LIVING EDGES

Embracing adaptability as opportunity for creating living edges in the Province of Zuid-Holland

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COLOPHON

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PREFACE

This report presents a regional planning and vision to the Province of Zuid-Holland (PZH) for the year of 2100 and proposes a strategy to realise this vision. This report was made during the third quarter of the first year of the MSc Architecture, Urbanism and Building Sciences at the Delft University of Technology, for the track Urbanism. This report was created during a 9 weeks course titled: ''AR2U086 R&D Studio – Spatial Strategies for the Global Metropolis'' and ''AR2U088 R&D Methodology for Urbanism Research and Design Studio''. The R&D studio dealt with issues related to circular economy, spatial justice and urbanisation in the Province of Zuid-Holland.

Because of the COVID-19 pandamec the last weeks of these courses were offered online. This meant teachers and students met online, discussing progress and following lectures. We would like to thank all the teachers for the way they handled this sudden transition from physical to online education.

This report was created by an international team of students from different backgrounds, who are all Msc students of the track Urbanism at the Delft University of Technology:

- Jan Eggink, Dutch, BSc Architecture and Built Enviornment graduate from the Delft University of Technology.
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ABSTRACT

To help combat climate change, promote sustainable development and match the goals set in the Paris Agreement, the Province of Zuid-Holland wants to transition to a circular economy. To make this transition successful, the Province ought to adopt an integrative approach, addressing other elements such as socio-spatial inequality, pressure for urban expansion and economic challenges that have to be integrated in the transition strategy.

The following report describes these elements and the challenges they bring and proposes a vision and a development strategy based on the sector where these elements connect: the agri-food sector. Zuid-Holland's agri-food sector is an important link in the global economy, and many of its infrastructures are oriented towards export through the Port of Rotterdam. However, there is an unequal distribution of profit and power related to the agro-food sector, which results in socio-spatial inequality.

Through quantitative and qualitative analysis of both the physical and social environment, we conclude that the spatial pressures and existing challenges are most present in the edges of the province's biggest cities. Hence, the Living Edges project envisions how the linear global agro-food sector can be transformed into a circular regional agri-food sector in a social just way . By designing a strategy in which this transition is detailed in space, the project aims to decrease socio-spatial inequality through bypassing the linear food system with interventions in the edges between the urban and rural areas. It does so by increasing diversity, social cohesion and equitable access to healthy, affordable food. As a result of efficient local circular production, the delta province will have more space for regenerative, nature-based and robust water defense systems.

The vision and strategy designed by the Living Edges project provides tools for emancipating the province from the linear global economy towards a local, equitable and circular economy. Through networked governance with a multi-scalar focus, the Province of Zuid-Holland can be an example to other similar regions in Northwestern Europe and promote the idea of a just region.

Dynamic Adaptation Policy Pathways are advised for the strategy in order to incorporate deep uncertainty in the long-term, large scale project. By using stakeholder engagement strategies, including stakeholders in different ways corresponding to the variety of scales and phases.

Key words: Circular Economy, spatial justice, climate change, agri-food sector, Province of Zuid-Holland, stakeholder engagement strategy, Dynamic Adaptation Policy Pathways

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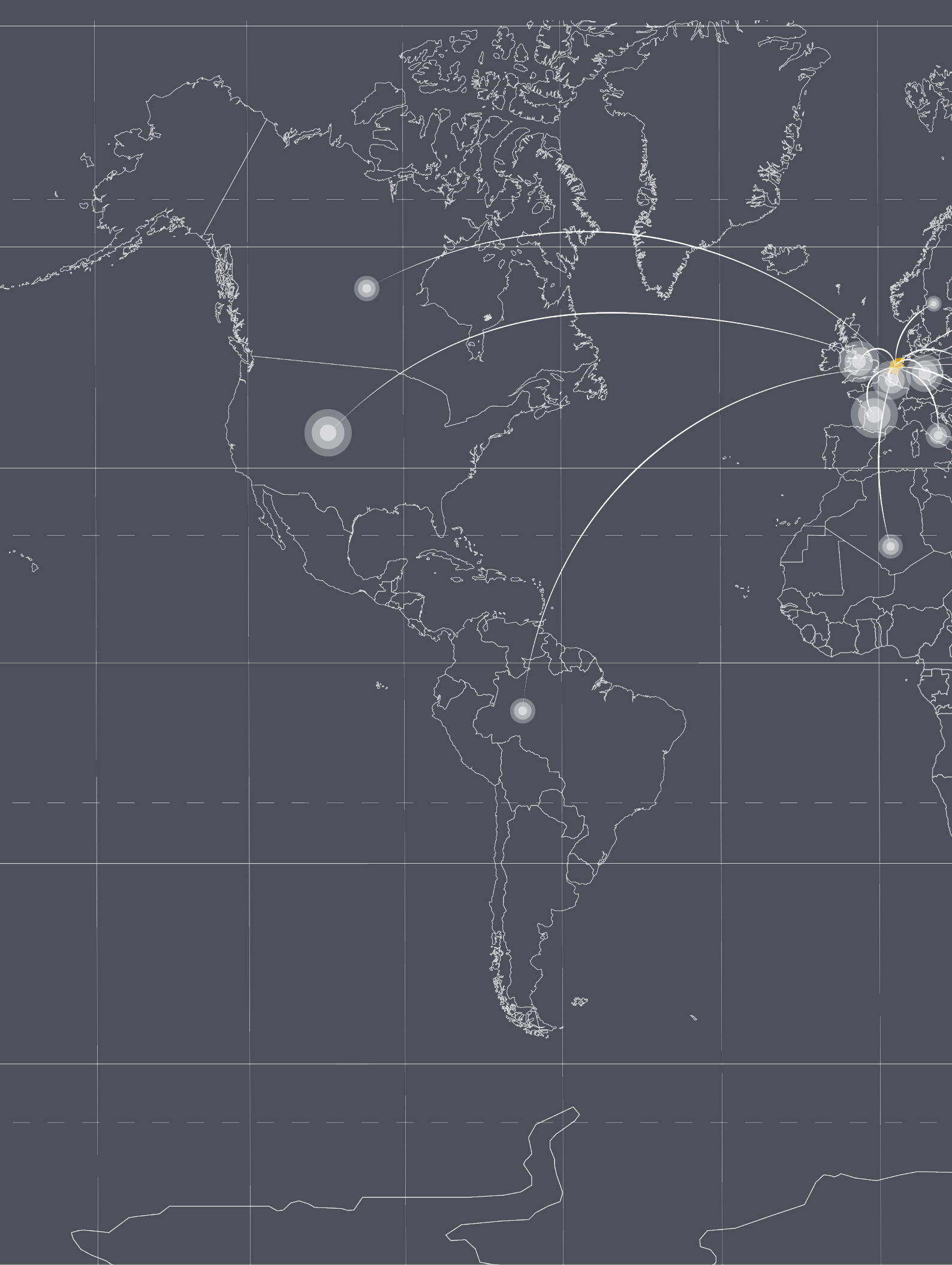

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INTRODUCTION

Figure 1 The Netherlands as global food producer. (Illustration by authors).

1.1 | GLOBAL PERSPECTIVE

Global food chain

Never before has food been so abundant in the Netherlands as it is today. The country sits on a highly interconnected logistical global network and takes advantage of this to place its production on the global market. The Port of Rotterdam serves a key element to this system, importing and exporting goods for the province but also through it to the rest of Europe and the world.

In 2019, The Netherlands agri-food products export amounted to 94,5 billion euros. and imports to 64,1 billion euros in 2019 (Jukema, Ramaekers, Berkhout, 2020). The country's economy is highly reliant on this production chain and works to reinforce its position.

Monocultures deplete

Consequentually, landscapes are being strongly depleted given the fact that they are being over explored to serve other regions of the world as well. The crops grown on these monocultures are often genetically modified to ensure multiple yields (Wilson, 2014). More energy and raw materials are needed to maintain these highy industrialized landscapes and so, other landscapes are captured and transformed into raw material producing landscapes. This development model is unsustainable in the future, and the consequenes of their effects can already be felt, on site with soil depletion and globally with climate change.

Damaged landscape

If we continue to mass-produce our food, we will eventually deplete our landscapes. Through the use of agrochemical input, overgrazing or the use of transgenic crops these monocultures can become depleted, resulting in deforestation, displacement of land and other environmental problems (Altieri, 2009). Socieities and economies dependent on these global productive chains will suffer with the future crisis of depleting landscapes, but also depending on where you are in the world, might struggle more to transition into another productive system.

Break the global food chain

This scenario should be rethought. Breaking free from the global food chain and regenerate production landscapes, serving more contextualized regions. Collectively, we need to reverse the historical global traditions of deforestation and forest degradation and restore our landscapes with regenerative ecosystems. In addition, the diverse, productive forests offer environmental benefits that mitigate effects of climate change, increase food security, and safeguard soil and water resources (Chazdon, Uriarte, 2016). The Province of South Holland must reinvent its economy, and become less dependent on the influence of the Port of Rotterdam in other sectors of its economy if it wishes to truely transition into a more circular regional system of production.

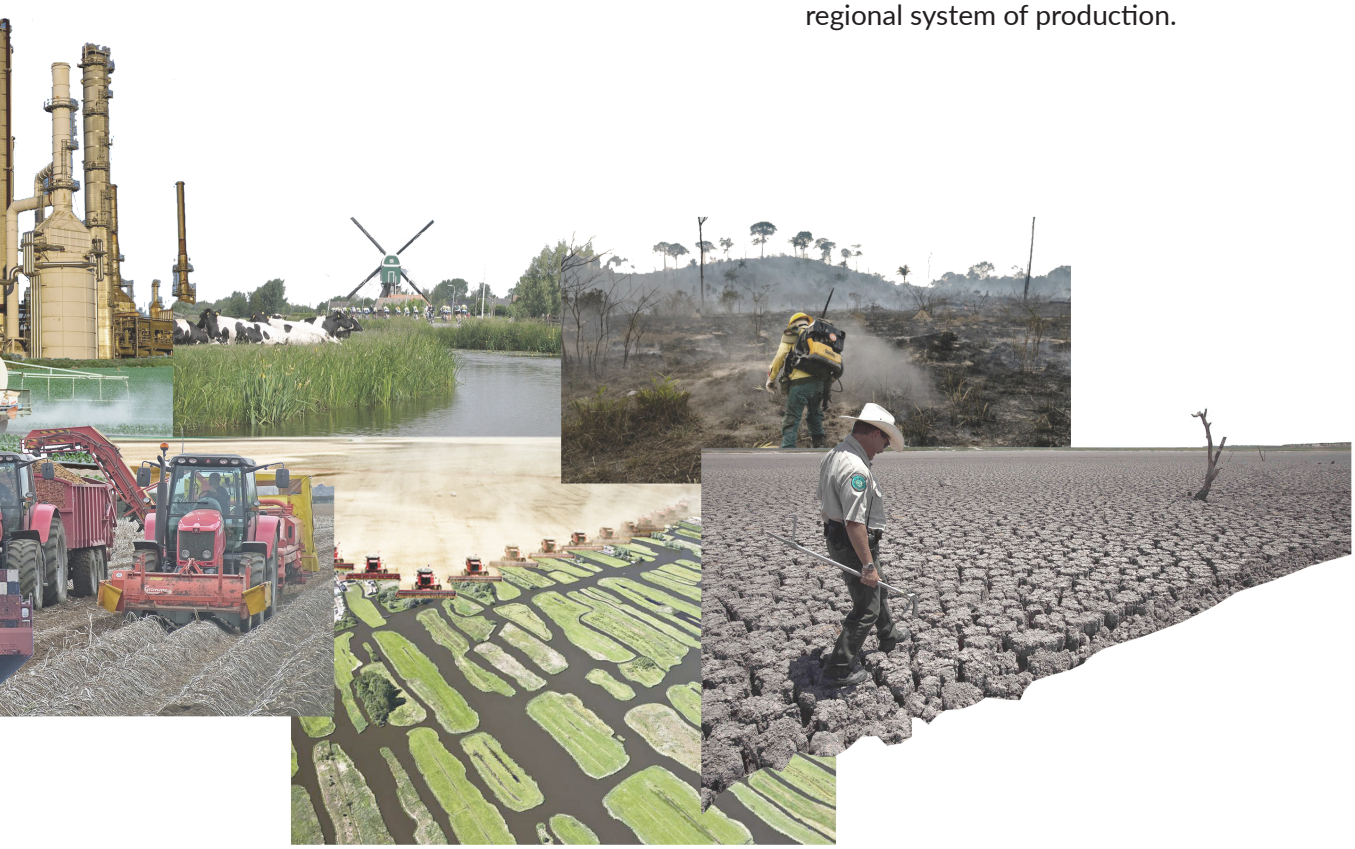


Figure 2 Impression of The Global Linear Agro-Food Productive System (Illustration: The authors. Source: Wikicommons.com and Getty Images.

