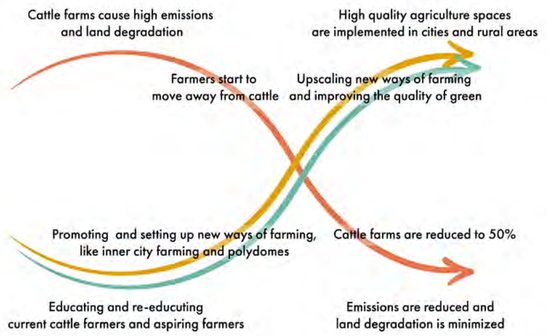
Figure 36: *Spatial transition: Towards a more plant based diet*
By author

3.3 Main transitions

3.3.2 More space of higher quality

When reducing the meat and dairy industry, space opens up for more qualitative green. These spaces can be used to connect other high-value spaces, for instance the Natura 2000 areas. By strengthening this network, improving biodiversity and adding more open water, subsidence can be reduced and the quality of life can be improved for both people and animals.

There will also be some room for densification in the Green Heart. These areas will be limited and small, to prevent large expansions in green areas. In these areas, circular villages can be created to provide for the growing need in housing while maintaining the green character of the area. These small villages will be close to other cities and connected to current infrastructure.



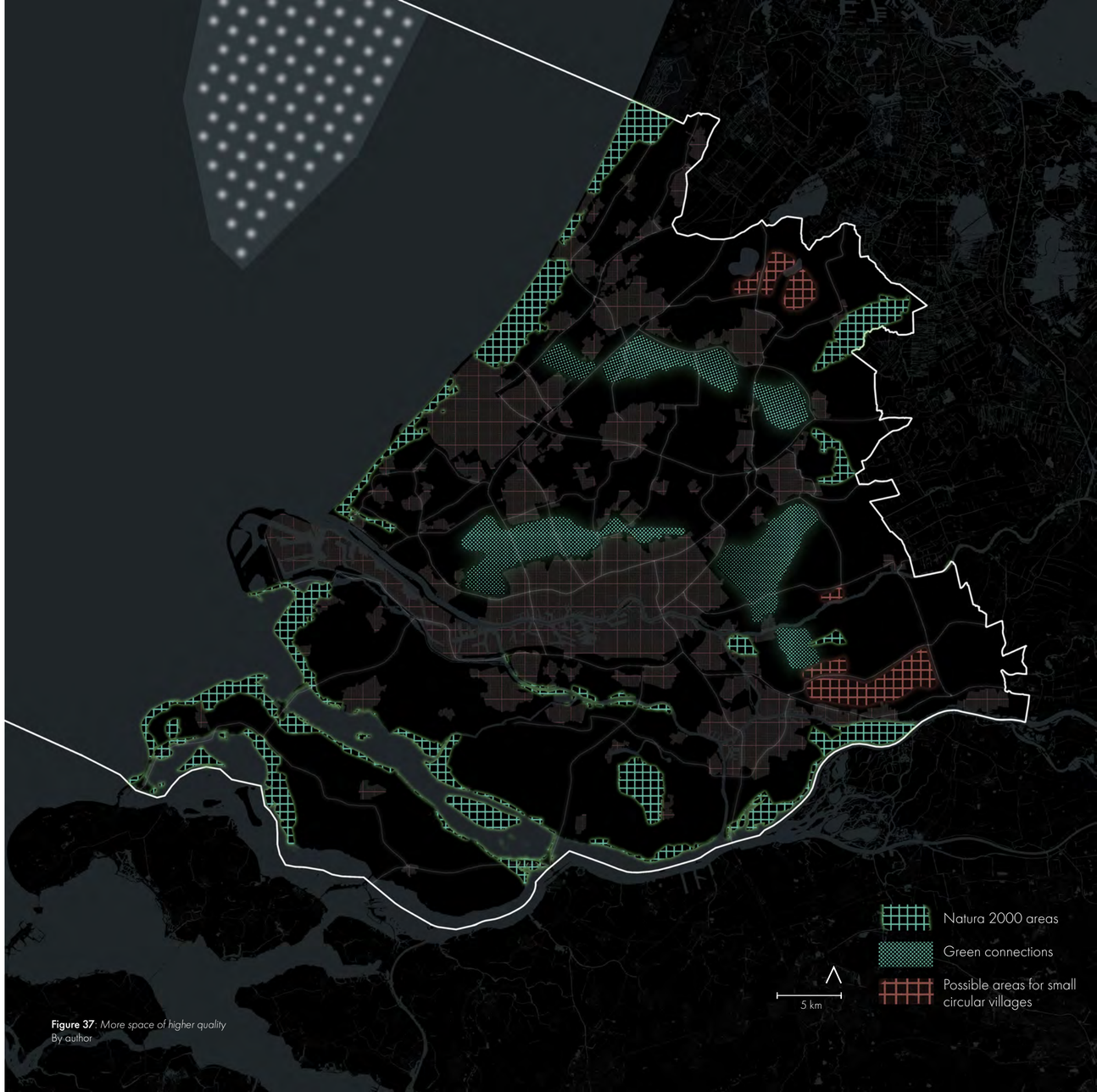


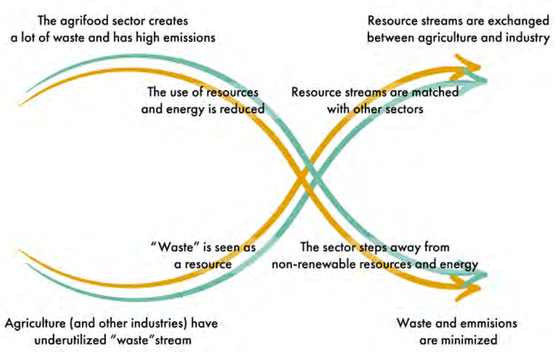
Figure 37: *More space of higher quality*
By author

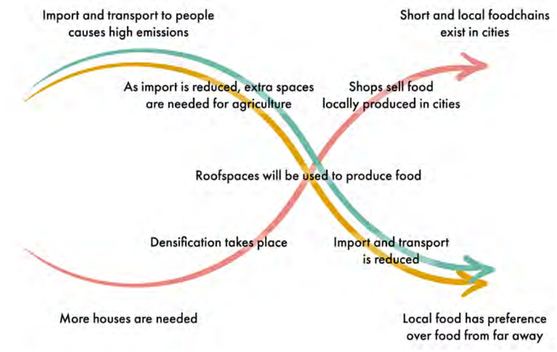
3.3 Main transitions

3.3.3 Matching flows and creating local chains

To reach circularity by 2050, flows need to be reused and matched. The horticultural sector requires a lot of energy and heat, which can come from external sources like energy from the wind farm on the north sea as well as residual heat from the Port of Rotterdam and other industrial areas near greenhouses. Only when waste is seen as a resource can circularity be reached.

The next goal is to increase the efficiency of using space. By adding polyculture for the arable, fertile land, the yield can be increased to provide more food with the same space. Within cities, areas can be defined as multi-use areas in which agriculture and housing coexist. By creating these inner city multi-use spaces, the chains can be shortened, increasing its sustainability while making healthy, local food accessible for all.





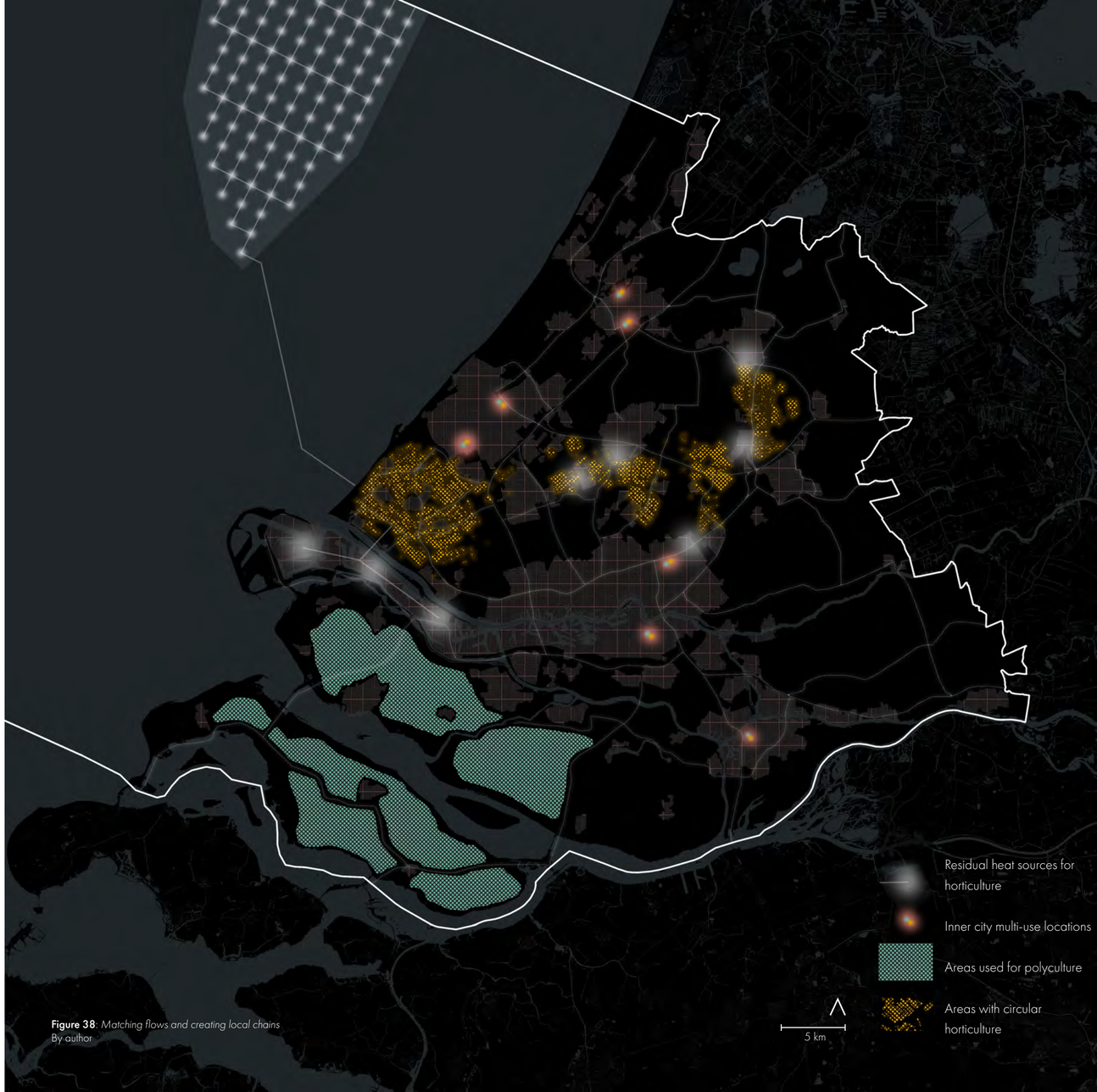


Figure 38: *Matching flows and creating local chains*
By author

3.4 Vision map

By 2050, both the land and the sea are used in a **space-efficient** way, reducing the (carbon-) footprint of the province and providing more food for its own population. Buying and eating **local food** has encouraged people to become more aware of the process and where the food comes from. This has resulted in a **shift in diet** and the inefficient space for cattle is reduced.

This conversion provides space for nature, housing and agriculture while also leaving room for the plans of the next generation.

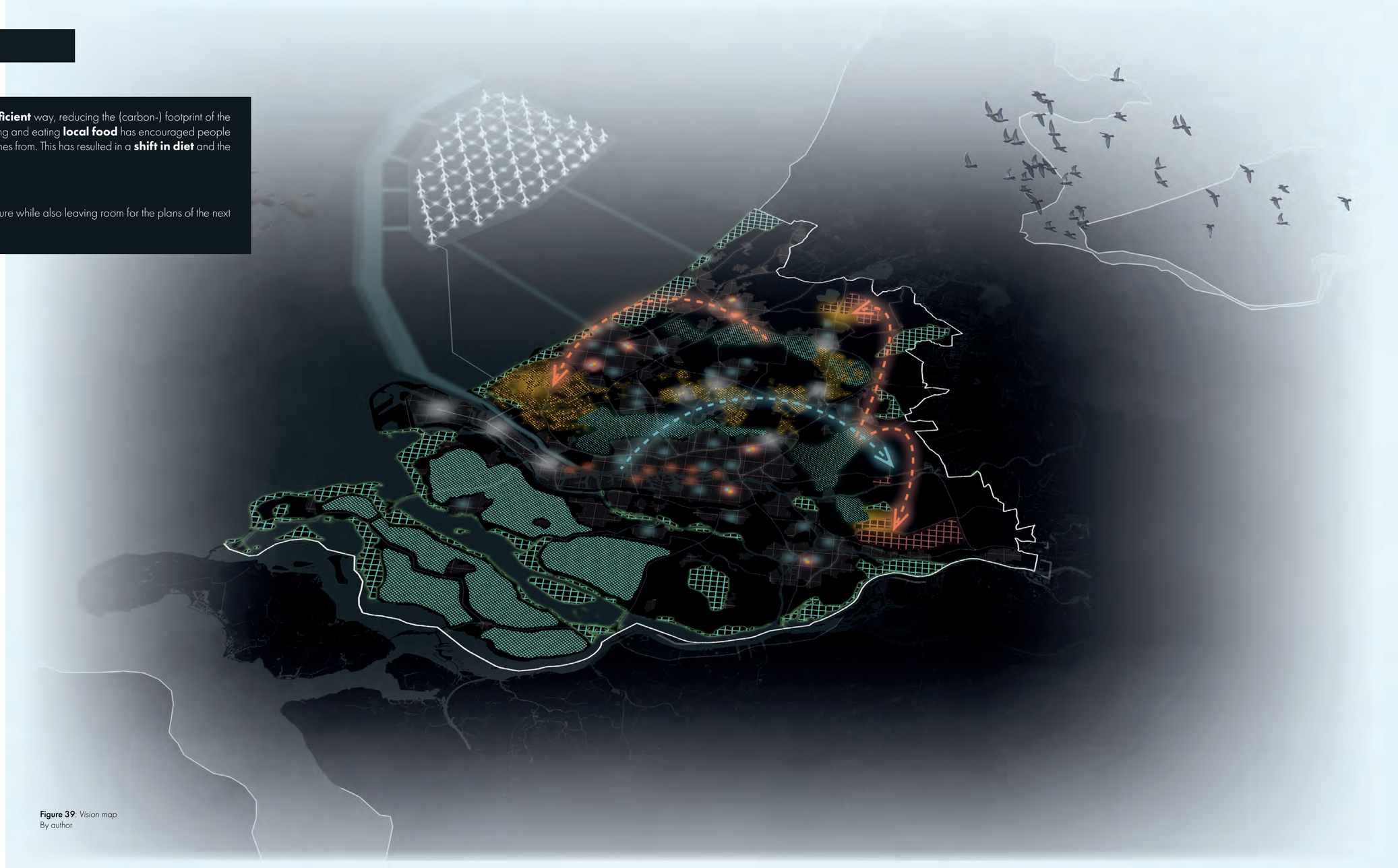


Figure 39: *Vision map*
By author

4. Strategy

Realising Local Food, Lower Footprint

4.1 - Phasing timeline
4.2 - Phases
4.3 - Strategic interventions

With the vision clear and in place, the next step is to look at how exactly that vision is reached. What specific actions need to be taken? What policies need to be implemented? When is the right time to implement these actions and policies? What stakeholders are involved and how can these stakeholders be activated and motivated to be involved and positive towards the vision? These are all questions that are answered in this chapter.