1.2 | THE PROVINCE OF ZUID-HOLLAND

This project is focused on one of the most prominent frontrunners in the global food production line, the province of Zuid-Holland (PZH). In this region knowledge and innovation is shared to adapt and preserve the delta region from climate change (Provincie Zuid Holland, n.d.-a).The region is located in the west of the Netherlands and has an area of 3.418,50 km² (CBS, n.d.-a). Currently 3,68 million people live in the province (CBS, 2020). This will have grown by 210.000 households in 2040 (Provincie Zuid Holland, n.d.-b).

A part of the province of Zuid-Holland, such as the cities Rotterdam and Den Haag, collaborates in the polycentric urban region de Randstad (Lambregts, 2009). In addition, the cities Rotterdam and Den Haag form the metropolitan region Rotterdam Den Haag, also known as MRDH (Metropoolregio Rotterdam Den Haag, n.d.). Because of its location, the PZH is part of the European delta region. A part of the province is related to the city of Antwerp in the Corridor Rotterdam-Antwerpen (CRA). Both the ports of Antwerp and Rotterdam are important for the economy and therefore must be well connected (Investerings Programma, n.d.).

The Port of Rotterdam is the biggest port in Europe. The port of Rotterdam plays a part in the logistical chain for Rotterdam, Europe

Figure 3 Province of Zuid-Holland (Illustration by authors, based on www.snazzy.com)

and the rest of the world (Port of Rotterdam, 2020).

Because of the presence of the Port of Rotterdam and other logistic routes, such as the betuweroute, the Province of Zuid-Holland exports the most compared to other provinces (CBS, 2015). This logistical power can be explained by the connected production areas such as the Westland greenhouse area, which very efficiently produces and processes agri-food products designated for export. Although the Netherlands are placed twenty-second based on agricultural production, they are the 2nd largest agricultural exporter in the world (PBL Netherlands Environmental Assessment Agency, 2018).

Figure 4 Province of Zuid-Holland in National context (Source: Illustration by authors, based on www.snazzy.com)

In addition to the productive landscapes and the Port of Rotterdam, the Province is a highly urbanised area. The area can be seen as a polycentric urban region with different important cities such as Den Haag, Rotterdam and Leiden. These cities contribute to a diverse, knowledge intensive and attractive area for offices and resident. As a result, it is expected that by 2030, about 230.000 houses will be added to the Province of Zuid-Holland of the one million homes in the Netherlands (Provincie Zuid Holland, n.d.-b).

The planning of landscapes results in a division between the production landscape and urbanised areas, the consumption landscape. Analysis showed a big division in the level of amenities, social problems and way of life between people in the production landscape and the urbanised landscape (RIVM, 2018). The Province of Zuid-Holland aims to reduce this division and aims to strengthen the coherence within the province (De Zwarte Hond. (2017).

To help combat climate change, promote sustainable development and match the goals set in the Paris Agreement, the Province of Zuid-Holland (PZH) wants to transition to a circular economy (Drift & Metabolic, 2020). To make this transition successful, the Province seeks to adopt an integrative approach, addressing other elements such as socio-spatial inequality, pressure for urban expansion and economic challenges have to be integrated in the transition strategy. The assignment for this course is defined as followed: transform the project area to a circular economy, counter socio-spatial injustice and facilitate the future urbanisation.

The Province has several structural environmental, social and spatial challenges that threaten the present-day occupational traditions. This report will analyse the threats and challenges and propose a vision for the future circular and equitable region. Last, a strategy is proposed that offers actions that will contribute to the realisation of the vision. The Living Edges project uses the agri-food sector transition as a tool to solve these multiple challenges at once.

1.3 | PROBLEM STATEMENT

The problems that the Province of Zuid-Holland faces today are related to the linear food system, which needs to change to a circular system. In addition, it needs to address the spatial inequality caused by the unequal distribution of power and profit in the agro-food sector and province's landscapes. Furthermore, there is a big pressure on space in the Province due to urbanisation, sea level rise and the implementation of the Paris Agreement.

Linear food system.

Due to the situation of Rotterdam in relation to the sea and the presence of the port, and the position of the province in the European Union the agricultural sector has grown in the past and today is an important economic sector for the province and for the Netherlands (Jukema, Ramaekers, Berkhout, 2020) (CBS, 2015).

Many products are imported and exported by the Rotterdam port. Many of the imported products, such as material to produce plastic, service the agricultural sector (Port of Rotterdam, 2020). The produced and packaged agricultural products are either exported or consumed in the Netherlands.

Currently the food system is linear. There is input of products, either from the port of Rotterdam or by local production that takes up 48% of the land in the Province of Zuid-Holland (Centraal Bureau voor de Statistiek, 2019a). Within this linearity, a funnel of five purchasing companies regulates the market (PBL Netherlands Environmental Assessment Agency, 2018). At the end of the process an end product is produced and a certain amount of waste is produced as a by-product. Annually The Netherlands exports a total amount of 101 billion dollars in agriculture products (PBL Netherlands Environmental

Figure 5 Linear food system export. (Source: https://www.pbl.nl/en/publications/the-netherlands-in-21-infographics).

Assessment Agency, 2018). Because the food system as it is today is owned by a small number of actors this turnover and profits are not fairly distributed. This results in spatial inequality where farmers do not receive a fair price for their product and distribution centres make all the profit.

Limited space.

Even though the province of Zuid-Holland is a highly urbanised area, it still uses about 50% of the space used for agriculture (Centraal Bureau voor de Statistiek, 2019a). In the future this division of landscape needs to change. In the first place because of the rapid urbanisation until 2030, which should add 230.000 houses. And in the second place because of climate change and implementation of the Paris agreement, which has far stretching spatial implications (Ministerie van Economische Zaken en Klimaat, 2019) (Provincie Zuid-Holland, n.d.).

The Dutch national policy states that before 2030, we need to build 1 million homes in the Netherlands. Of those 1 million, 230.000 are projected to be needed in the province of Zuid-Holland. Of this 230.000 homes, 80.000 households have been built so far, so 150.000 houses still have to be built (van der Ploeg, 2019). The province aspires to realise these houses within the existing city boundaries (Provincie Zuid Holland, n.d.-b). However, according to Brink Management en Advies (2018), only 12% of these homes will fit inside the existing city boundaries. Therefore, using the average factor of 0,68 ha/home (Brink Management en Advies, 2018), the Province will need to realise 40.494 ha outside the city edges. The full calculation can be found in the Appendix.

In addition, due to the Klimaatakkoord, the present energy production industry needs to become more sustainable (Ministerie van Economische Zaken en Klimaat, 2019). Some

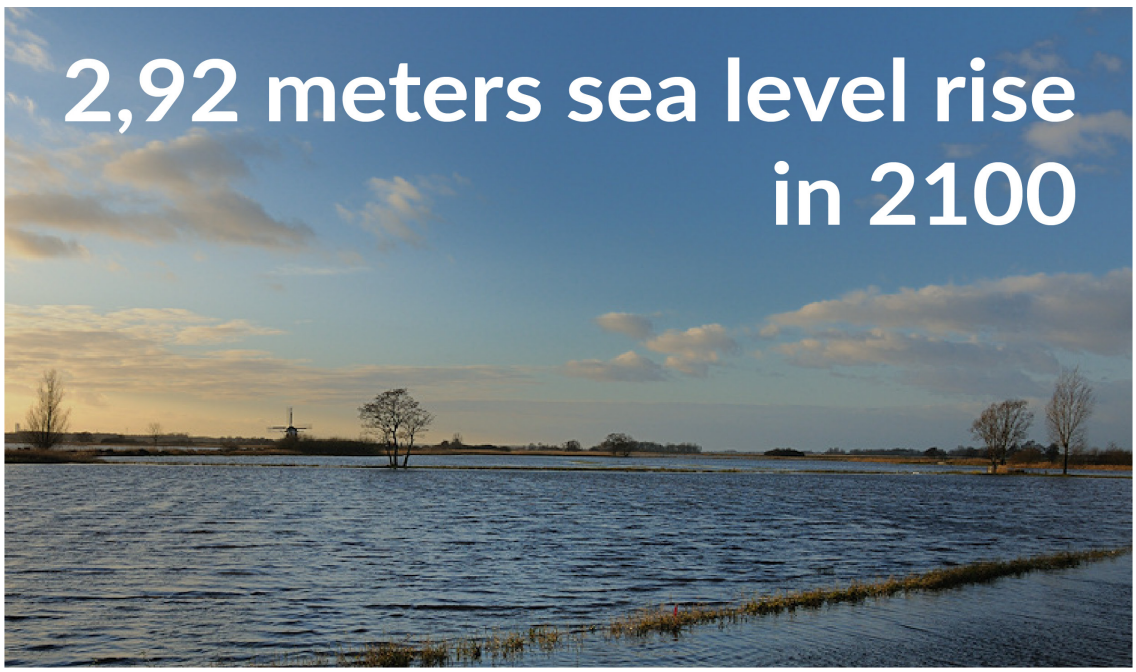


Figure 6 Sea level rise. (Source: https://www.vn.nl/zeespiegelstijging-plan-b/.)

alternatives that the Province can consider include large scale solar panel-fields or windmill farms in the landscape or on the sea. To transition fully to green energy, 150m2/capita of wind energy has to be realised (PBL Netherlands Environmental Assessment Agency, 2018). When comparing this to the total area of the PZH, Energy landscapes would demand 16% of the total area (see the Appendix for the full calculation). Of course, energy production does not only need to happen on land, but there is also the possibility of using the North Sea as a source for sustainable energy production.

Furthermore, the province of Zuid-Holland also has an intense water system in place, which is necessary to protect the region from the water from the river and the sea. These defense works have a certain defensive capacity which is threatened because of the sea and river level rise. The most unfavorable scenario for 2100 is a sea level rise of 2,92 meters (Schuttenhelm, 2020). This has a direct consequence for the land, either by raising the dikes or otherwise by allowing some areas to flood or be protected by nature based solutions.

All these aforementioned elements have their own claims on the space in the Province. But while they require more space, this is not presently available in such big quantities in the region. Therefore the mono functionality of the landscape as it is today will need to change in order to allow the regional systems to adapt to the future. What will the changed landscape look like and how will future functions be connected and layered?

Socio-spatial inequality.

Presently, in many cities in Zuid-Holland, neighbourhoods with lower socio-economic status have less access to safe and healthy public spaces than other neighbourhoods (Van Den Berg, n.d.). The unequal distribution

Figure 7 Socio-spatial injustice. Purchasing companies. (Source: https://www.pbl.nl/en/publications/the-netherlands-in-21-infographics).

of space impacts people's lives and their general well-being both physically and socially (Huber, 2016).

Next, not all citizens have access to a healthy lifestyle for behavioral and environmental reasons. On the one hand, food distribution locations such as supermarkets are not equally distributed throughout the whole city. Often the weaker neighbourhoods have less supermarkets as a result of monotonous, single function zoning. Furthermore, the individuals in weaker social groups often make less healthy grocery choices (Van Den Berg, n.d.) As a result of our current food culture and spatial organisation, 48% of adults in the Netherlands are overweight (World Health Organization, 2013).