First the general phasing of the project is explained, after that each phase is addressed separately with a more in depth explanation of what happens when and why. Lastly the key interventions are mentioned separately with a further analysis on what specific actions and policies are at play and how they affect the different stakeholders.

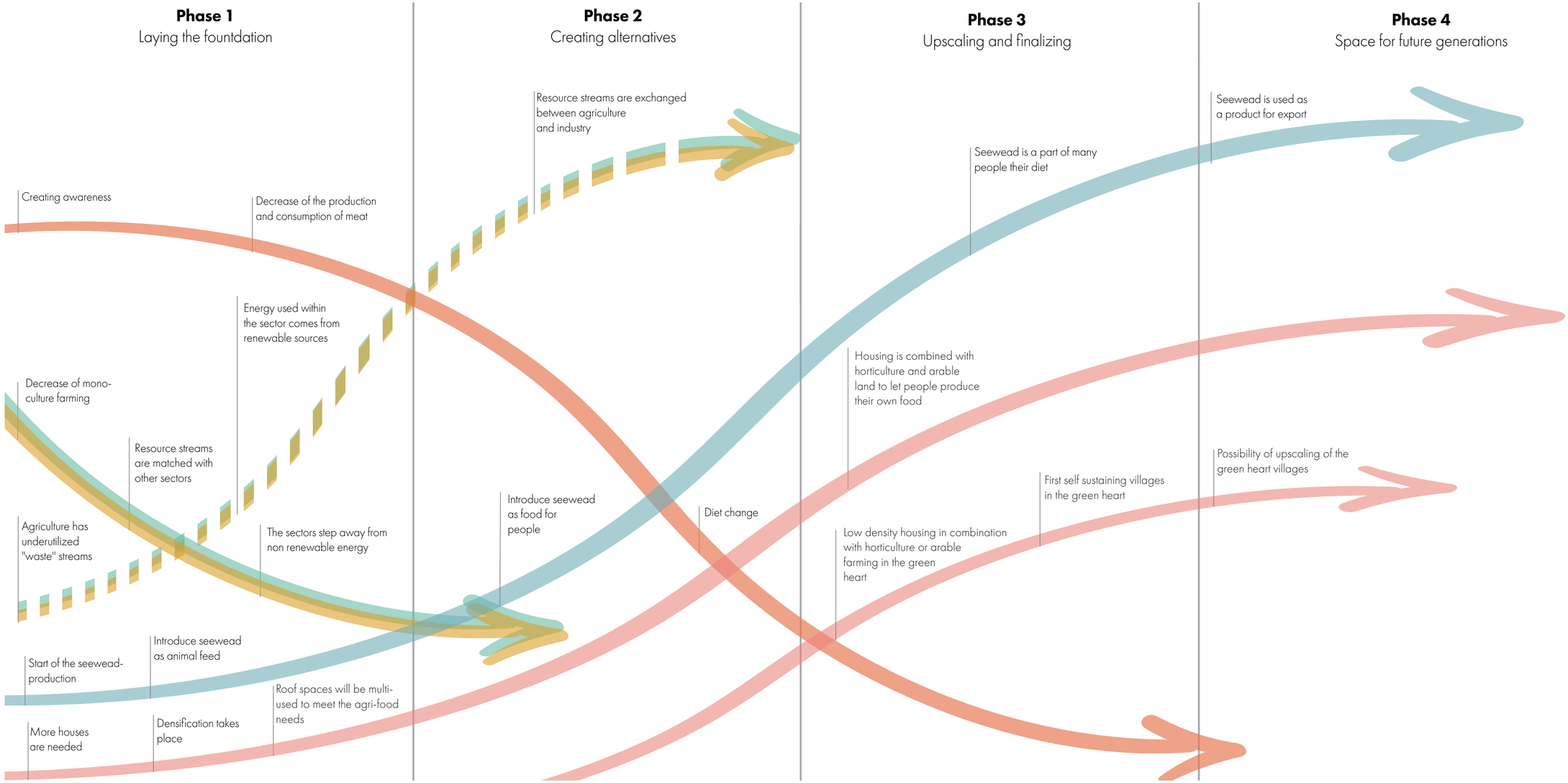


Figure 40: *X diagram with all transitions*
By author

4.1 Phasing timeline

To reach circularity within the agricultural sector by 2050, a strategy and timeline are needed. To make sure every part of the strategy does its job and there is no overlap between various timelines, a timeline of all goals is created (figure 42). The timeline consists of three phases: Laying the foundation, creating alternatives and upscaling & finalizing. Each phase has its focus. A more detailed description of the timelines and the steps that need to be taken can be seen in figure 41.

In the first phase the circular transition will be made on a small scale. While kicking off the changes on the smaller scale, a foundation will be made for larger and longer projects. These larger transitions either require more time, or require other policies and interventions to take place first.

The second phase consists of creating alternatives for both people and agriculture. The main reason for needing alternatives is the reduction of the meat and dairy industry. By reducing this sector, farmers might lose perspective for the future. Through educating the next generation and investing in other ways of farming, this future perspective can increase and farmers can keep having jobs in the agricultural sector. To decrease the human consumption of meat, other proteins are required. By introducing seaweed as an alternative to meat in phase 2, people can adjust their diet in time. In the third phase, these initiatives will be upscaled to keep up with the trends. Besides that all other ongoing transitions will be finalized and completed.

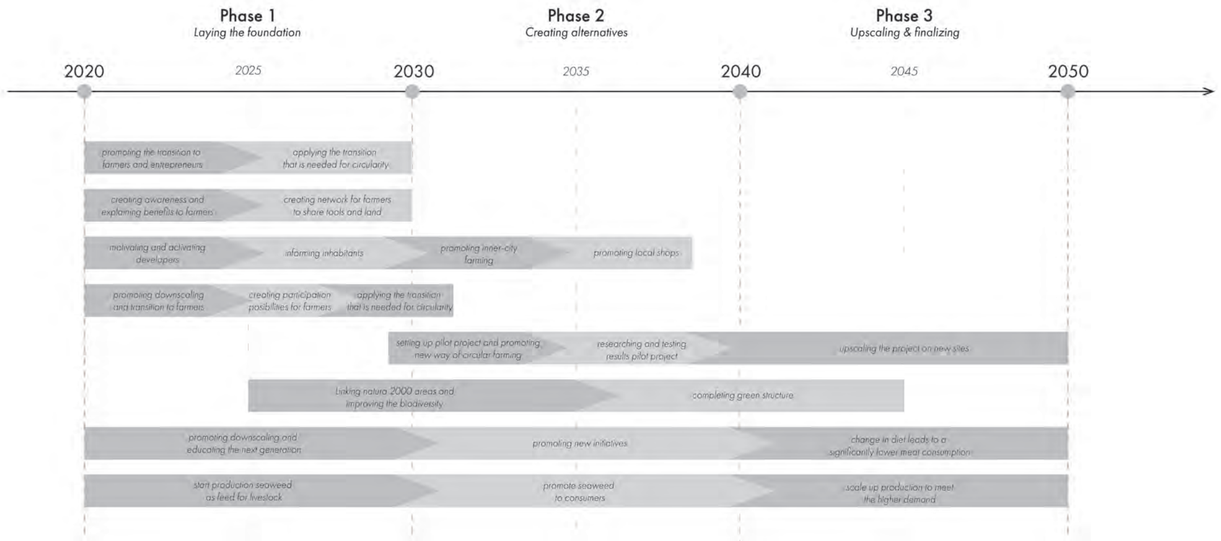


Figure 41: *Phasing timeline with specific interventions*
By author

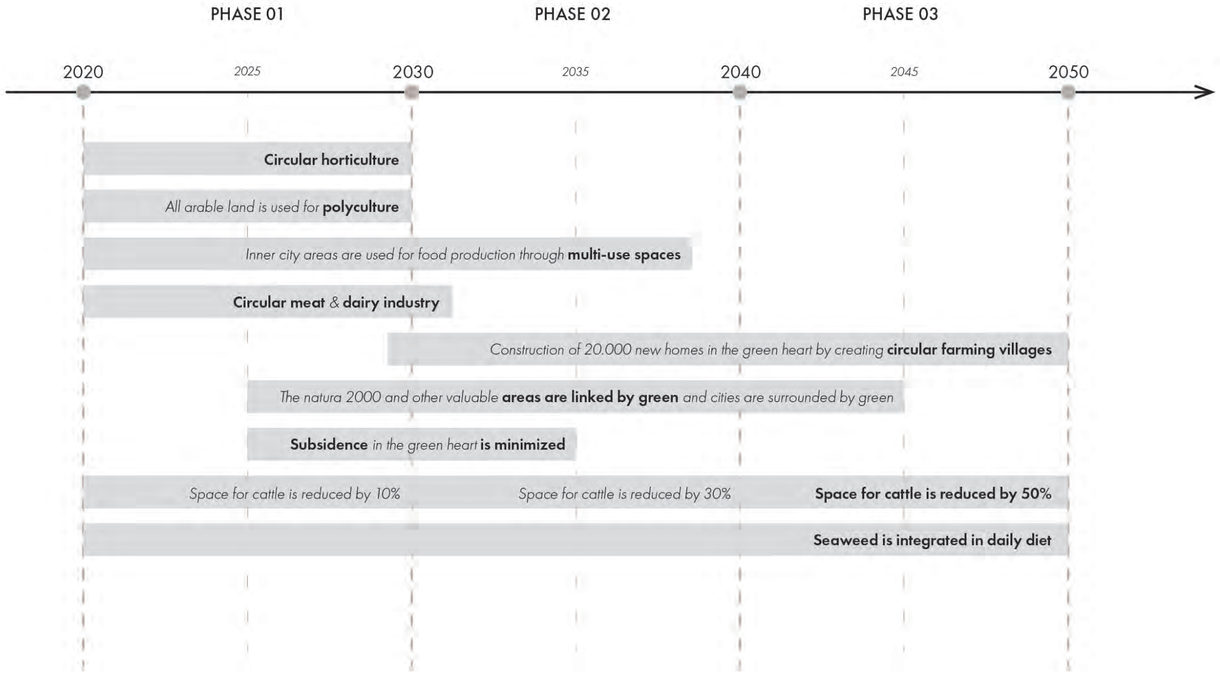


Figure 41: *Phasing timeline with milestones*
By author

4.2 Phases

4.2.1 Phase 1: Laying the foundation

The first phase, laying the foundation, consists of completing smaller transitions like polyculture, circular horticulture and a circular meat and dairy industry. It also starts the transition for larger interventions. The seaweed farms will in this phase provide feed for cattle and the space for cattle will start to reduce to make room for green connections. Besides this, inner city spaces that can be multi-used will be identified and development will start. The development of these multi-use spaces will happen in areas where development is needed or already planned, an example in The Hague will be elaborated later in this chapter.

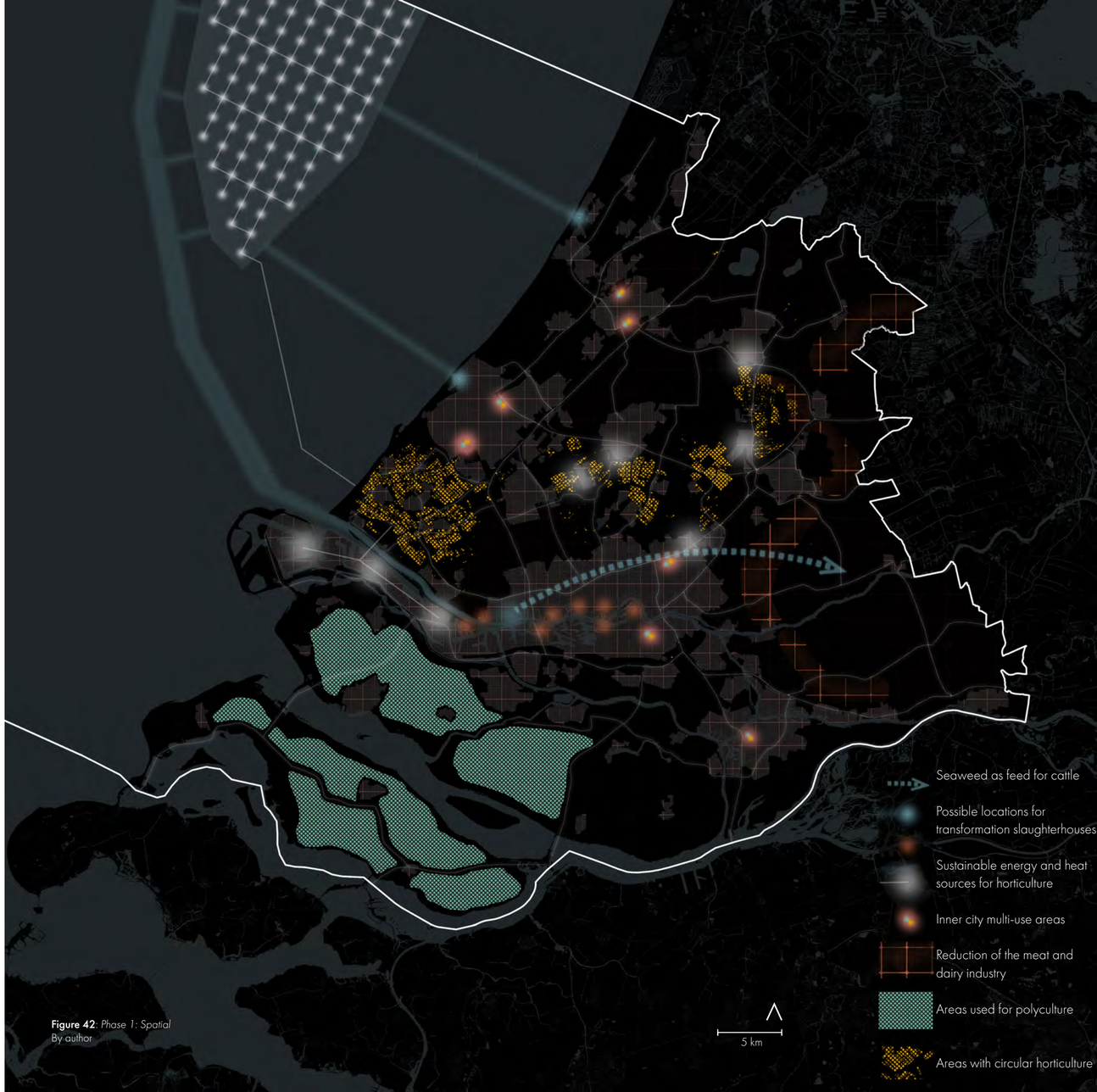


Figure 42: *Phase 1: Spatial*
By author

4.2 Phases

4.2.2 Phase 2: Creating alternatives

The second phase, creating alternatives, is about expanding upon the foundations that were created in the first phase. The main transition is the reduction of the meat and dairy industry. By making sure farmers have alternative methods and locations for farming, this transition can be accelerated. This will be done by creating inner city spaces for farming, polydomes outside the cities and a circular pilot village in the green heart. These interventions will be discussed later in this chapter. Besides these alternatives, the creation of the green connections will be continued and the production of seaweed will continue to rise and start being introduced as food for people as well.

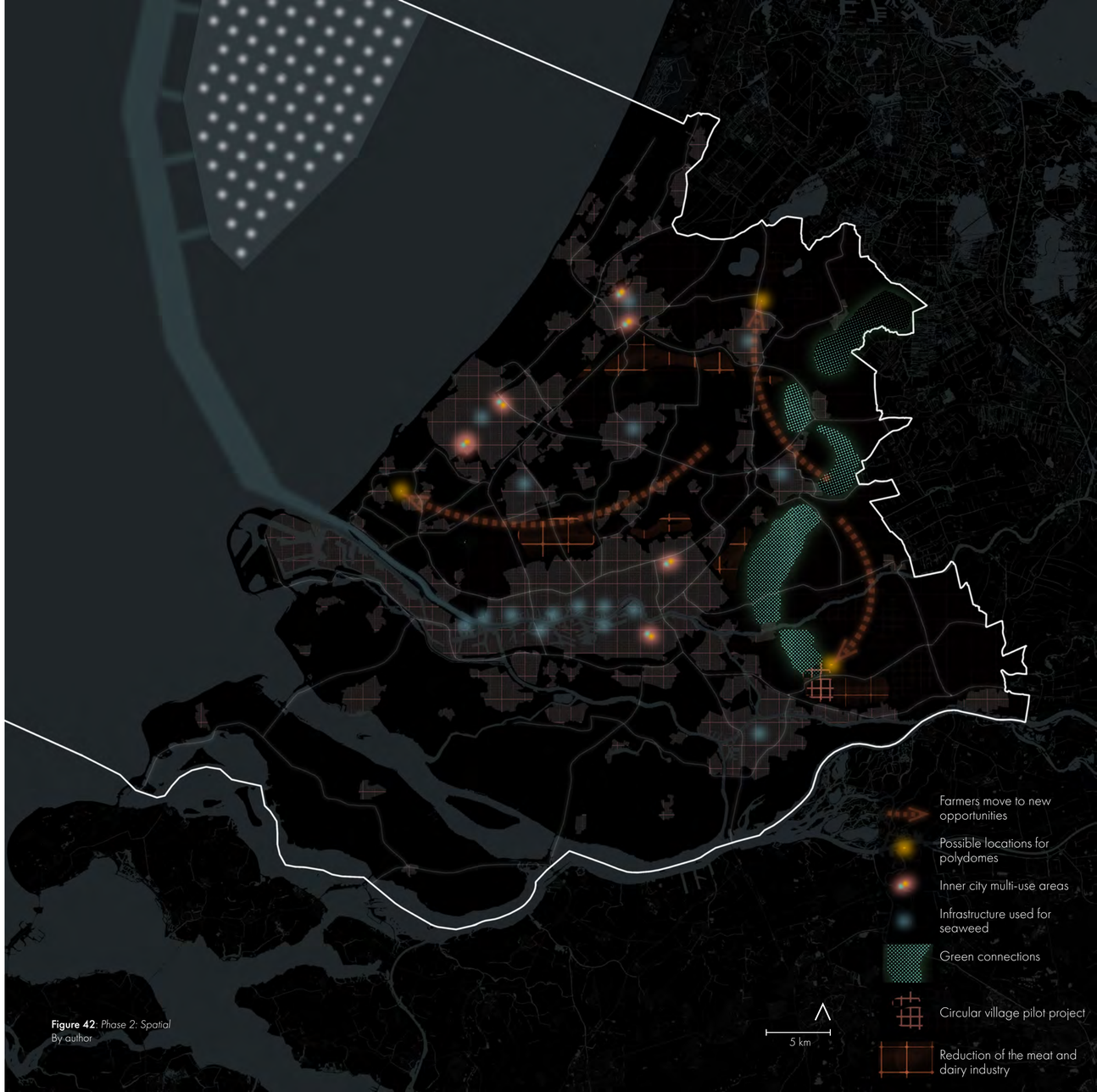


Figure 42: *Phase 2: Spatial*
By author

4.2 Phases

4.2.3 Phase 3: Upscaling & finalizing

The last phase, upscaling and finalizing, consist of the completion of all transitions. This means that most trends will continue. Because alternative methods and locations for farming have been created in the previous phase, the space for cattle will continue to decrease to a total of 50% compared to 2020. The green connections will be completed, resulting in a green structure in the province and a better and healthier environment for both people and animals. By researching the pilot project created in the previous phase, strengths and threats have been analysed concerning the densification in the green heart. This means that these small circular villages can be implemented at more locations, resulting in 20.000 new homes in the Green Heart by 2050. Seaweed has been integrated in the diet of people, resulting in a reduction of meat consumption while maintaining the same nutrients.

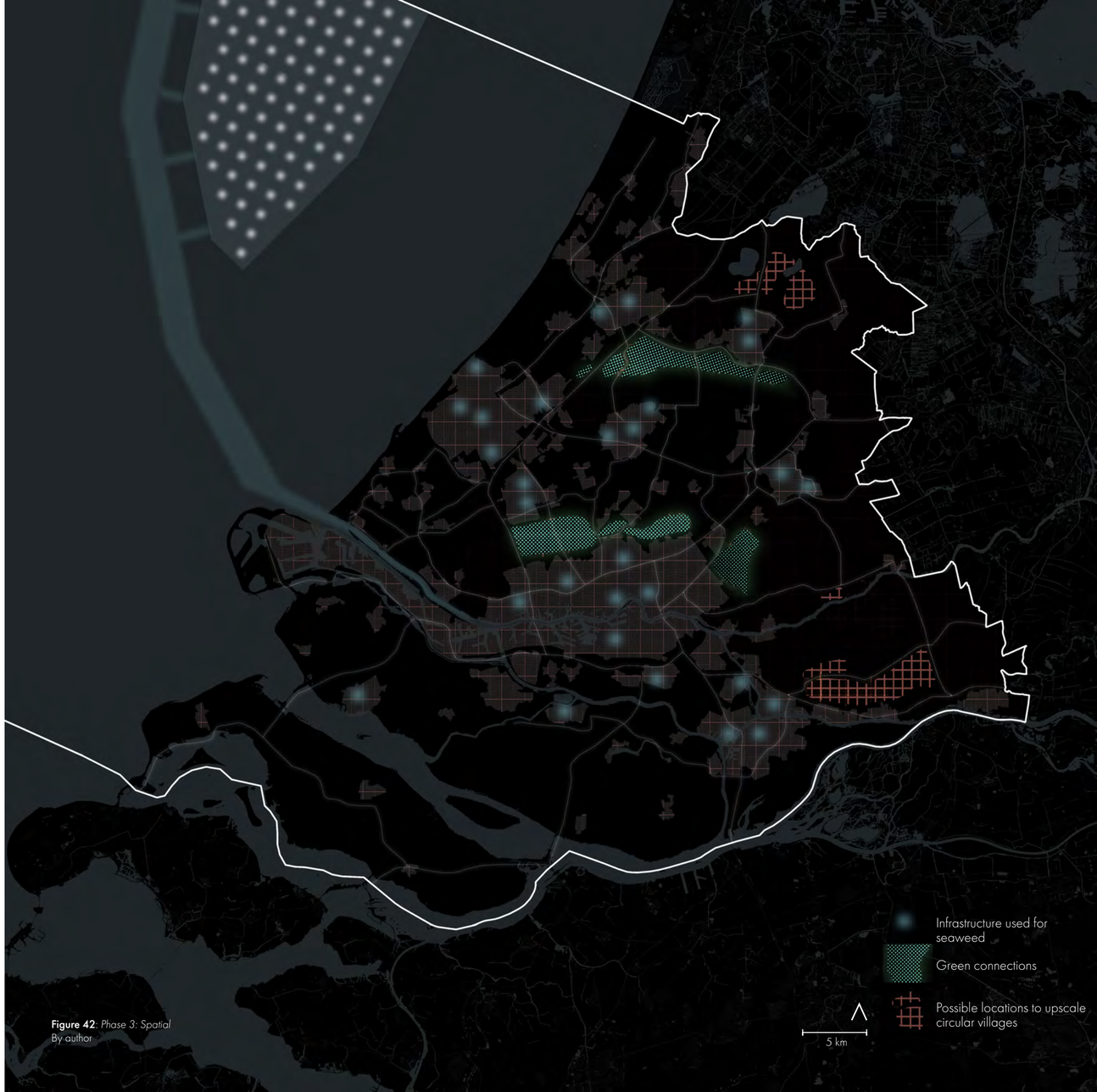


Figure 42. *Phase 3: Spatial*
By author

4.3 Strategic interventions

Certain interventions form a key to the success of implementing more circularity in the province. These projects or interventions and their impact on a smaller scale are explained in this part of the chapter. The key projects that are discussed include in the introduction and expansion of: aquaculture in the North Sea, Circularity in the horticulture and meat- and dairy industry, Polyculture, The creation of more green connections in the province, Inner city multi-use space and Circular villages in the Green Heart.

At the beginning of every key project, it is shortly mentioned which desired scenarios they help to achieve, as well as which goals they help fulfill. If they help achieve a desired scenario, it means they directly help solve one of the current problems in the province. If they help reach a goal, it means they are actively helping achieve the vision seen in the previous chapter.

Desired situations

Less pressure on resources

Less pressure on space

Meeting densification needs

Increasing symbiosis with the land

Goals

Producing our own food

Spaces are multi-use

Enough space for future generations

The environment is of higher quality

4.3 Strategic interventions

4.3.1 Aquaculture in the North Sea

The sea is an area with untapped potential, with seaweed being one of the possible applications. The crop has many benefits and can be used in the transition to a diet which involves less meat and dairy and more plant based and local foods.

Basic principles

The seaweed that is in supermarkets right now has either an origin outside of Europe, or is for a large part the result of wild harvest. This wild harvest is usually very bad for the ecosystems present at sea (Zalig Zeeland, n.d.). There are currently a couple experimental seaweed farms in the North Sea producing a limited amount of seaweed, mostly for research purposes. One of them is located in South Holland, twelve kilometers off the coast of Scheveningen (Haven in zicht, n.d.). With the expected growth in demand for seaweed (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2018) and multiple hundreds of square kilometers suitable for the cultivation of seaweed in the North Sea (van Duren et al. 2019), the expansion of seaweed farming looks like a natural course of action.

On top of the practicality of it, seaweed also comes with some major benefits when it comes to the different uses of it. When seaweed is used as cattle feed, it can reduce their emissions with 82% (Kraaijvanger, 2021). The climate impact of humans eating seaweed instead of meat also has great benefits in terms of emissions as it cuts out the emissions of the cattle industry. It also ranks above soy-based meat substitute, as soy comes from countries far away and causes extensive deforestation in those countries (Milieu centraal, n.d.). Seaweed can be grown in the North Sea, cutting out transportation emissions, and it can also be combined with windparks, therefore using the space at sea more efficiently while also not infringing on sea routes and fishing areas. The uses of seaweed go even beyond the diet of humans and animals, as it also has pharmacological, clinical, biochemical and industrial uses (Sharma, Pati, & Nayak, 2016).

The ecosystem of the North Sea can also benefit from the introduction of more seaweed farming, as it can actually increase the water quality and support the local fish populations by increasing the amount of oxygen in the water and filtering out ammonia produced by the fish (Neori et al., 1996). The combination of fish and seaweed also increases the yield of seaweed.

Introducing and expanding

Seaweed is not well integrated into the daily life of inhabitants in the province yet. Hence it is very important how and when the introduction is made. The first step that can be made is the introduction of seaweed as food for cattle. This first step makes sure that starting seaweed farms have a market to sell their yield to, while also reducing the emissions of cattle aiding in the transition to a more sustainable meat- and dairy industry.

Getting people to eat more seaweed is a more difficult process. One of the first steps of this operation can be the introduction of seaweed through local restaurants and cafes. If you try a seaweed burger in a restaurant and you find one in the supermarket a few weeks later, it is no longer a new food to you which lowers the threshold to buy the product. The next few steps in this process go hand in hand; introducing it to supermarkets, promoting it and educating people on the health- and environmental benefits.