The RIVM (2018) identifies multiple living environments in the Netherlands, which can each be associated with different social and health problems. They range from loneliness with elderly, to obesity in adults to alcoholism with young individuals. The health problems are linked to different neighborhood typologies. For example, in the rural landscape people suffer from loneliness and because they don't have the tendency to use the car because of the distances they suffer from obesity (RIVM, 2018).

The social-spatial inequality in the Province is also characterised by the unequal distribution of power and profits in the agri-food sector (PBL Netherlands Environmental Assessment Agency, 2018). Farmers are not as powerful as distributing or logistical companies and generate only a small amount of the profits that are created by their raw materials. The lack of appreciation and the continuous political debates about for example the Nitrogen crisis, have triggered many farmers to start expressing their discontent with the injustice of the system.

To summarise, different population groups have different social problems related to their direct living environment. The stakeholders of the agro-food system also experience inequality, which could be overcome by the transition to circularity. This socio spatial inequality needs to be resolved in the future, but the question that remains is how?

When layering these elements, the problem statement is created: Zuid-Holland and its agro-food sector need to change their global, linear agro-food sector, while simultaneously acting on socio-spatial injustice and the spatial pressures of the future.

1.4 | RESEARCH QUESTION

Following the problem statement: Zuid-Holland and its agro-food sector need to change their global, linear agro-food sector, while simultaneously acting on socio-spatial injustice and the spatial pressures of the future.

To provide a solution to the problem statement, the Living Edges project addresses the following main question: Considering the future spatial pressures on Zuid Holland, how will the province achieve socio-spatial justice when transitioning its own agro-food industry sector towards a resilient and circular system?

This research question has different sub questions with different elements. Following the limited space the spatial pressure element is added to the research question. The socio-spatial inequality is translated as socio-spatial justice in the research question. The linear agri-food sector is added to the research question because this needs to translate to a circular sector. THe circular economy is added to define how to achieve circular economy.

Figure 8 defines this relation and builds the research question based on the sub research questions. These (sub) questions will be answered in the conclusion chapter.

The goals of this project will be described in the vision chapter.

Sub research question

How to achieve social and health equality for the diverse population in the different landscape typologies?

Evaluation

How can socio spatial justice be achieved?

Integration

How does socio-spatial justice relates to the circular economy?

Sub research question

What will the different landscapes look like when multiple circularity objectives are layered within the existing space?

Evaluation

How can a layered landscape be achieved?

Integration

How can a transition to a circular economy assist in using the limitied space in an efficient way?

Considering the future spatial pressures on Zuid-Holland, how will the province achieve socio spatial justice when transitioning its own agro-food industry towards an adaptive and circular system ?

Sub research question

What defines a circular system?

What defines adaptive attitude toward a climate change?

Evaluation

How to achieve a cicular system that is adaptive to climate change?

Integration

How can a transition to a circuar economy be beneficial for the Province of Zuid-Holland?

Sub research question

What are the spatial implications of the transition from a linear to a circular agro-food sector on landscape

Evaluation

How to achieve a circular agro-food sector?

Integration

How can a transition to a circuar agro-food sector be beneficial for the Province of Zuid-Holland?

Figure 8 Research Question Map.

1.5 | METHODOLOGICAL FRAMEWORK

The "Figure 9 Methodological framework. (Illustration by authors)." on page 18 ("Figure 9 Methodological framework. (Illustration by authors)." on page 18illustrates the different methods that were used for this project, linking different methods to the phases that built up to the final Living Edges project.

The background research was based around the site visit. In preparation of the site visit, some research was conducted in order to inventarise the existing characteristics, planning ambitions and trends. This resulted in a starting thought, which was based on the link between the agri-food sector and sustainability. During the site visit photographs were taken of the different food flows and specific food products and how they were packaged, positioned and handled. In addition, people connected to different links of the agri-food sector were interviewed in a structured manner (Miller, 2001, p. 267), asking them about their opinion on how sustainable they considered their sector to be; whether they knew what the impact of their products were; gathering data about where their food actually came from; and finally asking them whether they knew how their sector might become more sustainable. By asking each individual the same type of questions, followed by a more open discussion, we were able to compare the different interviews and draw some conclusions relevant to our analysis.

After this initial background research, the context of the research had been set and more in depth analysis was needed for three main elements that had come to light. The elements that were analysed in the Province of Zuid-Holland were: Agri-food flow, socio-spatial inequality and limited space. The analysis conducted here was both qualitative and quantitative research, mapping the system and social implications as well as physical and historical characteristics.

During our analysis, the Problem statement and Research Question would constantly be reviewed acording to our analysis and vice versa. This enabled us to refine our Analysis and Research Question acordingly, in a feedback loop that imporved the precison of our analysis. by doing this, we were able to reach the tension field topics of the analysis: the agri-food flow and the ownership & power distribution and the resulting spatial inequality. These tension fields were analysed by using the SWOT method. In addition to a

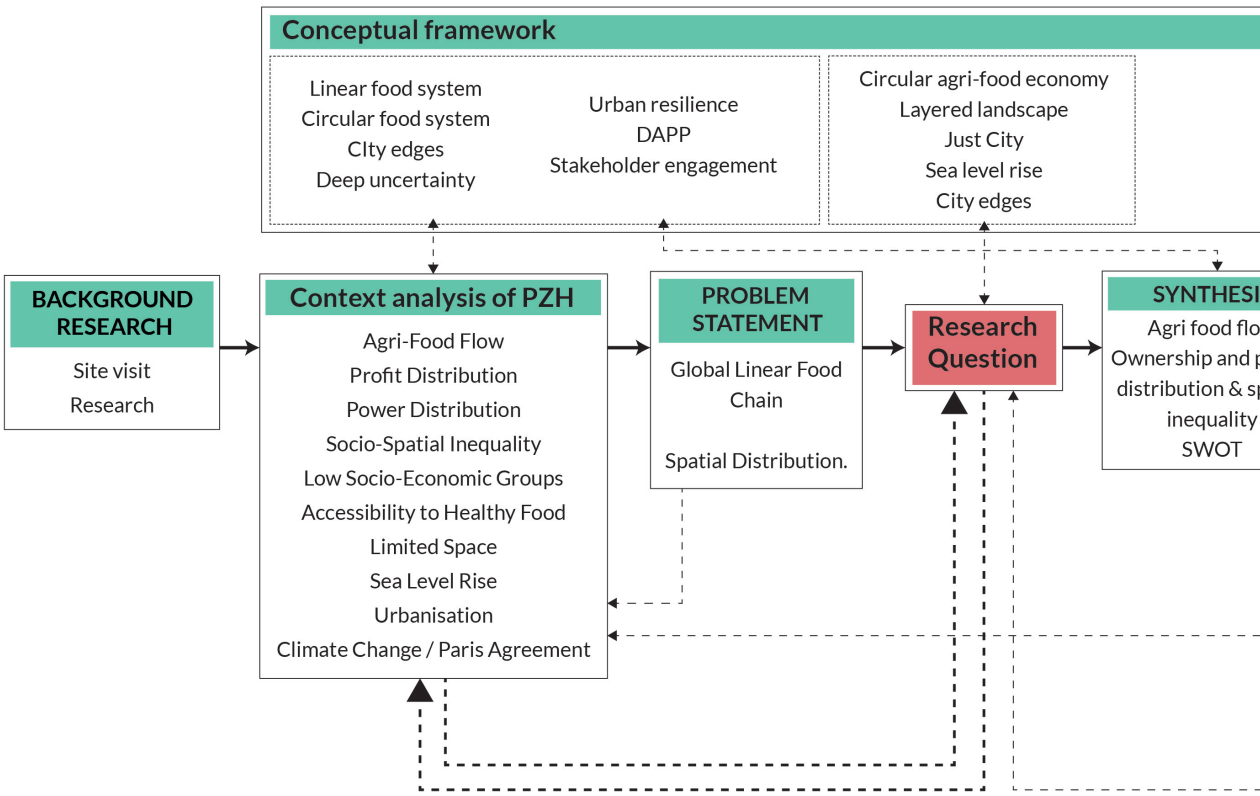


Figure 9 Methodological framework. (Illustration by authors).

verbal SWOT analysis (Koohsari et al., 2015). The synthesis was achieved with mapping the different elements of the SWOT in the Province.

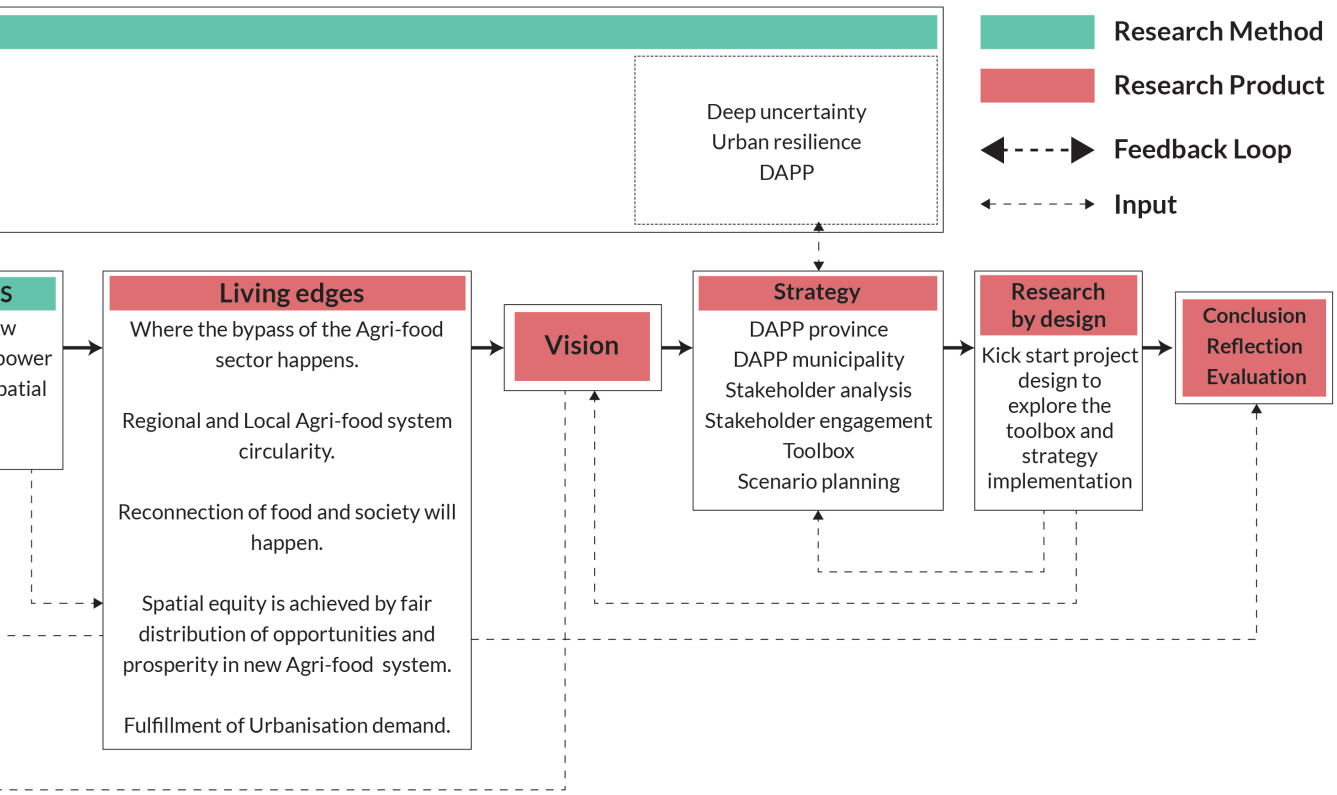
Our synthesis lead us to conclude that our project would focues on the liveability of the city edges. We compliented this with critical conceptual frame work to show our narrative of the "Living Edges". Our Living edge principles were defined using scenario planning at multiple scales on the edge (Stojanovic, Mitkovic, & Mitkovic, 2014). Using Research by Design (Roggema, 2016) as an iterative tool for formulating both the problem and solutions.