The introduction and expansion of seaweed farms opens up opportunities to reduce the meat- and dairy industry, an industry that is responsible for a lot of emissions, land degradation and take up a lot of space in the province. Seaweed is especially good as a meat substitute due to the high protein content of the plant (DiMaio, 2019). Reducing the meat-and dairy industry with 50% and introducing seaweed as a substitute will open up opportunities for a lot more projects and improve environmental quality at the same time.

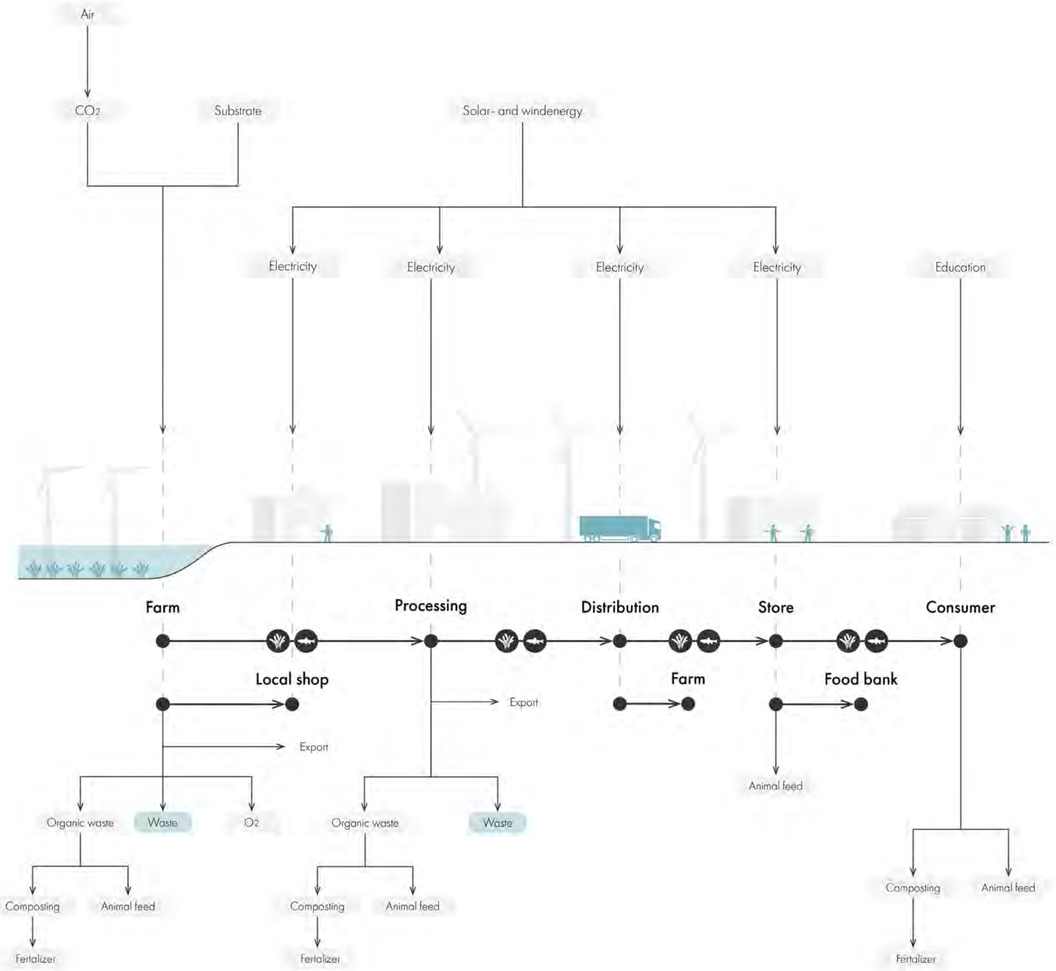


Figure 43: *New process*
By author

4.3 Strategic interventions

4.3.1 Aquaculture in the North Sea

Stakeholders

Farmers
For this transition it is very important that people are interested and motivated to start a seaweed farm. These farmers will need a sense of security that there will be a market for their products when they start their production. One of the places that is perhaps the most easy to start the production is expanding upon current experimental seaweed farms, but this sense of security is also needed for them.

Vattenfall
Vattenfall is the company who owns the wind farm in the North sea that is located off the coast of the province. To implement seaweed here, they have to be reassured that the cultivation of it will not interfere with their activities in the space.

Fishermen
The same that goes for vattenfall also applies to fishermen in the area, they must be reassured that the introduction of seaweed farms will not impact their catch or areas of fishing in a negative way.

Policies

Reducing cattle farms
The most difficult thing to achieve in this process is the reduction of cattle farms. Because of this difficulty, the focus for this reduction will not lie with buying out cattle farms completely, but reducing the size of large farms and making sure all cattle farms get a better price for their products. This will make it more economically feasible to be a smaller cattle farm and it will increase the price of meat in supermarkets, leading to a decrease of consumption which is necessary as the production goes down.

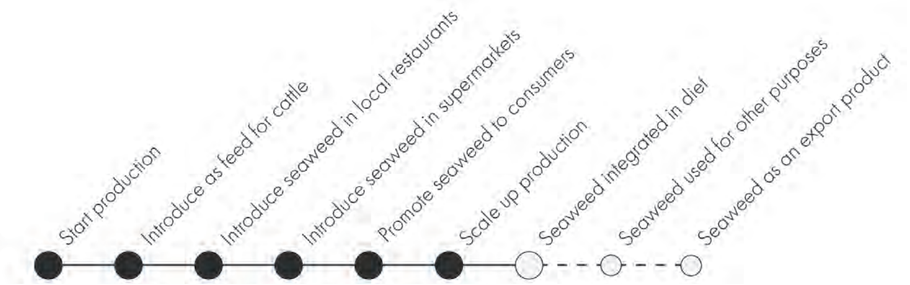
Education and promotion
As mentioned before education is extremely important in this process. Without people adopting this change in diet the increased production of seaweed has no place to go. So there must be an initial investment into education and promotion of seaweed products.

Contribution to a better 2050

Less pressure on space
Seaweed can be produced in places that are already in use as wind farms, thus taking up no extra space in the province. When taking the diet shift into consideration, this transition actually opens up a lot of space through the reduction of cattle farms. And some of the infrastructure used currently for the meat- and dairy industry in the port of Rotterdam can be used for the processing of seaweed.

Less pressure on resources and a better symbiosis with the land
Not a lot of resources are needed to grow seaweed in the North Sea as it fits into the present ecosystem and actually thrives through the presence of populations of fish and shellfish (Neori et al., 1996). Seaweed also has a unique capability to combat climate change as it is incredibly efficient in capturing carbon dioxide from the air, to be more specific, it is 20 times more effective per acre of land than a forest (Hurlimann, & Zucker, 2019).

Figure 44: *Stakeholders aquaculture*
By author



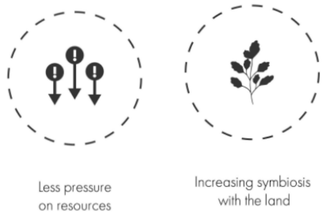
Timeline

"Looking out over the sea you can see the windmills in the distance. Some small boats float in between, reeling in seaweed from below the surface. It's hard to imagine that 30 years ago we barely ate seaweed, and the ocean wasn't as clean either!"
- Ricardo, 44 (fisherman)

Figure 45: *Impression seaweed*
By author

4.3 Strategic interventions

4.3.2 Circularity of the horticulture and meat and dairy industry



To reach circularity by 2050, it is key to invest in the sectors with the highest emissions. Both the horticulture and the meat and dairy sector are sectors with high emissions. These emissions come from the large usage of water and energy, and can be reduced with reusing its flows. Solving these issues will lead to a reduction of pressure on resources while also providing an increase of symbiosis between people and nature.

Basic principles

To increase circularity in both sectors there are two main principles that can be used: matching flows and reusing flows.

Matching flows means that current linear flows can be aligned with other flows. For example, the (residual) heat from external sources, like the port or a city, can be used as a source for heat in the greenhouses. When matching flows it is important to not only look within the sector, but to look at other sources and sectors as well.

Reusing flows is about minimizing waste and reusing that waste. The goal is not to recycle, but to upcycle. Which means that the use of resources is efficient and that these resources or their products can be reused afterwards. An example can be collecting wastewater and reusing it or reusing manure from livestock as fertilizer.

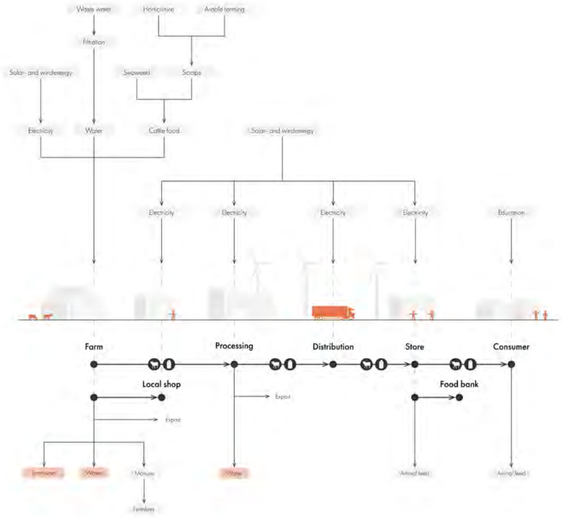


Figure 46: *New process meat & dairy industry*
By author

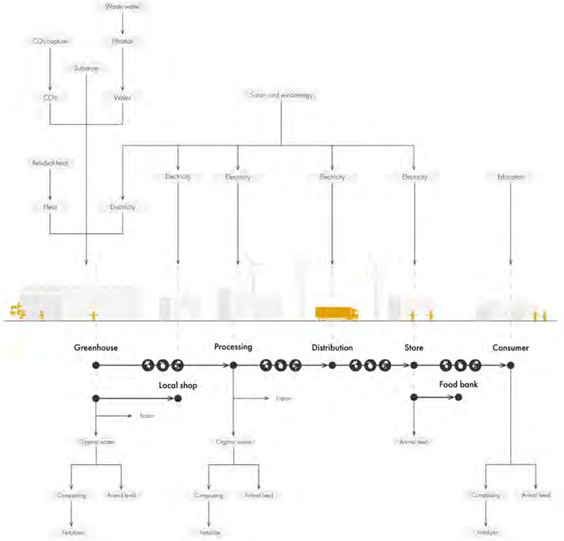


Figure 47: *New process horticulture*
By author

Resource flows

The meat and dairy sector is the sector with the least efficient use of space. It is also very difficult to create circularity within this industry. Cattle will always be producing emissions so absolute circularity will never be reached. However, on the way to a circular agri-food sector, these emissions can be reduced. By integrating seaweed as cattle feed, the cattle will cause less emissions. This does not make it circular, but it decreases the output of waste.

Reusing rain- and wastewater can be a way to reduce the water use of the sector, which is currently very high. Besides this, wind or solar energy can be used to provide the necessary input for the processing and distribution.

It is however inevitable that this sector needs to be reduced because an 100% emission free sector will never be reached. Until that reduction is fully complete, the best solution is to create an as circular as possible meat and dairy industry. This future flowchart is shown in figure 46.

The horticulture sector is the one with the most emissions but it is also the sector with the most potential. Currently most resource flows are not matched or reused and here lies the opportunity.

Most of the energy used by the horticulture sector comes from natural gas, which is a non-sustainable source. This can be reduced by using more sustainable flows like residual heat from either the Port of Rotterdam or nearby industrial sites and by using more solar and wind energy. Next to the demand in heat and energy, there is also a large use of water. To increase circularity, rainwater has to be filtered and reused.

It is not only the input that can make this sector more circular. Currently many crops are discarded as not sellable because of regulations. These crops however are of enough quality to be consumed. By selling these and other crops more locally, the chain can be shortened while also reducing the waste streams. Besides this, other organic waste can be used as fertilizer or animal feed. The result of the connection and reuse of these flows can be seen in the flowchart in figure 47.

4.3 Strategic interventions

4.3.2 Circularity of the horticulture and meat and dairy industry

Stakeholders

Farmers and the LTO
The main stakeholders for these interventions are the farmers and the LTO (Land en Tuinbouworganisatie / agricultural organisation). The farmers own the land and greenhouses and are the stakeholder with the most interest, the LTO represents them on a larger scale. Currently they are a fence sitter, meaning that this group awaits action or changes from other groups. This however changes if they are influenced either positively or negatively, and this change is mostly concerning money or the way of working. Farmers want to keep doing what they do. This does not mean they are not open to change. If governing bodies provide structure and money for these changes, they are open to apply these.

Port of Rotterdam
This stakeholder is expected to be neither completely positive nor negative towards these changes. When import is reduced, the Port might be losing money or jobs, which is not desirable. However, when connecting flows from the Port to other areas in the province, this stakeholder can provide for a circular transition, which is desirable for this stakeholder. This means that good talks with the Port are needed to make sure they are backing up these plans.

Supermarkets and other shops
This group of stakeholders includes small local shops and supermarkets. Local shops can benefit from these changes by selling local products, so they are mostly proponents. Supermarkets are however fence sitters. They do not really care as long as the price does not go up.

Policies

Matching flows and investing in infrastructure
To match and connect all flows of both sectors to other areas, infrastructure is needed. A policy needs to be created to make sure this infrastructure will be created so that both sectors can use this infrastructure when making the transition. Examples are the connection for heat between industrial sites and horticulture, but also areas in which seaweed can be collected and distributed towards the meat and dairy industry to be used as animal feed.

Financial incentives to become more circular / sustainable
To make sure farmers and owners actually apply this transition for their farms and greenhouses, a policy needs to be created which stimulates these stakeholders. By subsidising this transition, farmers can be convinced to join in these changes.

Selling locally
To reach the goal of selling more locally, there must be a better connection and relation between farmer and supermarket.

Contribution to a better 2050

Less pressure on resources
To reach circularity by 2050, resource flows need to be reused and matched between and within the agri-food sectors. By matching and reusing these flows of the horticultural and meat/dairy industries, pressure on resources will be heavily reduced.

Increasing symbiosis with the land
By making horticulture and the meat- and dairy industry circular and reducing the pressure on resources, the relation between people and nature can be strengthened. This makes sure people and nature are more in line with each other and can benefit from each other's strengths.

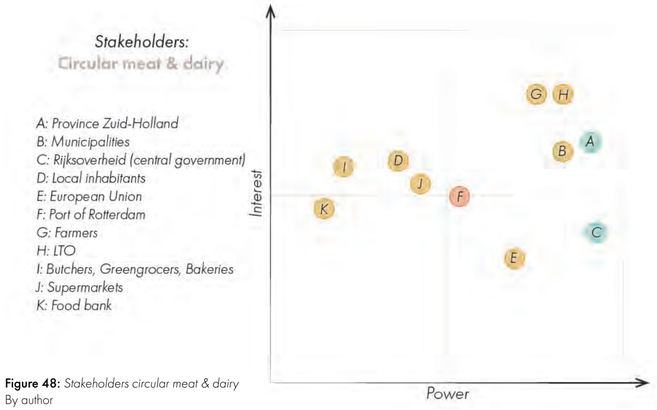


Figure 48: *Stakeholders circular meat & dairy*
By author

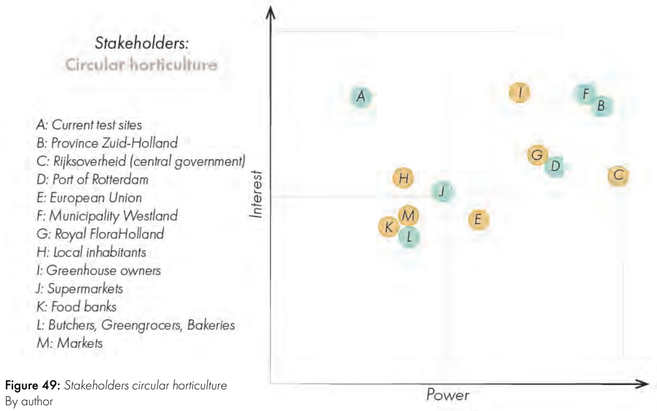
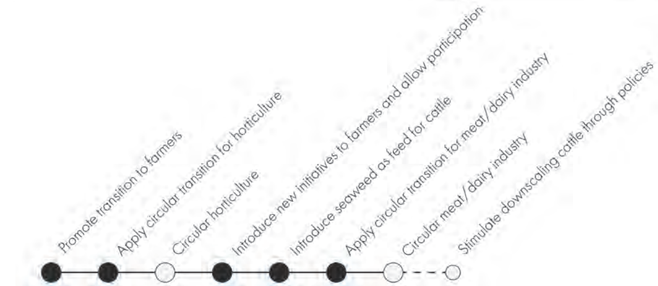


Figure 49: *Stakeholders circular horticulture*
By author



Timeline

Figure 50: *Impression*
By author

4.3 Strategic interventions

4.3.3 Polyculture

The way in which agriculture is applied in the province has a big impact on nature, biodiversity and the quality of the environment around us. It is therefore important to make sure there is a symbiosis between agriculture and nature.

Basic principles

Polyculture is based on the biological principle that diversity offers productivity in terms of the cultivation of food. Current agri-food systems rely mostly on monoculture, which creates little genetic variation in crops, these systems are kept productive by using large amounts of pesticides and fertilizer (Hinrichs, 2009). Through the implementation of polyculture the use of fertilizer and pesticides can be reduced significantly as the right variety of crops can create a soil that is higher in nutrients. The way this is done by rotating crops that grow in a certain area from year to year. An example of such a combination is carrots, lettuce and unions. By planting these crops in succession, they provide each other with nutrients which decreases and sometimes even eliminates the need to add these nutrients to the soil artificially (Lemire, 2017).

Permaculture brings polyculture to the next level by implementing a mix of different crops (and sometimes even animals, fish or insects) at the same time and profiting from how this variety increases the yield and makes the cultivation process more efficient. Examples of permaculture are food forests or polydomes.

The first example, a food forest, is less ideal to implement in the Netherlands, at least not on a big scale. The plants and trees that make a food forest so productive are not native to the Netherlands, sometimes not even native to Europe. The trees that are native just do not produce the desired amount of food for the province (Mergen, 2016).

The second example however, polydomes, have a very high likelihood of being beneficial to the province. The province already holds a lot of knowledge when it comes to horticulture and this mindset of innovation and technology could easily be applied to polydomes. A polydome combines the production of over 50 different crops with the keeping of bees, fish and chickens. A polydome maintains its own ecosystem which results in an extremely high efficiency of land use. To put it in perspective; the city of Rotterdam could feed 80% of its population with only 3% of the city's surface area (Except, 2011).

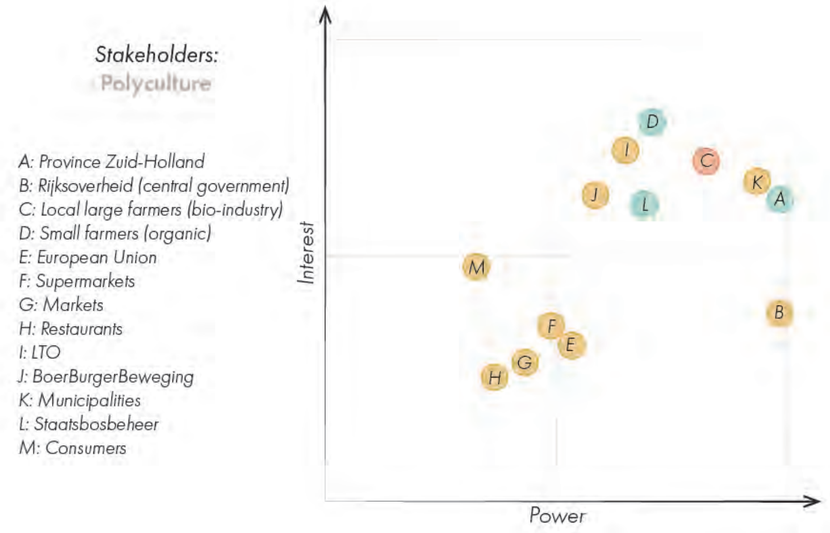


Figure 51: *Stakeholders polyculture*
By author

Stakeholders

The Main stakeholder involved in this process are the farmers. Although there are a lot of benefits involved for farmers, like a higher yield with less fertilizer and pesticides, it does take an extra effort on their part. Not only does the cultivation of different crops require different knowledge, it also requires different machines and tools. This makes it particularly hard for smaller farmers to implement polyculture as it requires a big investment to purchase the right machines for the job. Solutions to make the transition to polyculture for farmers easy and accessible are crucial to the success of these projects.

The biggest profit of the introduction of polyculture and permaculture is nature. But since nature itself does not have a voice it is up to the province and municipality to stand up for its needs.

Policies

Creating a network
Since implementing polyculture takes different knowledge and tools than most farmers currently have, the creation of a network could be greatly beneficial. In this network farmers can share knowledge, machines or even their land, to make it as easy as possible to transition to polyculture. These networks will look different for large farmers compared to the network of smaller farmers as they have different needs and priorities that should be taken into consideration

Education and motivation
Next to making it easy and accessible to implement polyculture through the creation of a network, it is incredibly important to show farmers what the benefits of polyculture are in terms of increased yield and efficiency. For the implementation of permaculture extra steps should be taken in terms of education for (aspiring) farmers. This can mean sharing knowledge from farmer to (aspiring) farmer or the creation of internship opportunities in polydomes.

If these actions turn out to not be enough for farmers to make the transition, financial incentives can be given to prioritize polyculture over monoculture.

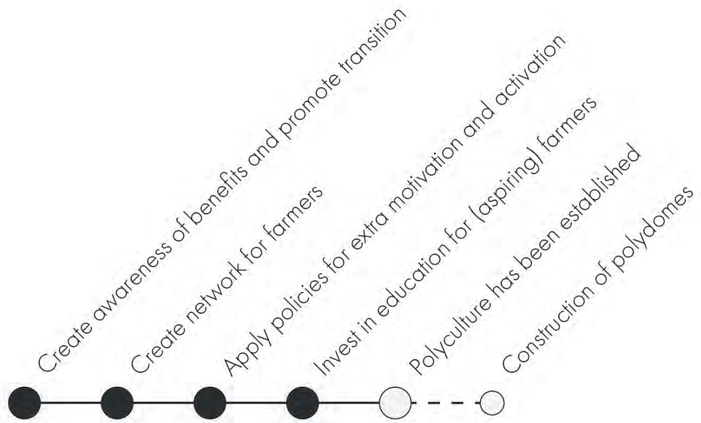
Contribution to a better 2050

Symbiosis with the land
The rise of polyculture and the increased differentiation of crops will increase biodiversity (Groen Kennisnet, 2020). Which is beneficial not only for the farmers, but also for nature.

Less pressure on space
Polyculture, especially polydomes, will increase the yield of farming on the same surface area, making it possible to produce more food with less space. This will open up space for other needs in the province, such as nature and housing.

Less pressure on resources
With the implementation of these projects regarding polyculture, the pressure on resources decreases. For arable farming it will mean that less fertilizer and pesticides are needed, for polydomes the decreased need for resources goes even further as water use is decreased significantly as well. On top of this the differentiation in crops and animals in one place offers opportunities to take full advantage of all the different resource streams.

Frontrunner in innovative farming
With the introduction of poly- and permaculture, especially ambitious projects like the polydome, the province can stay at the forefront of innovation and technology in the agri-food sector.



Timeline

"Last year this field was still full of potatoes and carrots, but this year there are a bunch of different things growing. Me and some other small farmers work together and rotate our land to increase the yield. I know my neighbour likes to lend out his machines in exchange for other ones so he can easily grow different crops on his land each year."

- Mateus, 35 (polyculture farmer)

"I started out as a 'regular' farmer. After a decade of growing the same crops I started missing the challenge, I felt like a was at the peak of my career with my only option being growing the farm and doing more of the same. I realised that my knowledge of farming and running a business in the agri-food sector could easily be applied to a broader set of issues like those in a polydome. I am extremely happy I made the decision to start working in a polydome. I am surrounded by like-minded people with each their own skills I can learn from."

- Merel, 38 (works in a polydome)

Figure 52: *Impression polyculture*
By author

4.3 Strategic interventions

4.3.4 Green connections

The population of 60% of different types of animals in the province have been steadily declining since the 1990's and 2000's, and this decline is even more rapid for endangered species in the area (de Knecht, van der Greft-van Rossum & Pouwels, 2012). The name of the Green Heart evokes an image of an area with lots of different plants, animals and trees and water, but the actual image for most of the green heart is far reaching grasslands with cattle as far as the eye can see. Lack of biodiversity is something that is hurtful to the environment and reduces spatial quality. Tackling this problem will improve our lives and those of local wildlife and plant species.

Overview of the possible areas

The green connections (figure 53) in South Holland will connect important areas like the Natura 2000 areas. To make sure these areas are connected, the land use of certain spaces need to change. The main change will be the reduction of the cattle farms. Because of this reduction, the space opens up for an increase of biodiversity.

Some areas in the province are or will be damaged by heavy subsidence. The main cause of this subsidence is the intensive land-use by cattle. When connecting the green areas, it is important to do this by converting the areas with a high risk of subsidence. To prevent subsidence, the amount of open water will be increased.

Creating a network

When connecting the natura 2000 areas, a network will be created for both humans and animals. This will contribute to biodiversity as well as to the quality of life. The Cities will be surrounded by green and open space will no longer only be reserved for cattle, making it a great area to use for recreation in terms of walking and cycling. To make sure these spaces will not be used for housing or other farms, policies need to be created to protect this new network.

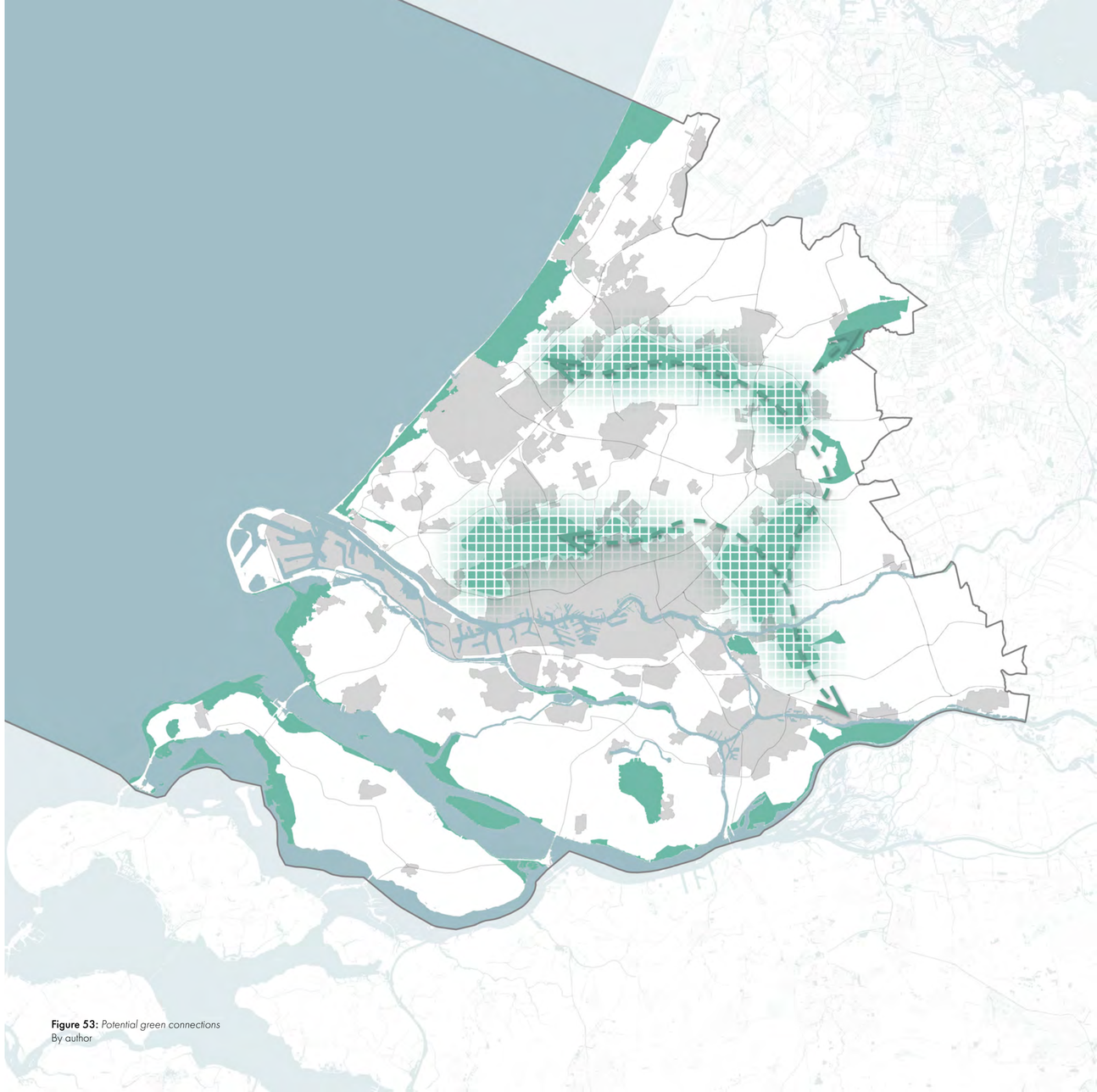


Figure 53: *Potential green connections*
By author

4.3 Strategic interventions

4.3.4 Green connections

Stakeholders

Farmers
The creation of these green connections is dependent on the reduction of cattle farms in the Green Heart. As mentioned before, this stakeholder will be the hardest to convince when it comes to the project of making green connections. They need to be reassured that a reduction of their farms will not lead them into economic trouble and helped along in the transition towards more small scale cattle farming.