The living edges proposal is translated in the vision for the project. Synthesising accurate maps at regional scale gave an impression of what the conceptual vision elements would result in space wise. The maps were based on both scientific research and statistical data of the Netherlands.

After analysing and presenting our vision, its strengths and weaknesses were identified. Analysing stakeholder typologies, attitudes towards change and the possibilities of activating them to transition. This formed the basis for the problematisation of the strategy on how to implement the vision. Using different theories from the theoretical and conceptual framework, such as deep uncertainty and urban resilience, we were able to collect the strategic components for the strategy. Adapting well-known concepts (sometimes from other sectors than urban planning) such as Dynamic Adaptive Policy Pathways (Haasnoot, 2012) and Stakeholder Engagement (Resilient by Design, 2017) to develop a strategy for implementing the vision.

From the strategy Research by Design (Roggema, 2016) was conducted to explore the application of the toolbox on different kick start projects. Using 3d modelling, collage visualisations and estimated calculations in an iterative process to understand how the strategy and vision could best be applied on the local scale.

Based on the Living Edges proposal and the vision, the research (by design) was concluded and evaluated. The project research and proposal was contextualised based on scientific literature, societal relevance and ethical considerations. Finally, an individual and group reflection are used to further conclude on the learning experience of the project.



1.6 | CONCEPTUAL FRAMEWORK

Conceptual framework

In this conceptual framework we define the concepts used in our research and explain how they are connected to each other. There are three core elements which are used to build our proposal 1) Principle triangle 2) Deep uncertainty, 3) Stakeholder engagement.

1. Principle Triangle

In understanding the principle triangle we realised that there are current situation that has an input for to build up the princple triangle, which is the problem triangle (Figure 10). Therefore, these are the framework elements for the princple triangle:

a. Linear agri-food sector

The agri-food sector is a major economical player in the Netherlands, with an agri-food export valued at 94,5 billion euros in 2019. Besides the export, the Netherlands have imported agri-food products valued at 64,1 billion euros in 2019 (Jukema, G., Ramaekers, P., & Berkhout, P. (2020).

The Province of Zuid-Holland is connected to the agri-food sector, with 48% of the land use used by the agri-food sector (Centraal Bureau voor de Statistiek, 2019a).

However, the linear agri-food sector in the Province of Zuid-Holland is threatened by different elements, such as depleting monocultures that service the production of agri-food products. Moreover, the Province of Zuid-Holland wants to transition to a circular economy, which means that the linear agri-food sector must change. Instead of importing 64,1 billion euros in agricultural resources the Netherlands will need to produce its own resources needed for the production of agricultural products. The transition to a circular economy has to be completed by 2050 (Drift & Metabolic, 2020).

Besides the transition towards a circular economy, the Province of Zuid-Holland has additional challenges related to the agri-food system. The main challenges we identified are: the limited space for production and urbanisation and socio-spatial inequality as a result of unequal distribution of power and profit in the linear food system which will be explained further in the next chapter.

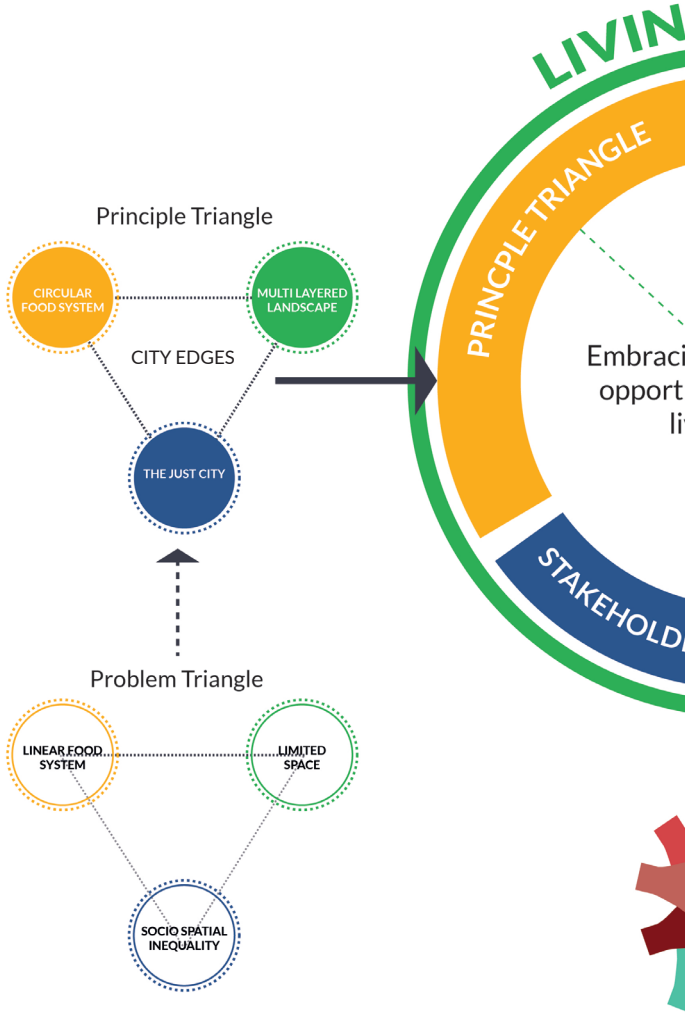
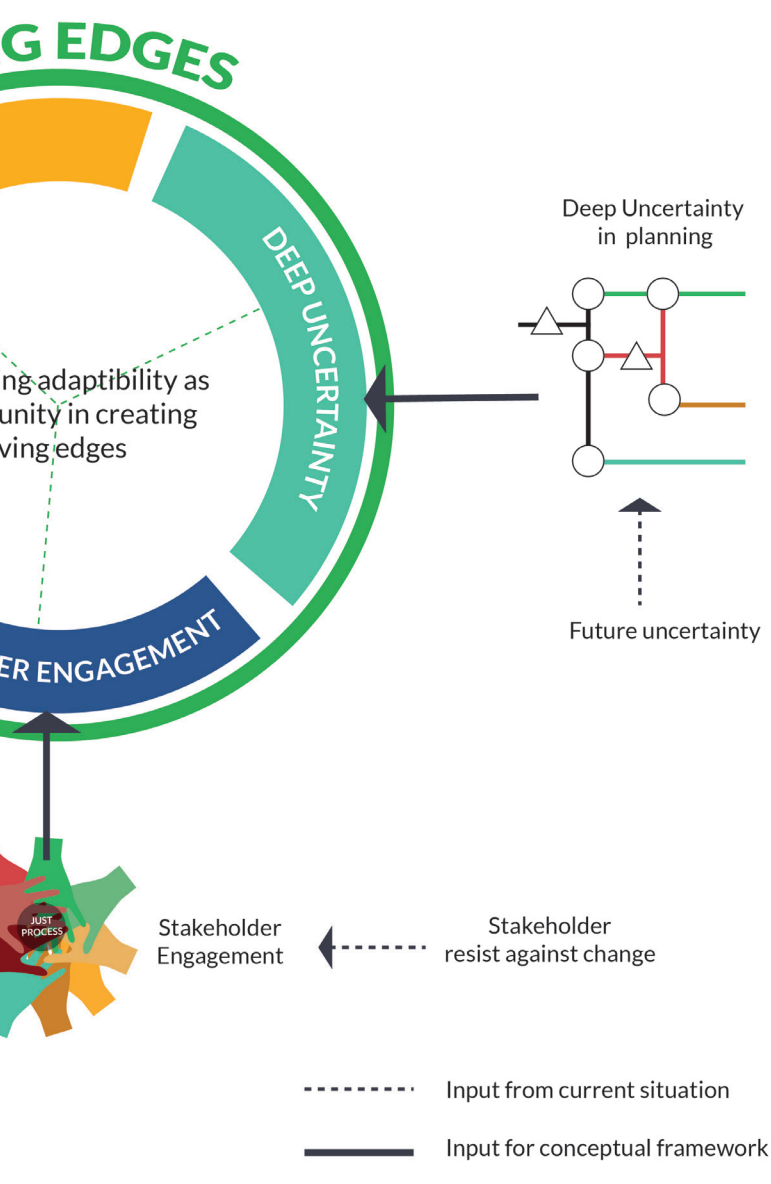


Figure 10 Conceptual framework. (IIIlustration by authors).

b. Socio-spatial inequality

Socio-spatial inequality is one of the characteristics of the linear agri-food sector.



In the Netherlands this is visible in the unequal access to healthy food. Certain areas, such as pre-war neighbourhoods in the Netherlands have unequal access to healthy food. In these neighbourhoods, the average income of the residents is low (RIVM, 2018).

This low income relates to the choices these residents make when doing groceries. Low income groups generally choose less healthy food, because of financial reasons. This results in a shortened life expectancy of nine years in the Netherlands for low income groups (Van Den Berg, n.d.).

Disadvantaged groups are mostly situated in 'bad'' neighbourhoods, with less green to move and rest. This results in residents moving around less, and obesitas (RIVM, 2018). Moreover, these neighbourhoods have a high concentration of cafes and fast food restaurants, which seduce residents to make unhealthy choices (Van Den Berg, n.d.).

Besides socio-spatial inequality in pre-war neighbourhoods, residents in the rural landscape and other neighbourhoods experience socio-spatial inequality. In the rural landscape the level of amenities is low. Because of that, and to fight the feeling of loneliness, residents in the rural landscape use the care more often, resulting in obesitas. While in the city centre residents deal with socio-spatial problems such as loneliness, residents of neighbourhoods on the outside of the city deal with drug problems and physical problems (RIVM, 2018).

The low socio-economic groups, residents of the pre-war neighbourhoods, are more vulnerable to impacts of certain crises, like sea level rise, because their financial resources are not that strong (Littman, 2018). This brings us to the chapter related to the sea level rise, the limited space.

c. Limited space

Limited space in this case needs to be understood from a multi-dimensional perspective: there is increasingly more limited space for agricultural production because of the need to produce energy in a sustainable way, because of predicted future urbanisation and because of probable sea-level rise.

To reach the goals set in the Paris agreement, The Netherlands have to reduce the amount of fossil fuel and produce green energy. The Netherlands has set the goal of a reduction of 49% CO2 emission by 2030 (Ministerie van Economische Zaken en Klimaat, 2019). The

Figure 11 Problem triangle

increase in green energy production has a spatial impact, since the production of green energy by means of wind needs around 150 m2 per capita (PBL Netherlands Environmental Assessment Agency, 2018).

Additionally to the energy challenge, there is the challenge of further urbanisation. The Dutch national policy states that before 2030, we need to build 1 million homes in the Netherlands. Of those 1 million, 230.000 are projected to be needed in the province of Zuid-Holland. Of this 230.000 homes, 80.000 households have been built so far, so 150.000 houses still have to be built (van der Ploeg, 2019). The province aspires to realise these houses within the existing city boundaries (Provincie Zuid Holland, n.d.). However, according to Brink Management en Advies (2018), only 12% of these homes will fit inside the existing city boundaries. Therefore, using the average factor of 0,68 ha/home (Brink Management en Advies, 2018), the Province will need to realise 40.494 ha outside the city edges, which amounts to 25% of the existing land used by agriculture. The full calculation can be found in the Appendix.

Finally, because of the position of the Province of Zuid-Holland as a coastal region, the sea level rise is of major importance to the province. There are different scenarios related to forecast sea level rise. The most unfavourable scenario talks about a sea level rise of 2,92 meters in 2100 (Schuttenhelm, 2020). This means that, unless significant infrastructure is built, a large part of the province may be lost to the sea or to floods. Moreover, there is high flood risk of dikes alongside rivers (Deltares, 2018).

d. City edges

Our project focuses on city edges, because city edges are places with a lot of potential for redevelopment (LOLA, 2011). The rapport created by LOLA provides us with a framework for our spatial and societal analysis.

Concluding on the analysis, we found out that the socio-spatial inequalities were most present in the city edges. Because of the presence of socio-spatial inequality combined with the high potential for redevelopment we choose to use the city edges as our kick start areas for our project.

e. Circular agri-food sector

By transforming the linear agri-food sector to a circular sector we want to counter the socio-spatial inequality, the limited space and the agri-food flow.