Nature
Nature is a voiceless stakeholder, but will greatly benefit from the creation of these green connections as biodiversity will increase and local populations will thrive. These green connections with added water will reverse land degradation in the area and offer a more diverse and larger habitat for many species of flora and fauna. It is up to municipalities and the province to be a voice for the needs of nature.

Policies

Reducing cattle farms
As mentioned before, the reduction of the meat and dairy industry is a hard measure to implement and the main focus for this measure will lie in downscaling large farms. Getting farmers a better price for their products will promote this transition and make it possible for smaller cattle farms to stay in business.

Protecting current and future nature areas
When it comes to these newly created green connections, protection is the most important thing that should be implemented by the province. This is necessary to protect these areas from being overtaken by housing or falling back into the same pattern of land degradation through farming.

Contribution to a better 2050

Better symbiosis with the land
In the new situation we will no longer be battling nature for space to use for the agri-food sector, nature will be used to bring back a better balance in the area of the green heart. Bringing back biodiversity and creating larger habitats for native species, as well as combating the subsidence caused by peat oxidation.

An escape from the city
Not just nature will profit when introducing more nature and open water into the green heart. The environmental quality will be greatly increased, creating a great space for people to enjoy.

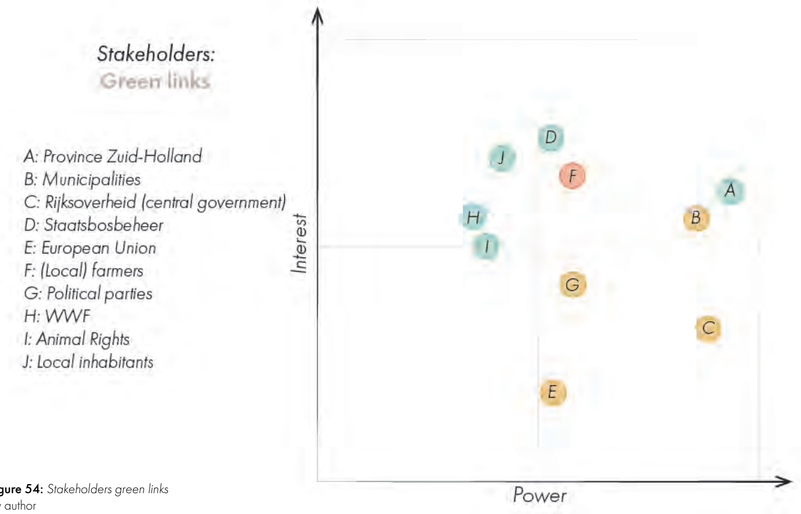
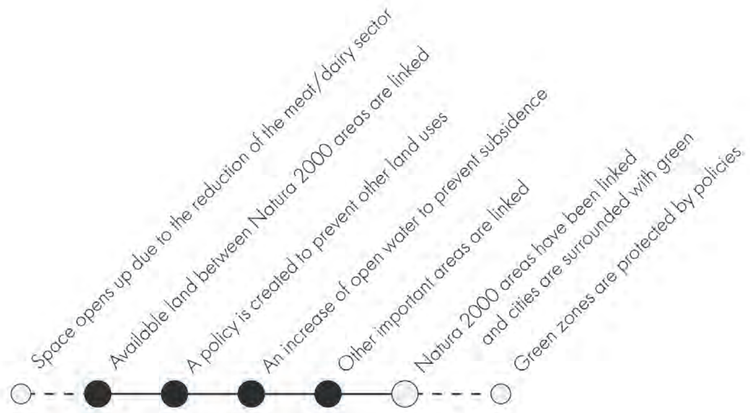


Figure 54: *Stakeholders green links*
By author



Timeline

"Walking through the green heart is way different than it was 30 years ago. Wide farmland with cattle have made room for free nature. Lots of animals have found a home here in the last decades and it's great to enjoy for us humans too!"

- Peter, 56 (often takes long walks or bike rides through the green heart)

Figure 55: *Impression green connections*
By arthur

A growing population does not only mean a need for more housing. It will also increase the need for food. As import and export from far away raise emissions, the creation of local food chains can be a solution to reduce this pressure on the environment. Bringing producer and consumer closer together and making it profitable for the seller and affordable for the buyer will enhance local food chains. Introducing agri-culture into cities is an effective way of bringing producer and consumer closer together. Due to the density of cities and the need for housing this can be done most effectively through multi-use space, combining living in agri-culture.

Overview of possible areas

For these multi-use spaces introducing agri-culture into cities, two types of neighbourhoods are identified as possible places. The first is neighbourhoods with current plans for new buildings / renovation of old buildings or other drastic spatial changes. These planned changes can be seen as opportunities to also make changes towards the implementation of agriculture.

The second is areas lacking behind in terms of spatial quality or that are dealing with other problems within the area. In these neighbourhoods multi-use spaces and inner city-agriculture can be used as a boost for the surrounding area and it can also bring the interest of developers into the area to invest in solving other underlying issues. Figure 56 shows the potential cities for this inner city multi use spaces.

Figure 56: *Potential areas for inner city multi use spaces*
By author

The hague, Zuidwest

One of the spaces where multi-use space could be implemented is a neighbourhood in The Hague called 'Zuidwest'. This neighbourhood has been assigned as a 'krachtwijk' (power neighbourhood) by the municipality, due to it being one of a couple dozen problem neighbourhoods in The Netherlands (Kompagnie, 2019). Implementing multi-use spaces in these types of neighbourhoods can give them a boost to lessen socio-economic problems in the area by bringing liveliness and opportunities to the area.

An example of how these multi- use spaces can be implemented in this neighbourhood through renovation and new buildings is seen below.

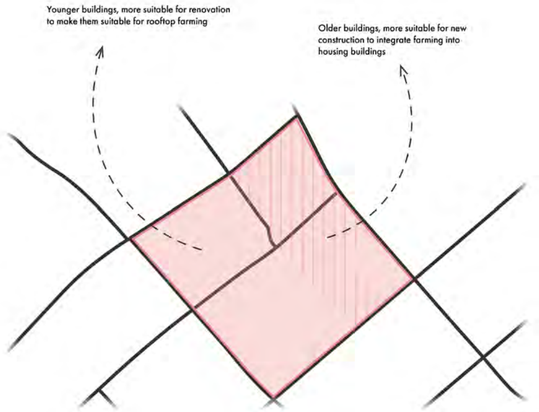


Figure 57: *chosen area for implementing a multi-use area, The Hague*
By author

The chosen area consists of two main parts, one with buildings mostly built in the 90's and after and one part with mostly post-war buildings.

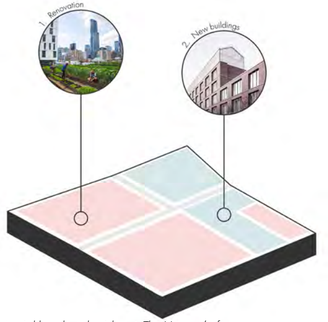


Figure 58: *New lay-out neighbourhood zuidwest, The Hague (reference images from (Living Architecture Monitor, 2020) and (Malvezzi, 2019))*

For the newer buildings renovation would be the best option. In the coming decades when it comes time to renovate these buildings, a modification can be made to implement farming on the roof, for some buildings a large renovation would not even be necessary if the roof can already support the extra weight. For the older buildings, demolishing and building up new buildings would be the best course of action. The current buildings are mostly three to four stories high and do not reach a very high degree of densification. Building up something new not only creates the opportunity to implement agriculture in the area, it also brings with it an opportunity to increase the amount of homes to meet the densification needs of the city and province.

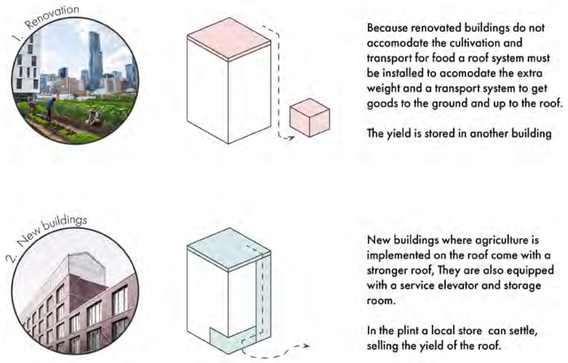


Figure 59: *Building design for implementing agriculture (reference images from (Living Architecture Monitor, 2020) and (Malvezzi, 2019))*

For most buildings, renovation would include accommodating the extra weight on the roof, as well as a transportation system to get goods on and off the roof. As the buildings were not designed for this new use, most likely the storage of the produce etc. would have to be placed in another building.

For the new buildings, the new farming function of the roof can be fully integrated into the building. This could include a service elevator to transport goods on and off the roof, storage space on the ground floor or basement and a roof that is equipped to deal with the added weight. Local stores or restaurants could also settle in the plint of the building, creating an extremely short chain from farm to fork. Just like selling locally is encouraged above selling to further away buyers, produce that can't be sold locally should go to other towns inside the province or inside The Netherlands first before export is considered.

Target groups and stakeholders

To really get rooftop- and city farming off the ground the co-operation of farmers is crucial. Investing in educational opportunities and involving farmers in new initiatives is therefore an important part of this project. A dairy farmer in South-Holland who has been farming in a certain way for decades is not likely to pack up everything he knows for a new project, but their sons and daughter might. Getting the next generation interested in new, sustainable and innovative ways of farming through educational opportunities like internships can provide the pull to get city farming started.

Workers on the farms can live close to their work in the apartment under and around the rooftop farms. A system could also be implemented where inhabitants of the buildings can volunteer on the farms in exchange for some fresh produce. Another option is that some plots are not part of a farm, can be rent out by inhabitants to grow some of their own food

For developers these changes must be economically feasible and it should not be in the way of the densification needs of a certain city. Showing them the benefits of implementing agriculture and what it can do for a neighbourhood in terms of quality and livability will give them the reassurance that homes can still be built and that it will be desirable for people to live there.

Lastly, there is an opportunity to get stores and restaurants to settle in the plint of the rooftop farm buildings. Buying straight off the farm can save them a lot of money as well as transport costs.

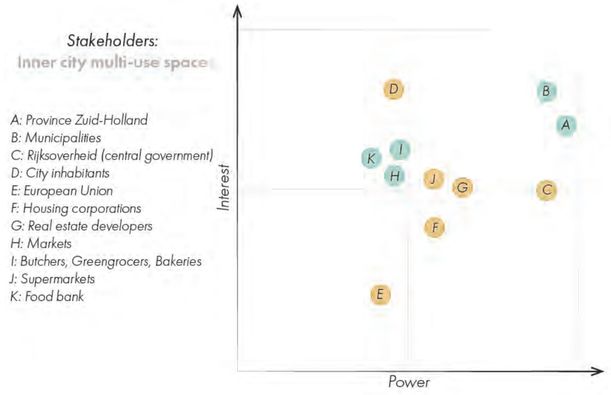


Figure 60: *Stakeholders inner city multi use space*
By author

Typologies

The implementation of inner city farming can be achieved in multiple ways. Three typologies that can be used are seen in figure 61. As discussed before rooftop farming on residential buildings is one of the most beneficial approaches when it comes to inner city farming as it gives the opportunity to implement farming, create local and short chains, but also leaves room for densification.

Another option is vertical farming. A vertical farm can produce a lot of food with a small footprint, but it does take up space in the city that could be used for housing. A balanced combination of both typologies is therefore vital to create enough homes and produce enough food for the province and its growing population.

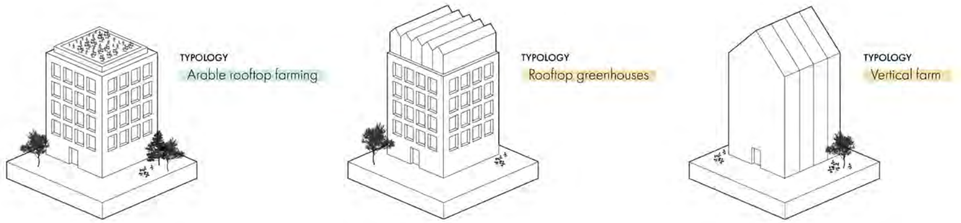


Figure 61: *Typologies inner city multi use*
By author

"I grew up on my parents dairy farm, I already knew back then that I wanted to go into farming. When I was in school I did an internship in a polydome and it really piqued my interest in new and innovative ways of farming. I now own a few greenhouses on the roofs of apartment buildings in The Hague. It brings me joy to share my love for farming with the people in my neighbourhood and I know I'm making my parents proud."

- Sarah, 35 (rooftop farmer)

Figure 62: *Impression inner city multi use*
By author, based on (POLTRED STUDIO, 2017; Space10, n.d.)

Policies

Selling and buying locally should have priority
One of the key elements of multi-use spaces in cities is the creation of local chains, with a more direct bond between producer and consumer. To achieve this policies should be in place to promote selling and buying locally for farmers and stores. This can be done in two ways; making it cheaper or easier to sell locally or making it more expensive to sell to buyers further away.