A circular agri-food sector can be seen as a sector where farmers, involved civilians, companies and research combine ecological principles and modern technologies. This sector is not only focused on profit but also on an economical use of raw materials and energy and to prevent pressure on climate, environment and nature (WUR, (n.d.)).

The elements composing the circular agri-food sector are: layered landscapes, food based society and the circular food system.

- **Circular food system**

In the living edges area the circular food system will be implemented. By using and connecting existing waste flows to other producing sectors, the waste products become the resources required in the other sector. By doing so, the food system becomes an efficient cycle. This results in a growth in food production of 70% without adding pressure on the world, by growing the production area (WUR, (n.d.)). Because of the high efficient circular food system less space is required to grow the same amount of agricultural products. The consequence of the transition to the circular food system is that agricultural production areas will lose their function and become available. The freed up space could for example be used for future urbanisation or for the production of green energy.

The implementation of the circular food system will be done by implementing small to middle scale types of farming. These different types of farms can be placed inside the society, resulting in a food based society.

- Food based society

Because of the implementation of small to middle scale types of farming inside society, we transform the current socio-spatial inequality towards a food based society. In this society disadvantaged groups are strengthened by fairly distributing power and profit of the circular food system. By the implementation of different types of farming inside societies, we offer equal access to healthy food for different neighbourhoods. This eventually results in a better health and a better environment for the residents (Ellen Macarthur Foundation, n.d.).

By placing production of agricultural products inside the society, a food based society is formed. An example of this could be a food garden or urban farming. The agricultural production area, on which the food based society is based, forms and maintains social relationships (Hale et al., 2011, p. 1855). By implementing the food based society we counter the feeling of loneliness, the unequal profit and power distribution and we counter the unequal access to healthy food.

- Layered landscapes

Within the circular food system different types of farming are used which serve more than one goal, by doing so these different types of farming use the limited space as efficiently as possible. Within these layered landscapes, there is a difference between the combination of production areas and urbanisation or production areas and water.

An example can be the implementation of vertical farming, where urbanisation is combined with farming (Al-Chalabi, 2015). By implementing vertical farming urbanisation and agricultural production are facilitated in the same area. Another example can be a productive, protective wetland. This wetland can be flooded but is also a production area for biomass (Siobhan Fennessy, Cronk, & Mitsch, 1994). In this way the area can be used for agricultural production and for facilitating the sea level rise.

2. Stakeholders Engagement

Because the amount of stakeholders and their different opinion towards change we propose a networked governance model. This model proves to be suitable to our strategy because it is equitable and just and therefore a sound foundation for our transition strategy (Beach, Sandy (2008). For the transition strategy we use the phasing of the project San Fransisco bay. The following phases can be defined: The early phase, the implementation phase and the evaluation phase. Within the early stage, we define kick-start projects, collective research and collaborative design. By using this strategy we ensure successful engaging for a diversity of stakeholders (Resilient by Design, (n.d.)). These three defined phases are related to the DAPP strategy.

3. Deep Uncertainty

The deep uncertainty concept consists of two parts: the possible amount of sea level rise and the way that this is dealt with either regional, national or either global. The amount of sea level rise is uncertain, but can rise up to 2,92 meter in 2100 (Schuttenhelm, 2020). Because this is an uncertainty the strategy we are proposing must adapt to that. In our strategy we used a model provided by Deltares as starting thought for our deep uncertainty (Deltares, 2018). This model described different possibilities related to the sea level rise. In our strategy these different scenarios were taken into account.

Our project must be resilient and be able to adapt to the changing context. We envisioned our project to be an urban resilient project. Urban resilience is based on four basic pillars: resisting, recovering, adapting and transforming to disasters and dangers(Ribeiro, Pena Jardim Gonçalves, 2019). Urban resilience has four themes: metabolic flows, governance networks, social dynamics and the built environment (Arizona State University, CSIRO, Stockholm University, 2007). There are two interpretations on urban resilience. The first one is the engineering resilience. This is based on a mechanistic model of systems that can recover their original state aftershocks. The second one is ecological resilience. This is based on an evolutionary model enabling adaptation to disturbances (Caputo, Caserio, Coles, Jankovic, & Gaterell, 2015).

Due to the uncertainty in the future scenarios the phasing of the project will be done by implementing the Dynamic Adaptive Policy Pathways. These pathways embrace uncertainty (Yohe, 1990). This DAPP can be used to create an overview and evaluate different possibilities to implement a vision for the future (Haasnoot, Middelkoop, Offermans, van Beek, van Deursen, 2012).

In conclusion, through this conceptual framework we understand these elements of our concepts in relation with each other. The problem triangle changes to counter the challenges and transform to princple triangle with city edges. The cityedges concept connects to the stakeholder engagement and the DAPP in the deep uncertainty concept, in the end become our project proposal, Living Edges.

INVESTIGATING ZUID-HOLLAND

Figure 12 City Edges Diagram. (Illustration by authors).

2.1 | PRINCIPLES

To unravel the complex relationship between the agricultural industry and consumption system of Zuid Holland and its territory, three main research themes were analyzed in depth to map the situation of the province regarding the transition of the food production system towards circularity in an equitable format for society. These are: The Linear Food System, mapping out the key sectors involved in the Agrifood chain; Social-Spatial Inequality, where neighbourhoods mean income and Demographics are cross referenced with supermarket accessibility and; Limited Space, which considers the existing land use of Zuid Holland and future space needs. These three themes will feed the basis of our argumentation to achieve an equitable circular agrifood transition in Zuid Holland.

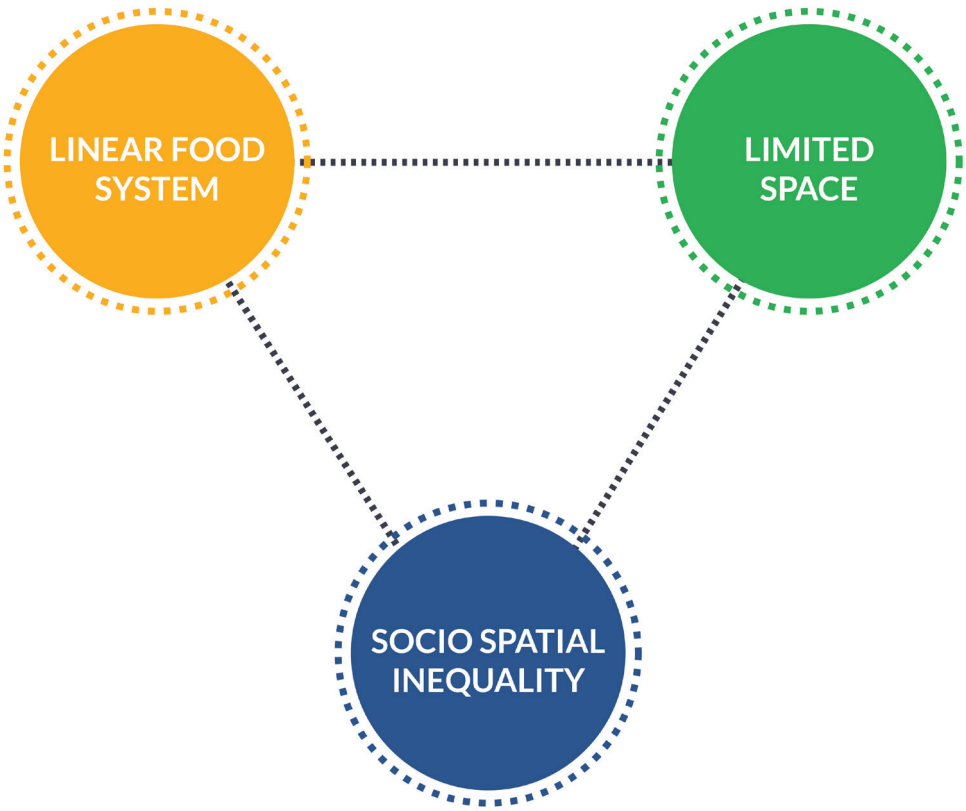


Figure 13 The Analysis Triangle. (Illustration by authors)

The linear food system of Zuid Holland is a fragment of a larger global chain of production, which trades raw materials and goods on a global level and is susceptible to market demands. This dynamic, named planetary urbanization (Brenner, 2014), local and regional systems are codependent on materials, goods and trade chains that service larger global demands and rely on economies of agglomeration and specialization to generate high demands for global trade.

Given that the province ambitions to achieve circularity in the agri-food sector, it is important to consider and map the scales of the linear production system in order to select key nodes and flows to act on when devising the strategy for transitioning to circularity. The diagram below (Figure 17) shows the main sectors related to the agri-food chain in the Netherlands. There is a bottleneck in distribution, where a handful of companies benefit from the exisitng operational landscape that and control the flow of goods.

Figure 14 Crop Landscape of Goeree-Overflakkee, Zuid Holland. (Source: Google Earth).

Figure 15 Distribution Center of Westland, Zuid Holland. (Source: Google Earth).

Figure 16 Residential Neighbourhood of Spijkenisse, Zuid Holland. (Source: Google Earth).

Figure 17 Concentrations and Bottlenecks in the Dutch Food Chain (Illustration by authors, data source: www.pbl.nl).

2.3 | SOCIAL SPATIAL INEQUALITY

It is widely known that good quality and healthy food brings many benefits to peoples lives, contributing to fewer health issues and prolonging life expectancy. It is even part of the United Nations Sustainable Development Goals, present in both points: 2. Zero Hunger and 3. Good Health and Well-Being (United Nations, 2018). Another concept that incorporates food quality as an agent of good health is the holistic approach of Positive Health (Huber et al., 2016), which also encompasses other important aspects such as physical exercise and mental wellbeing. Unfortunately, not everyone in the world has equal access to a healthy diet, given societal, cultural and economic discrepancies.

This is no different for Zuid Holland, even though the province is the second largest exporter of food in the world, many still can't easily access healthy food on a daily basis (Van Den Berg, n.d.). One major factor for this accessibility discrepancy is that lower income social classes cannot afford healthy food, while processed food is usually much cheaper in comparison. Spatially, the distribution of supermarkets (Figure 21) also contributes to inequality of healthier food access, since many lower socioeconomic neighbourhoods (Figure 18) have much fewer choices of supermarket options to pick from, or have to travel longer distances to reach supermarkets, if compared to denser cities or higher socioeconomic neighbourhoods (Figure 19). Considering the food chain infrastructure layout of the Netherlands (figure xx), it is relevant that much of the food sale to consumers happens within cities, while in comparison their outskirts and countrysides are poorly serviced.

By overlaying both the mapping of supermarkets in Zuid Holland (Figure 18) and the Lower Social-economic neighbourhoods (Figure 19), The Social-spatial Inequality is mapped (Figure 21).

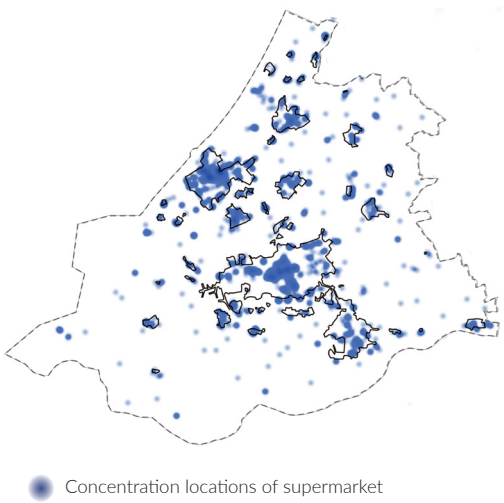


Figure 18 Heat map of Supermarkets in Zuid Holland (Illustration by authors, data source: LISA data).

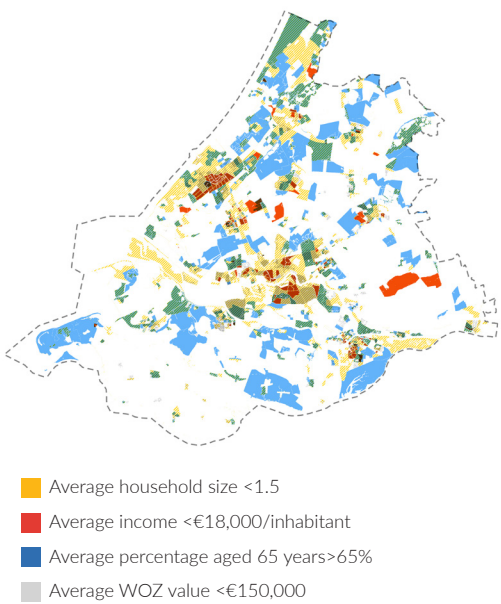
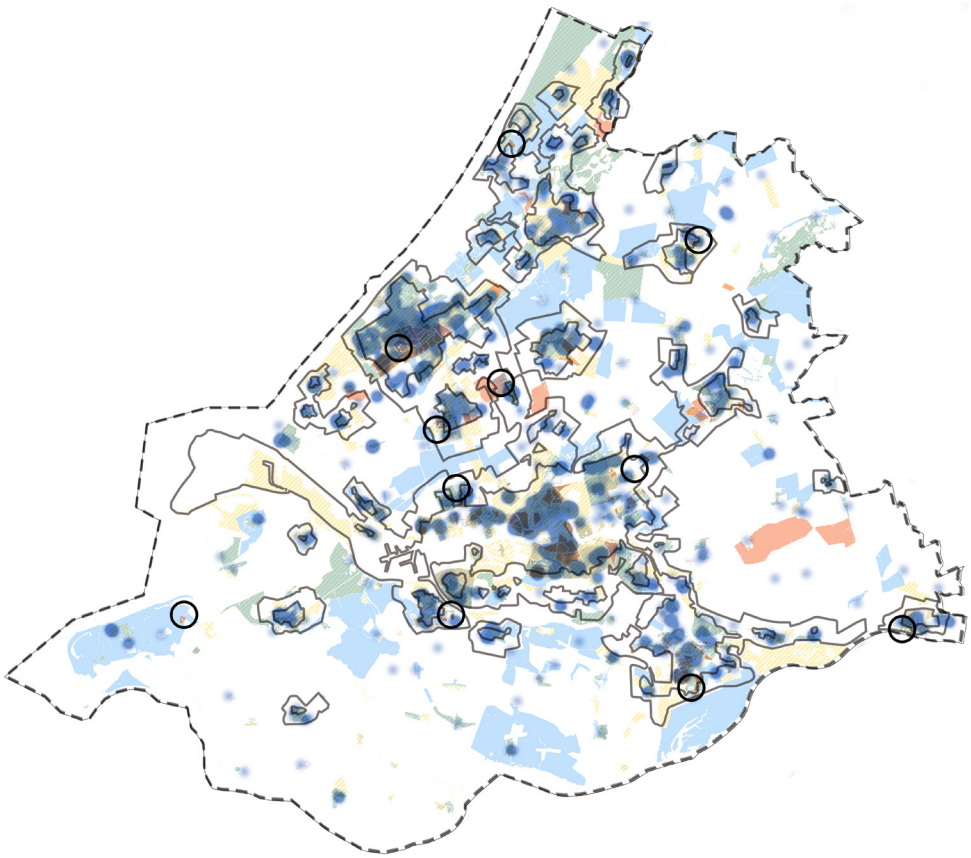


Figure 19 Social-Spatial Charactirization of Neighbourhoods in Zuid Holland (Illustration by authors, data source: LISA data).

ALDI Discount Spermarket: Mainly proccessed, high sugar and gluten food.

ECO Spermarket: Mainly Fruit and Vegetables.

Figure 20 Supermarket entrance product display comparison (Source: The authors).



Locations in the city edges that has the most socio economics issues are located in the city edges, where there are lack of access to supermarkets

Figure 21 Supermarket distribution versus Social-spatial neighbourhood charactirization. (Illustration by authors, data source: LISA data).

2.4 | LIMITED SPACE

Mapping of the main land use linked to the Agri-food Linear Production Chain and the water pressure considering 1, 2 and 3 meter rise levels.

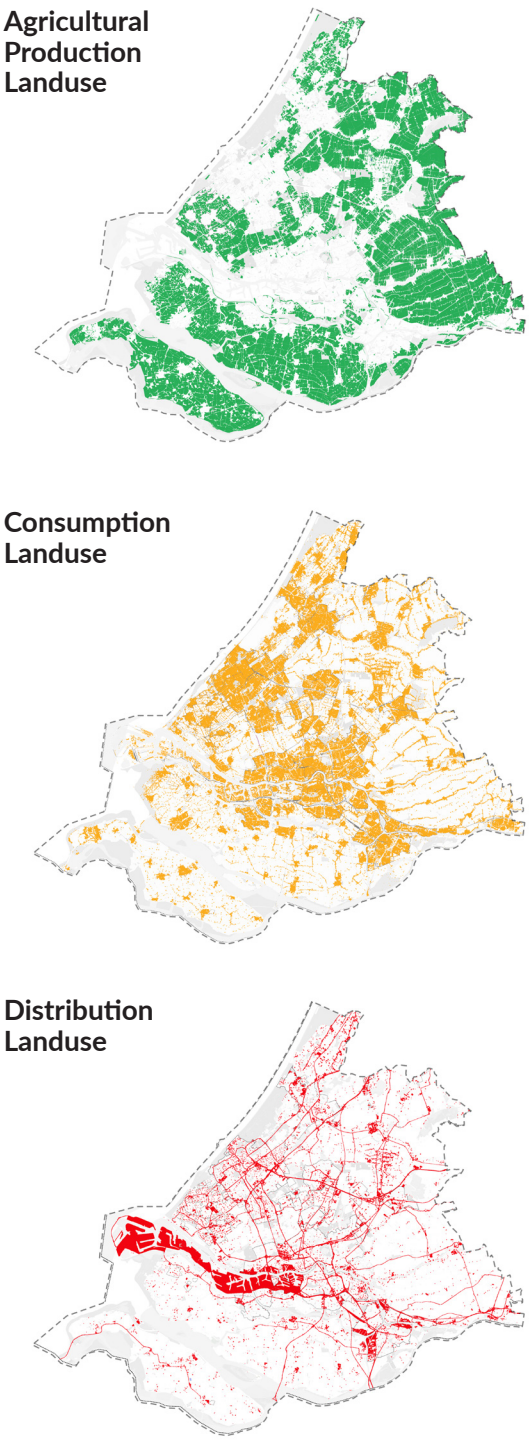


Figure 22 Agri-food Linear Production Chain Landuse (Illustration by authors, data source: LISA Data).

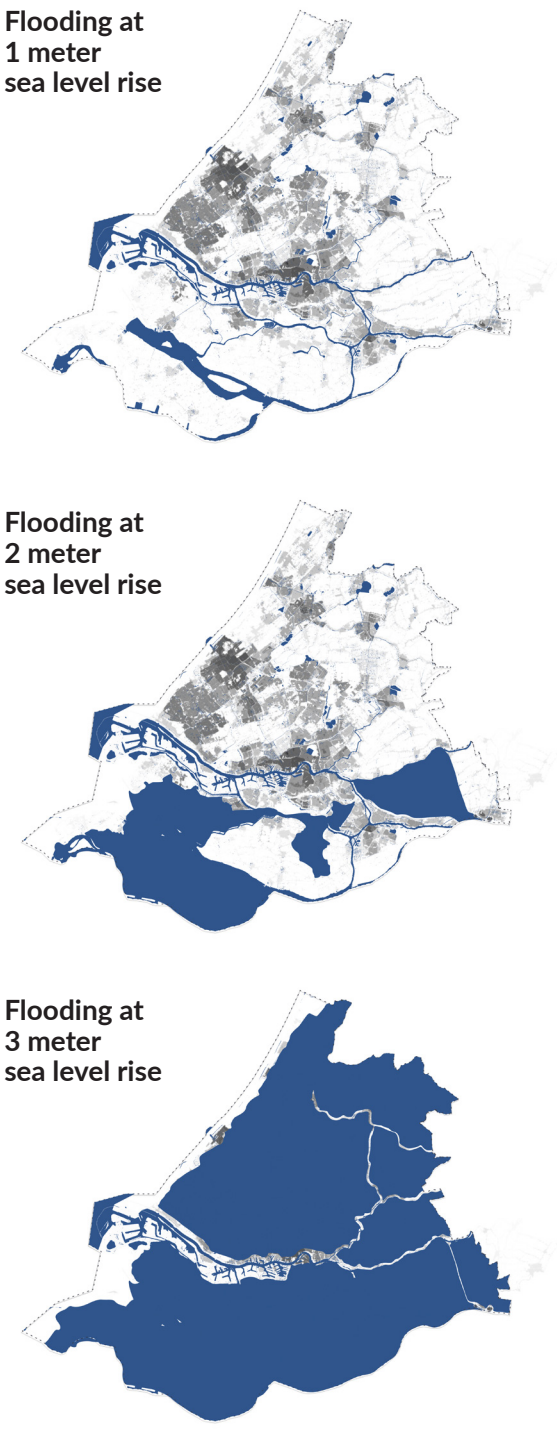
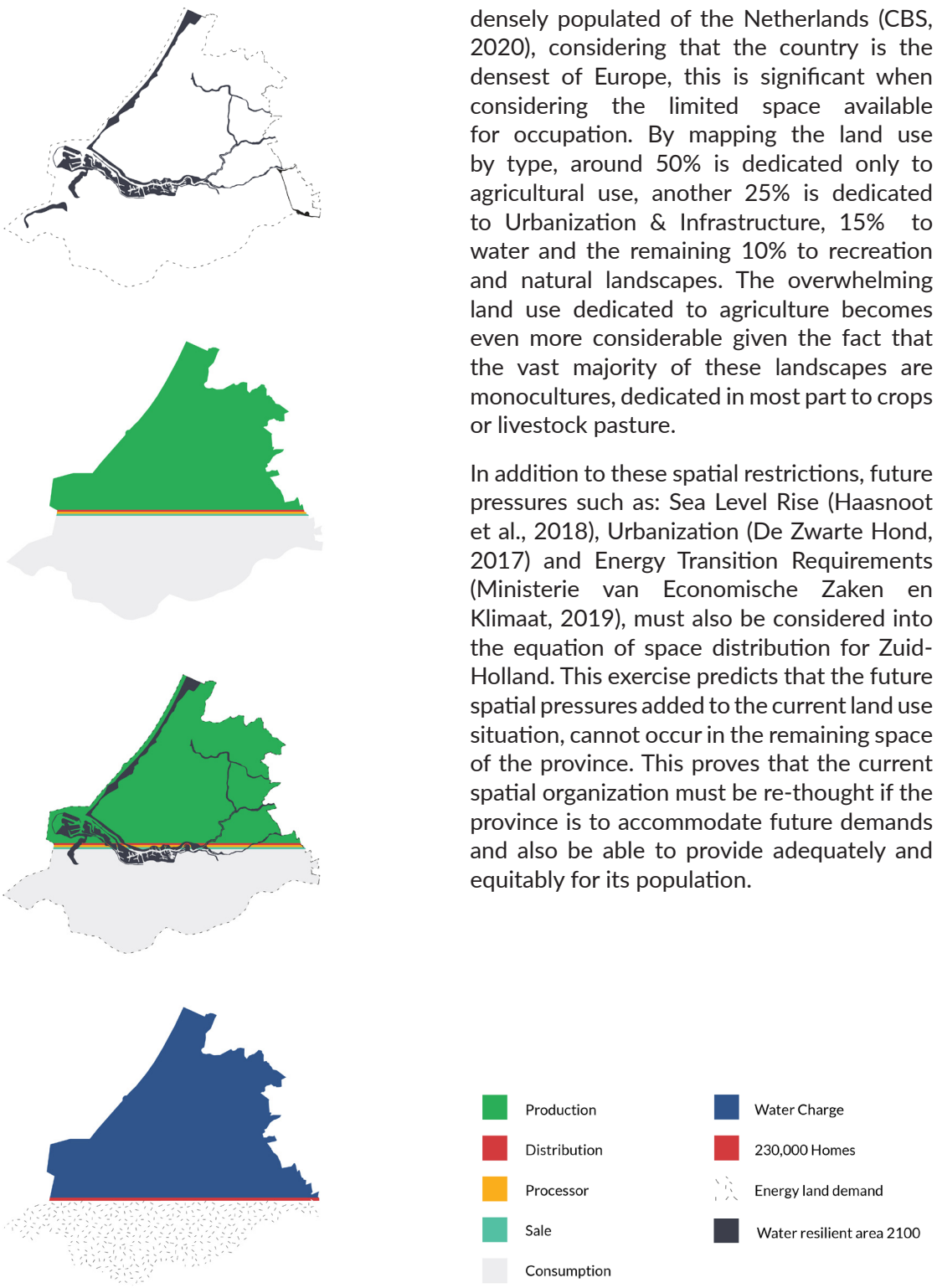


Figure 23 Sea level Rise Spatial Pressure of Zuid Holland (Illustration by authors, data source: The author, data source: EduGis).