Incentive for developers and designated zones
The municipality should identify areas in their cities that are most suitable for city agriculture and give guidelines for the percentage of each typology that should be included in new development plans for the area. Developers should be educated on the benefits and opportunities of these areas and giving economic incentive to build in these areas if needed.

Education
Farmers or aspiring farmers should be motivated to come into the city to farm. Because this involves new and innovative ways of farming, there should be an investment in creating internships and educational opportunities in rooftop farms and vertical farms to spark interest with the next generation of farmers.

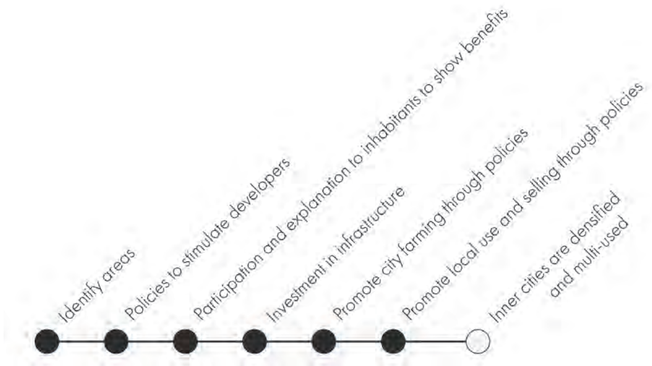
Contributing to a better 2050

Local chains and awareness
By creating local chains and bringing producer and consumer closer together transport is reduced significantly and awareness with consumers is increased. With an incentive to sell locally, people have an affordable and healthy source of food nearby.

Less pressure on resources
Not only does the reduction of transportation decrease emissions significantly, vertical farming uses a lot less water and other resources than other ways of farming. Inner city rooftop farming makes it possible to farm a higher variety of crops due to the different conditions of rooftops versus regular arable farming. This reduces the need for import from other countries. Lastly, bringing agriculture into the city will bring the sector closer to resource streams of the city and in return the city can more efficiently use the resource streams coming from inner city farming.

Providing more food
Using rooftops for farming and introducing more vertical farms in the city increases the space where food can be grown in the province and therefore increasing the production as a whole. With a growing population it is vital to have this increase in food production as it not only reduces the need for import, but also takes care of future generations food needs.

Meeting densification needs
With the integration of agriculture into cities, new buildings and renovations to old buildings will be made. These renovations and buildings offer the opportunity to increase the amount of housing in these buildings as well, which helps solve the housing shortage in the province.

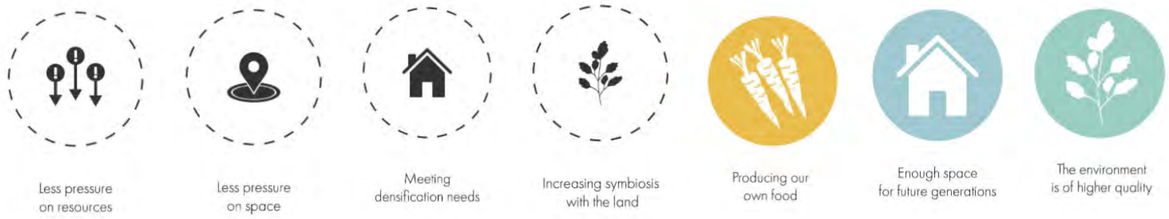


Timeline

"There are tomatoes growing on the roof of my apartment building. I get them from the store across the street. I really enjoy knowing where my food comes from. My neighbours help out with growing them in their spare time, it's great to see them all excited when it's time to harvest."

- Ali, 29 (inhabitant of apartment building with greenhouses on top)

Figure 63: *Impression inner city multi use*
By author



As mentioned before, the province of South Holland is camping with a housing shortage. So far the focus of the province and municipalities has been mainly on inner city densification. However, looking at the numbers, inner city densification may very well not be enough to fix this shortage of housing (Financieele dagblad, 2018). But where else can we build? The COVID-19 pandemic may have given an interesting twist in where and how people want to live. With working from home on the rise and an expectation that not everyone will return back to their office after the pandemic, housing needs for these remote workers have shifted towards a place with more space, closer to nature (Voermans, 2020).

Adding housing projects outside of the city, closer to nature brings a perfect opportunity to learn more about how housing can be more circular and more in symbiosis with the environment.

Overview of possible areas

For the potential areas for housing outside of the city,closer to nature it is important to look at a couple of things. The first is connectivity, living outside of the city should not mean that these new housing projects are completely secluded. This is also very important for people who do not work from home or come to work in the new village. A second factor is that there needs to be space for them. This space can open up through the reduction of the meat and dairy industry, these new villages will thus be built on land that is currently for cattle. A third factor is the protection of nature. These new villages can not infringe on current protected nature areas as well as new protected nature areas added in this project. With these criteria in mind some spaces for circular villages can be identified (figure 64).

To start off this circular housing project in the green heart one location is picked for a pilot village. This village will function as a pilot project to make sure that the circular systems are functioning properly. Lessons that are learned from this pilot can then be taken into consideration when it comes time to build more of these villages.

Figure 64: *Potential areas in Green Heart for circular villages*
By author

Pilot village

One of the first spots to open up due to a reduction of the meat and dairy industry is in the South-West of the green heart between Dordrecht and Gorinchem. This spot is part of a green connection running from the South to North of the province.

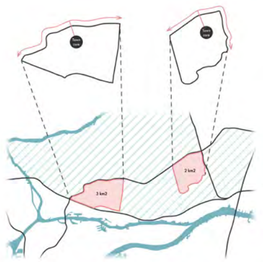


Figure 65: *two spots for densification in the South--West of the Green heart*
By author

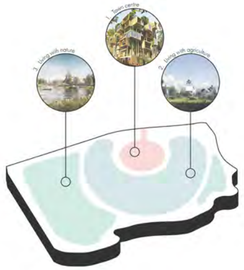


Figure 66: *lay-out of the pilot village*
By author, *reference images from ((Salzano, 2018) , (Global Architecture Archive, 2017 and (Crockett, 2016))*

The two spots shown in figure 65 are suitable for setting up a circular village as it is located on current cattle farms and the densification would not disrupt the new green connection or current protected nature areas. The surroundings of the villages will be used to increase biodiversity, strengthen green connections and combat subsidence by introducing more open water in the area.

The new circular villages will consist of three main parts: the centre, living with agriculture and living with nature. The centre contains amenities for the inhabitants as a store, community centre and gym as well as some denser housing in the form of medium to low height apartment buildings. This part of the village is connected to a larger road with good connections to other towns and cities. Living with agriculture is a part of the village that surrounds the centre and it includes smaller and bigger dwellings combined with greenhouses and farmspace. The final layer is the outer ring of housing bordering on the green areas. These areas will include smaller and bigger homes in a lower density.

Figure 67: *design of pilot village*
By author, *reference images from ((Salzano, 2018) , (Global Architecture Archive, 2017 and (Crockett, 2016))*

The whole village runs on a circular system while also generating its own electricity and its own food. A scheme of this system can be seen in figure 68.

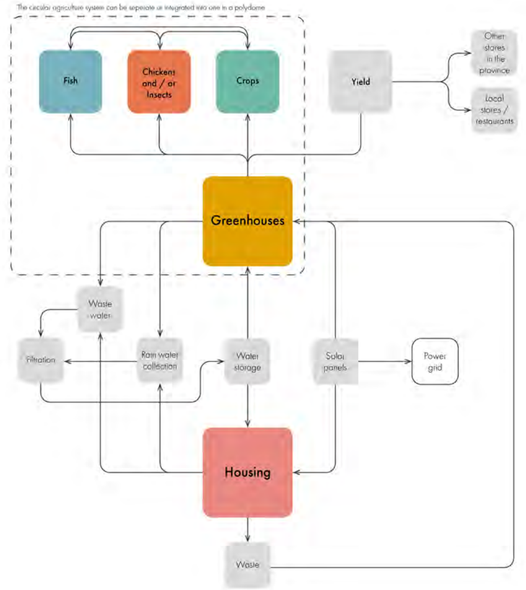


Figure 68: *circular system of the village based on systems from (Crockett, 2016) and (Malvezzi, 2019)*

For most buildings, renovation would include accommodating the extra weight on the roof, as well as a transportation system to get goods on and off the roof. As the buildings were not designed for this new use, most likely the storage of the produce etc. would have to be placed in another building.

For the new buildings, the new farming function of the roof can be fully integrated into the building. This could include a service elevator to transport goods on and off the roof, storage space on the ground floor or basement and a roof that is equipped to deal with the added weight. Local stores or restaurants could also settle in the plint of the building, creating an extremely short chain from farm to fork. Just like selling locally is encouraged above selling to further away buyers, produce that can't be sold locally should go to other towns inside the province or inside The Netherlands first before export is considered.

Target groups and stakeholders

Important for the circular villages in the green heart is to attract farmers, farm workers and technicians. This to set up and maintain the circular systems and farms within the village. These groups do demand a different type of housing for different incomes, so this is something that needs to be taken into consideration when setting guidelines for these towns.

Next to people who work in the village themselves, people who work from home or closeby would be a great match for living in the village. With working from home becoming more prominent, people who no longer have the need to live in a city close to their work can start looking at places with more space outside of cities (Voermans, 2020).

The villages are also a great opportunity for people in neighbouring towns and villages to get in touch with a circular way of living. Having a restaurant or community kitchen where people from outside the town are welcome can get them excited about living with a closer connection to nature and the food we eat.

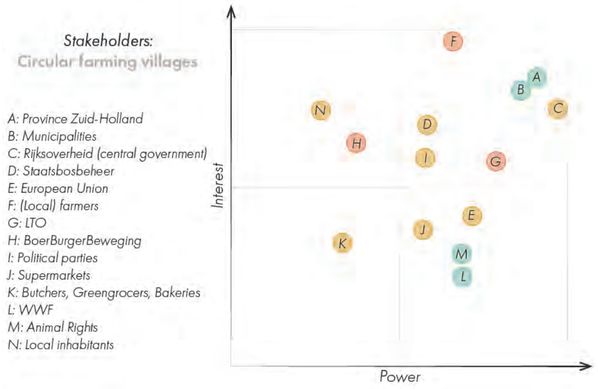


Figure 70: *Stakeholders circular village*
By author

Typologies

One of the goals of this village is to make this place accessible not only to the wealthy, but to make living with nature and the land affordable for everyone. Another reason why this is so important is because the housing need in the province is largely in the lower to middle range. The typologies in the village cohere to this problem by incorporating tiny homes and apartments into the village with a mix of rent and buy. The other typology that is added is family homes that can vary in size from around 3 to 5 residents.

Through implementing these typologies, the villages will achieve a mix of people varying in job, income, age and family composition.

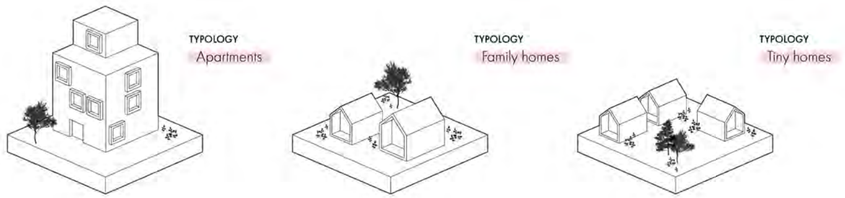


Figure 69: *Typologies circular village*
By author

Figure 71: *Impression circular village*
By author, based on (Space10, n.d.; EFFEKT, 2011; Excepi, 2011)

Policies

Limiting the growth of villages and protecting green connections
With the introduction of any type of housing projects in the green heart it is crucial to protect green areas and limit the growth of the project. Densification will always be second place to the goal of creating green connections and increasing biodiversity. To achieve these limits have to be placed on the growth of these villages. This means placing strict guidelines for the density and amount of houses that can be built. On top of that the newly created green connections should be protected, ensuring that housing projects do not infringe on the biodiversity of the area or the habitat of local wildlife.

Education
Another important factor to make these circular villages succeed is education, not only for inhabitants to get excited to live in a new, more sustainable way, but also for farmers to take an interest in these villages and start taking part in the process. Creating educational opportunities and internships for farmers and aspiring farmers will give this transition the push it needs.

Contribution to a better 2050

Less pressure on resources
By creating a system within the village that is completely circular, the footprint of the village is extremely small. By putting these different systems close together they can benefit fully from each other's resource streams and keep transport and emissions to a minimum.

Setting an example
Achieving circularity in the villages in the green heart opens up the opportunity to learn from the innovative and new ideas that take place. Creating circularity that works on a smaller scale creates chances to translate it to other new developments like neighbourhoods and eventually whole cities.

Creating enough affordable housing with a high quality
New housing projects outside of cities will increase the amount of houses that we can build for people, contributing to the solution for the enormous housing shortage of the province. As most of the housing shortage consists of a lack of affordable housing, creating these typologies will help out lower to middle income inhabitants.

Awareness of our footprint
Living in circular villages will bring people closer to nature and the impact their choices have on the environment around them, as well as making healthy food cheap and available nearby. This will motivate people to make more sustainable choices by making it easy and affordable.

Timeline

"Ever since the pandemic I've been working mostly from home. I no longer had the need to live in the city close to my job. I thought I would never be able to afford living in open nature, but with the newly built tiny homes in the green heart I can! There is nothing I enjoy more than living on the edge of a forest and buying my produce straight from the land."

- Marcel, 54 (inhabitant of green heart village)

Figure 72: *Impression circular village*
By author

5. Conclusion

Local Food, Lower Footprint

5.1 - Conclusion
5.2 - Discussion
5.3 - Ethics
5.4 - Sustainable development goals
5.5 - Individual reflections

This concluding chapter contains a conclusion that summarizes our entire vision with the associated interventions. After that, the discussion will tell what we think are the weaker points about our entire project and what could be done better in the future. Finally, there will be an individual reflection for each person which reflects from an individual perspective on the project, the group process and their own part in the group process.

5.1 Conclusion

South Holland is full of opportunities to move to a more circular and sustainable agri-food sector by using space and resources more efficiently. Each of the sectors within agriculture has a foundation on which it can build towards a circular future. Solving the biggest problems within the province, pressure on resources, pressure on space, a growing population and a lack of biodiversity / symbiosis with the land, can be combined into an overall transition to circularity and sustainability.