The Province of Zuid Holland is the most densely populated of the Netherlands (CBS, 2020), considering that the country is the densest of Europe, this is significant when considering the limited space available for occupation. By mapping the land use by type, around 50% is dedicated only to agricultural use, another 25% is dedicated to Urbanization & Infrastructure, 15% to water and the remaining 10% to recreation and natural landscapes. The overwhelming land use dedicated to agriculture becomes even more considerable given the fact that the vast majority of these landscapes are monocultures, dedicated in most part to crops or livestock pasture.

In addition to these spatial restrictions, future pressures such as: Sea Level Rise (Haasnoot et al., 2018), Urbanization (De Zwarte Hond, 2017) and Energy Transition Requirements (Ministerie van Economische Zaken en Klimaat, 2019), must also be considered into the equation of space distribution for Zuid-Holland. This exercise predicts that the future spatial pressures added to the current land use situation, cannot occur in the remaining space of the province. This proves that the current spatial organization must be re-thought if the province is to accommodate future demands and also be able to provide adequately and equitably for its population.

Figure 24 Diagram of present and future land occupation quantities (Illustration by authors,data source: www.cbs.nl, De Zuarte Hond).

2.5 | TENSION FIELD

Based on the analysed themes brought by the problem triangle, we derived two problems that can synthesise the problem themes previously discussed. These derivations, of which we call tension themes, form the elements of the tension field. The first, the Agri-Food Flow specializes in the infrastructure present in Zuid Holland dedicated to produce, process and commercialize food related products and derivatives. The second, analyses the sectors involved in the ownership of certain parts of the system chain and their subsequent profit distribution, which can help identify stakeholders that suffer from inequality in the system.

Figure 25 Tension Field Topics: Bridging the Analysis Triangle. (Illustration by authors).

As shown in Figure 27, the market mix of companies involved in the agricultural sector has fallen significantly as well as the number of jobs in the sector. This is due to higher yield efficiency and mechanization of agriculture becoming more prominent thus reducing the need for human labour. On the other hand, this also shows that the growing profits of the sector tend to become less well distributed with wages or competitors in the market share.

Consequently, this impacts the sectors that have a role in land use distribution. In Figure 26 we see that the production sector occupies most of the province, at 45% and is second in employment compared to other sectors of the agri-food industry. The case is that most of the profits concentrate where there are less employed, in the processing and suppliers (distribution) sectors, showing that there is an unequal distribution of the prosperity being generated by the sector.

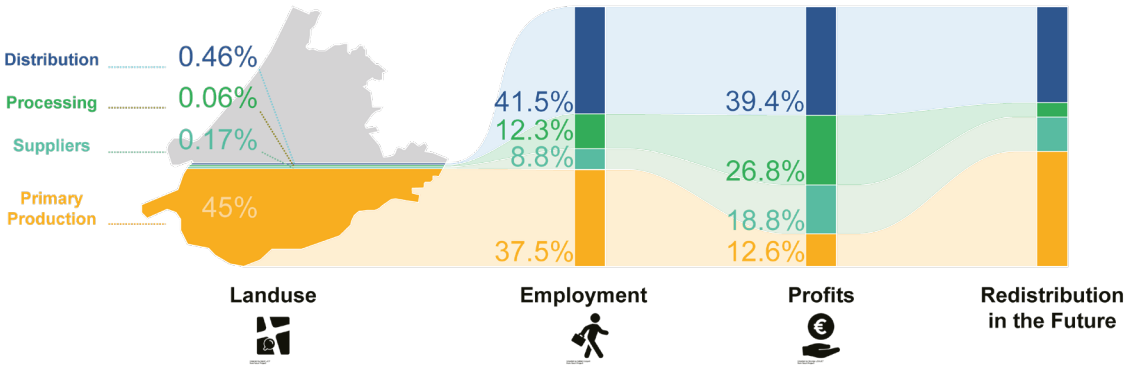


Figure 26 Agriculture Sector Profit Distribution. (Illustration by authors, data source: LISA data, pbl.nl The Netherlands in 21 infographics and De Agro&Food sector in Nederland).

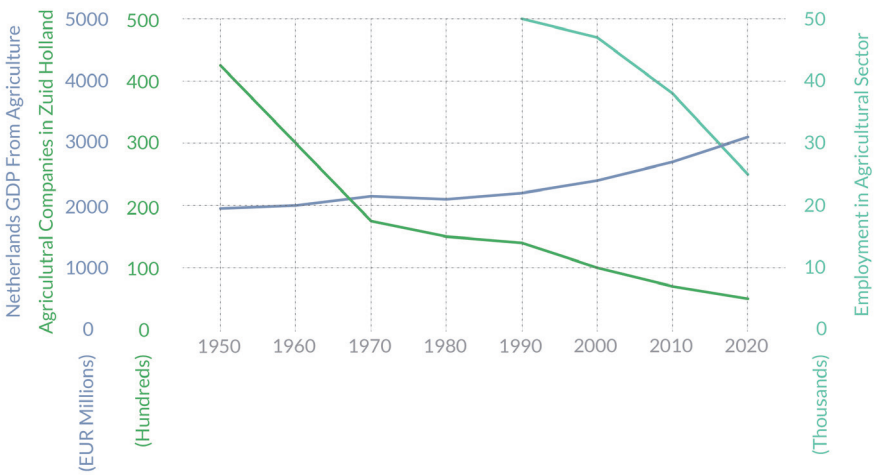


Figure 27 Agriculture Sector Data in Graph: Netheralands GDP, Agriculture Companies & Emplotment in Agriculture Sector. (Illustration by authors, data source: Tradingeconomics.com and CBS.nl).

2.7 | AGRI FOOD FLOW

Considering the layout of the current linear Agri-food sector system over the territory of Zuid Holland (Figure 29) we can identify key nodes and routes through existing infrastructure that determine the core structure flow of this sector. The arrangement over the territory is also very dependently oriented in favour of the port of Rotterdam, as many other productive sectors in Zuid-Holland are, and thus makes use of the Port's global flows to increase demand of agricultural products being produced in the province. In order to achieve local and regional circularity, we must not depend on the existing system based on its current arrangement, given the restraints and path dependencies (Brandao et al., 2019) of the existing system.

This logistical infrastructure, that services the agricultural sector from production to consumption, and is highly fluid and connected to the global market dependent on economy of scale production, must be rescaled to attend directly to the provinces' healthier and equitable food needs. Revisiting the Dutch Food Chain (Figure 28) we understand the need to reinforce the connection between Production and Consumption directly, bypassing the current distribution model altogether. In doing this, we can establish a new model for food production and consumption for the province that services its needs locally, independent from demands and threats of a global chain of production, striving to poten tially achieve circularity on a regional and local scale.

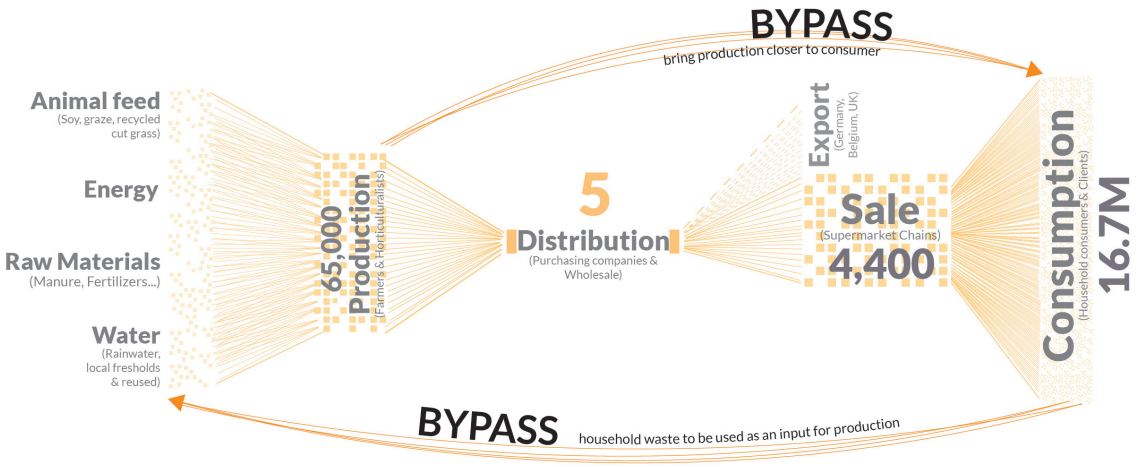


Figure 28 The Dutch Food Chain Bypass (Illustration by authors, data source: www.pbl.nl).

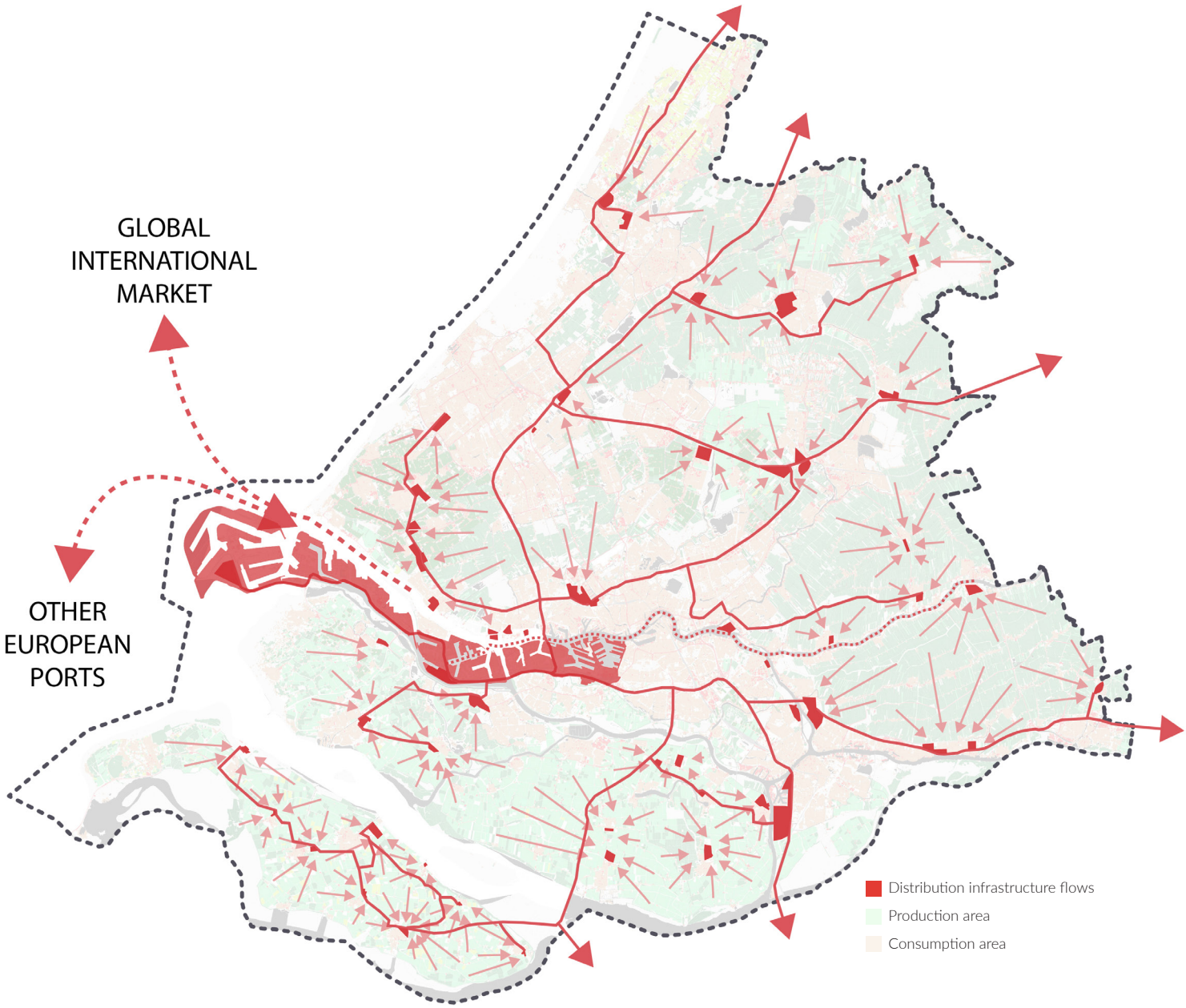


Figure 29 Zuid Holland Agri Food Distribution Infrastructure. (Illustration by authors, data source: LISA Data).