Goals need to be set up to not only solve the current problems, but look further towards the 2050 we want to live in. Producing our own food will help us reduce emissions caused by transport as well as taking away the part we take in environmental damage through agri-culture in other parts of the world. Making spaces multi-use will decrease the pressure on space as well as give an opportunity to create local chains with accessible healthy food. Creating enough space for future generations will not only solve the current housing shortage, but will also take pressure off the next generation by making sure there is enough space to live and enough food to eat. Creating an environment with a higher quality will not only support local wildlife, but also increase quality of life for people.

Setting these priorities and investing in them early can get us in front of the circular transition instead of lagging behind it, trying to solve problems as they come. In 2050 we can live in a South Holland with a cleaner sea, more quality nature and enough food and housing for everyone. These spaces can be of high quality and affordable at the same time and offer a place for everybody.

Key projects to implement when trying to achieve this vision of 2050 are; creating a more circular horticulture & meat/dairy industry, implementing more polyculture, introducing more multi use spaces in cities, creating circular villages, creating green connections and introducing aquaculture.

Answering the research questions

How can we use the space for agriculture more efficiently?
Using agricultural space more efficiently can be achieved through multiple interventions. First of all, industries with a high land-use compared to the output of products can be reduced. In South-Holland, this is the meat- and dairy industry. Secondly, the yield of current sectors can be increased through the implementation of polyculture and permaculture. The third intervention is using the seascape more, through the introduction of aquaculture. Lastly, more multi-use spaces can be implemented. An example of this is rooftop farming and the combination of wind farms with seaweed cultivation.

How can we decrease import and produce more locally?
To produce more food locally certain actions need to be taken. The first being the increase of the production of certain crops. Cattle feed is now mostly imported, but by starting seaweed production, this import is no longer necessary as the cattle can eat seaweed instead. Secondly, efforts can be made to bring producers and consumers closer together. This can be done through implementing farming in villages or creating multi-use spaces in cities, where agriculture and living come together. These actions however can not succeed without policies in place that favor buying and selling locally.

How can we combine the spatial effect of the circular transition with an increase in housing?
The circular transition can be combined with an increase in housing in two ways. Firstly, through multi-use spaces. Inserting agriculture into cities takes renovations and new buildings. These projects can be combined with housing projects, that way homes and agriculture spaces can be created at the same time. The second way is by creating circular villages on spaces that used to be for cattle farms. This way more houses are created while also testing circular concepts on a village scale.

How can people benefit from these changes?
There are three main ways that people benefit from the transitions described in this project:
1. Through the implementation of multi-use spaces and the favoring of selling and buying local food, healthy and affordable food is accessible to everybody.
2. The circular transition is combined with an increase in housing, therefore making affordable housing more accessible and decreasing the housing shortage.
3. The interventions in this project will increase spaces for nature with more quality and biodiversity.

5.2 Discussion

This project is not without flaws and we must acknowledge some of the missing links as well as some shortcomings of this project. The following things are important to keep in mind when considering the measures suggested in this report.

Circularity
The assignment for this project was to make steps towards a circular agri-food industry, but the circularity sometimes falls to the background in this project. With an urbanist background, space and how it is used sometimes comes to the foreground stronger than circularity.

Attracting opposition
This report makes a few choices that can attract a lot of opposition from stakeholders. The two main subjects that can attract this opposition are the reduction of the meat and dairy industry and the implementation of housing in the Green Heart. These decisions can create a fierce response with one or multiple stakeholders and these possible reactions make these projects more risky to carry out. This does not mean that these projects are necessarily a bad idea, but it does mean that a lot of attention needs to be paid to these stakeholders throughout the process and there is the risk that tensions will rise so high that trying to implement these projects becomes extremely hard.

The housing project in the Green Heart
As mentioned before, the housing project in the Green Heart can attract some opposition and this opposition is not completely unwarranted. If the policies to regulate the growth of the villages and protect the surrounding nature are not handled well there is a risk of housing taking over the Green Heart which is not at all the desired situation. It is therefore key that these policies are handled correctly and well communicated to all the stakeholders.

The por t
Even though the port of Rotterdam is an extremely important part of the province, the economic repercussions of the changes made in this project are not thoroughly discussed. When diving deeper into the topics discussed in this report, these impacts should be looked into further.

5.3 Ethics

When talking about ethics, one intervention in this project comes up most prominently and that is the reduction of the meat and dairy industry. The method in which this reduction is realised is through offering an alternative (seaweed) and raising prices of animal products. This however does lead to a disparity between socio-economic classes in society. It creates a system where meat and dairy is accessible for wealthier individuals and not for poorer individuals. This places the burden of the diet change on the shoulders of those with a lower income.

Another point this brings up is the expectation that people will change. Through the reduction of the meat and dairy industry and the implementation of more aquaculture the diet of people in the province will change, but is it reasonable to expect, and maybe even to a certain extent, force people to change? Maybe to even a greater extent we expect farmers to change, putting the large burden on their shoulders to 'fix' the impact we and our actions have on the environment.

5.4 Sustainable development goals

The UN's sustainable development goals form a guideline for sustainable development (United Nations, n.d.). The project explained in this report helps to work towards nine of these goals. They include good health and wellbeing, quality education, clean water and sanitation, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land and partnership for the goals. Some of these goals even play a very major role in this project.

11. Sustainable cities and communities
This goal is most prevalent in the interventions to make circular villages. These villages have the intent to reduce their footprint to a fraction of what our current way of life demands. On top of this it strives to not only make these places accessible to wealthier individuals, but offer affordable housing options as well.

14. Life below water
With the introduction of aquaculture in this project, the opportunity opens up to improve water quality and support local fish populations. This causes an effective increase in the quality of the North Sea.

15. Life on land
Through the creation of a green network in the province, biodiversity can increase and land degradation can be combated. These changes will boost local ecosystems and provide more spatial quality for inhabitants. Because of the development of more local food chains and more local food production, import can be decreased and the impact on nature through agriculture in other parts of the world will also be reduced.

5.5 Individual reflections

Froukje Visser

Implementing something as huge as the circular transition to a regional scale is challenging. A vision for such a large scale has a lot more variables than you can picture at once. This made navigating this project, especially in the beginning, harder than I have experienced in other projects before. But it is also this aspect that made me learn a lot of new things quickly. Which I found to be very valuable throughout this project.

It is however also in this complexity that we lost some detail in this project. For example, in this project the key stakeholders are named and the focus lies with getting these stakeholders on board with our plan. I think in actuality there are more stakeholders that could be key to achieving these projects or could form blockades on the way. This could have been analysed in more detail and would have made the strategy stronger.

Another thing that could have been more fleshed out was the vision. Because the vision was the main subject for the midterm presentation, we lost sight of it a little bit when working on the strategy, resulting in a very detailed strategy of a less detailed vision. More on the process side of things, there could have also been a better balance between research and design throughout this project.

Lastly it is impossible not to mention the slight difficulties that were caused by doing this project digitally. I think the main issue we had when doing this project digitally is that the overview on other people's work was limited. There was less knowledge of what exactly everyone was doing and how well it was going which ended in some last minute work that could have been avoided if that overview was present.

Lisanne den Held

First of all, I underestimated the depth of subsidence of this course. The amount of research outside of the build environment makes this unknown field of agriculture very interesting and on the other hand quite a challenge. It seems almost impossible to fully understand and explain brought up interventions in order to make their credibility undoubted. Hence, this exercise makes us do that. This means that brought up interventions feel a bit short sighted and maybe even useless through the eyes of an professional. But I do believe that this way of looking at the problem concerning the build environment in combination with agriculture can make the reader of this design proposal think of new, credible, proposals.

Because of a personal situation, I sadly was not able to dive into the substance as much as I would have wished to. Luckily, this group exercise makes it possible to learn from others gained knowledge as well, which for me checks one box of the learning goals. I do believe that this course has thought me to be able to combine other (new) disciplines with the already gained knowledge, an ability which is very useful within future exercises.

Hidde van Beek

Reaching circularity by 2050 will be a challenge for multiple reasons. Important stakeholders must be convinced to choose sustainability over easy solutions and obvious methods while also keeping in mind to leave no groups behind. But we cannot continue to keep going the way we are currently going, so change is needed. The agricultural sector currently puts a lot of pressure on both space and resources. To reach circularity in this sector, choices need to be made and not everyone can be happy with these.

This report shows a possible transition to a (nearly) circular agri-food sector by 2050. By cutting the meat and dairy sector by 50%, a lot of space opens up for this and the next generation. Farmers will not always be happy about this, and this can be a obstacle in the strategy. By providing other and new opportunities to this group, the sector can be modernised, preventing possible future problems. The spaces opening up by the reduction of the cattle will partly be used for small circular farming villages. With this path, the strategy takes a risk. By appointing locations in the green heart for housing, developers can view this as an opportunity to increase their profit. Strict regulations are needed to make sure these circular villages stay limited in size, ensuring the preservation of the green structure. The strategy discussed in this report takes high risks, but not without rewards. Political parties are discussing the reduction of the meat and dairy sector without actually proposing plans for it. By showing possibilities to decrease this sector and proposing opportunities for the farmers who are hurt by these interventions, new ideas can be gathered.

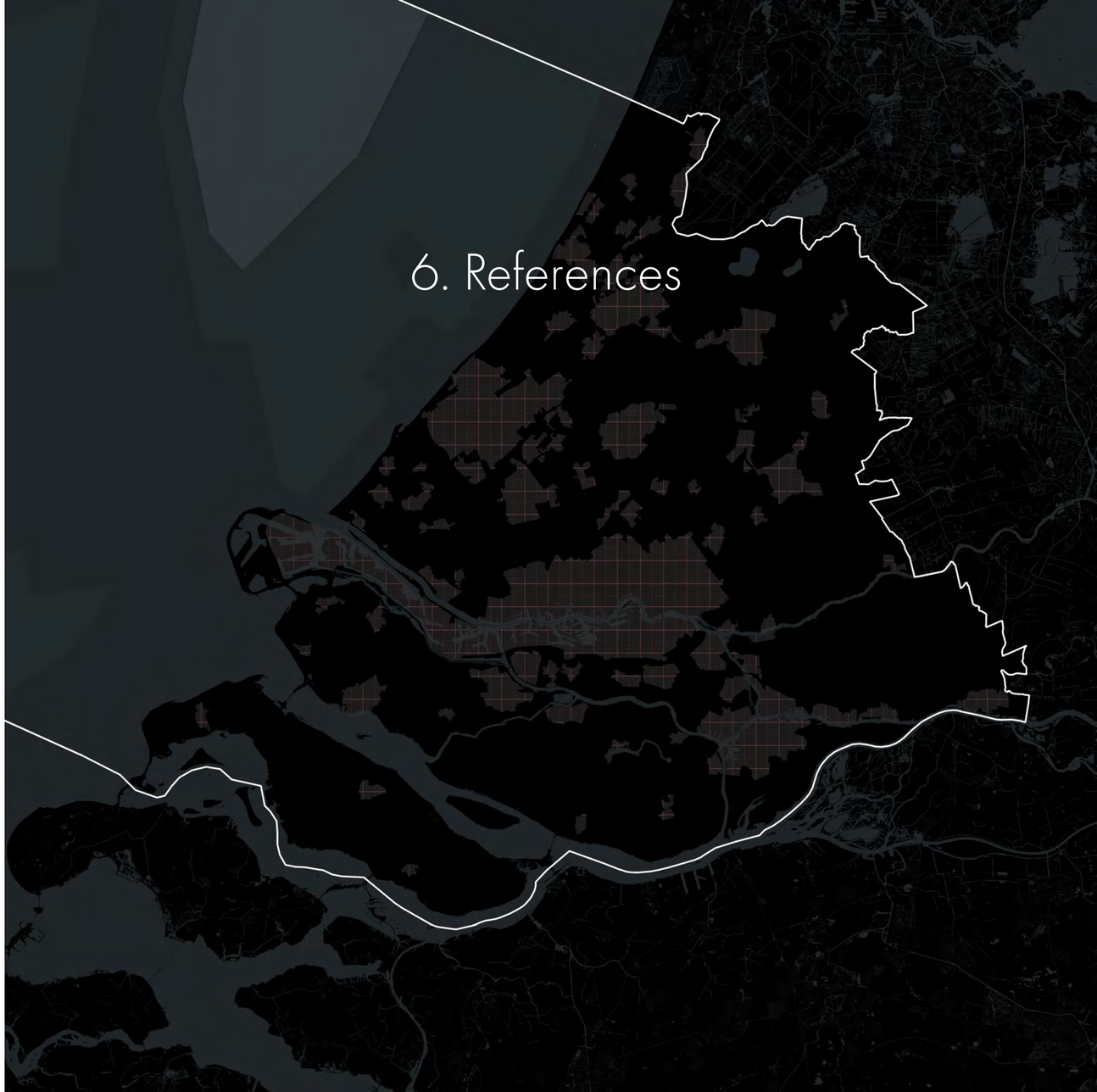
The course has been done completely online. While having some benefits, it has also had its downsides. I sometimes felt restricted in communications during group meetings and our group has had its problems over the past few weeks, creating an uneven distribution of workload. Despite these struggles, I think we can be proud on the result.

Dennis Groen

Reaching full circulairity in 2050 for South Holland will be very challenging. So have I experienced this project as a quite challenging project. It was the first time that I have worked on such a large scale. Working at a regional scale brings many variables and stakeholders that are involved in planning and design with it. I was a little worried about the complexity and scale of the task beforehand, it seemed difficult to keep an overview. However, I think that in general we as a group were able to keep a good overview, by constantly zooming out to the bigger picture. This is an aspect that I certainly learned in this project.

Another aspect I learned in this project is to make all the interventions that you want to do in an urban planning project on a large scale spatial. In the beginning of the project, we were mainly working with text, diagrams and tables for our interventions. But when we later started to make it spatial, we only found out what the interventions really did and what the consequences were. In a next project, I will take this into account from the beginning.

As far as the group process is concerned, I think we have generally been working steadily week by week. Only at the end we still had to finish things with some time pressure. The fact that the entire project was digital was unfortunate, but I think we handled it well by scheduling a lot of digital meetings on fixed times. In the end, I am satisfied with the result, but if it was possible to meet physically, I think the cooperation could have been more efficient, which would have benefited the end result.



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