2.8 | SYNTHESIS: LIVING EDGES

How does the tension field translate over the territory of Zuid-Holland? Based on our analysis we comprehend that these dynamics have greater potential for intervention on the edges and peripheries between consumption and production landscapes: the city and the rural. As a framework to achieve this concept, we used the city edge theory (LOLA, 2011).

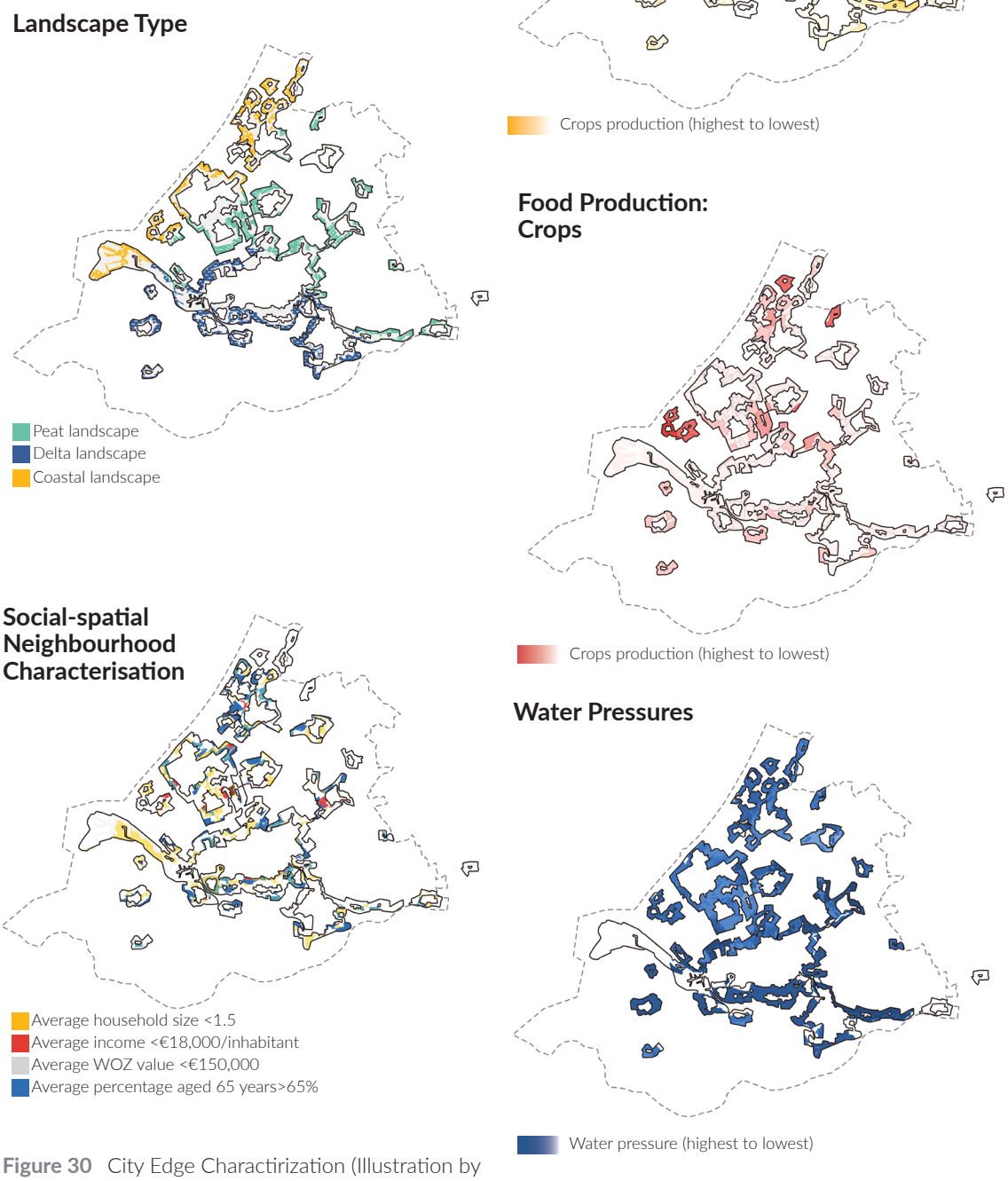


Figure 30 City Edge Charactirization (Illustration by authors, data source: LISA Data, EduGis)

Mapping the conditions and qualities of the edges was done by layering the following thematic maps: Landscape Type, Food Production (Livestock), Food Production (Crops), Social-spatial neighbourhood Characterization and Water Pressures. This enables us to understand the quality of the edges and characterize their livability and programmatic and performative potential. By doing this we can identify where and how the city edges can transform into living edges, where we can make the production- consumption bypass with spatial equality, urbanization and reconnect food production with society.

Figure 31 Living Edges Map (Illustration by authors, data source: LISA Data).

3 REGIONAL VISION

Figure 32 Living Edges Sketches. (Illustration by authors).

3.1 | VISION GOAL

Embracing adaptability as opportunity for creating living edges

Local food circular economy

Living Edges will be the spatial reflection of the circular agri-food sector in the Province of Zuid-Holland, and also an important step to break the global linear food system. This will be done by implementing diverse small and middle scale farming projects in the edges of cities to meet local food demand. Meanwhile, geographical segregation in food production and consumption are also broken down, and waste from production and consumption is more easily recycled and reused locally. This circular agri-food system is to be made more efficient by being multifunctional, by introducing quality green space in the urban fabric and producing diverse products.

Fair distribution of food

We propose a redistribution of the profit in the food chain, a more powerful position for local food producer while the distribution and process sector lose some power. By bypassing the current stakeholders in the linear-food system the profit of the system can be fairly distributed. In this way, food production can be more localized so that the cost of transporting, processing and preserving food will be reduced, which makes it easier for weaker people to get cheap and fresh healthy food. Eventually, both the profits from food production and the availability of healthy food will become more fair.

Improve lives in the edges

The drosscapes left by transforming to a circular agri-food sector can be used for further urbanisation or for implementing green areas within the city boundaries, which can help solve different socio-spatial problems in the edges. In the rural areas they reduce the feeling of loneliness by offering more social contact and new job opportunities. In the urbanised area they give greenery to the neighbourhoods. By the implementation of the small & middle scale agricultural production areas that are placed within communities, healthy food and healthy spaces become accessible for everyone.

Climate adaptation

The Zuid-Holland are going to be more resilient at multiple scale levels. By transferring food production from outskirt to the living edge, the outskirt landscapes can be transformed into protective buffer and large-scale water storage to defense from the sea level rising. Besides, through greening of the living edge by the new food production landscape and buffering in green-blue urban structures, cities in Zuid-Holland can adapt to extreme rainfall conditions. This new landscape structure, creating large nature reservation and ecology corridor also help to improve the biodiversity and the ecological environment both in the cities and rural.

Protective and productive regenerative landscapes

First, the outskirt landscapes of the present are envisioned to transform into protective and productive regenerative landscapes. Three typologies are identified based on the different types of water pressures. The proportion of permanent agriculture in these areas will gradually decline while seasonal crops will increase. Farmland will gradually be transformed into wetlands, lakes and nature reserves.

- coastal landscape
- peat landscape
- delta landscape
- main water structure
- area that can be flooded
- city edges
- water pressure

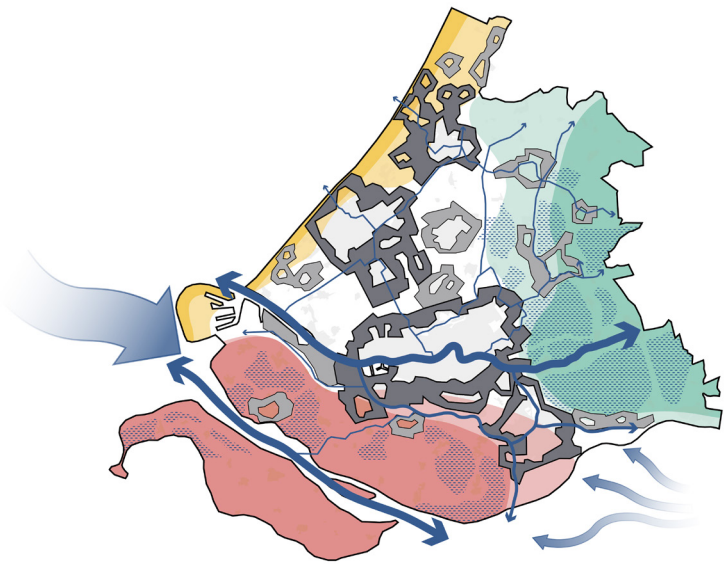


Figure 33 Protective and productive landscapes. (Illustration by authors).

Diverse life between cities

The inland landscapes between the cities have both recreational and agricultural use, whereby a quality improvement is required in accessibility, experience and use. Clusters of greenhouses will be smashed up by green corridors, which will use more renewable energy and new technologies to become more sustainable. Leisure parks are also productive landscapes that provide flexible ways of producing food. Meanwhile, this area is also an ecological patch connecting the urban green space with the outskirt natural landscape.

- aquaculture
- permanent farmland
- seasonal production landscape
- vertical farming
- city edges

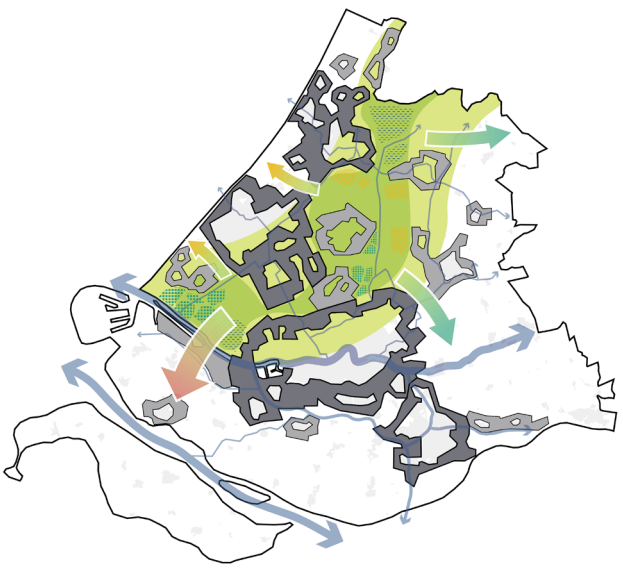


Figure 34 Diverse life between cities. (Illustration by authors).

Living Edges for adaptation

The edges become more intensified in use. Here communities create living edges through densifying and integrating nature and circular agriculture. By analyzing landscape values, urbanization trends, and food production flows, the city edges will be divided into different properties. They form a circular system in which urban sprawl and food circulation interweave, simultaneously connecting the green Spaces inside and outside the city.

area for densification
area for green connection
area for circular agriculture

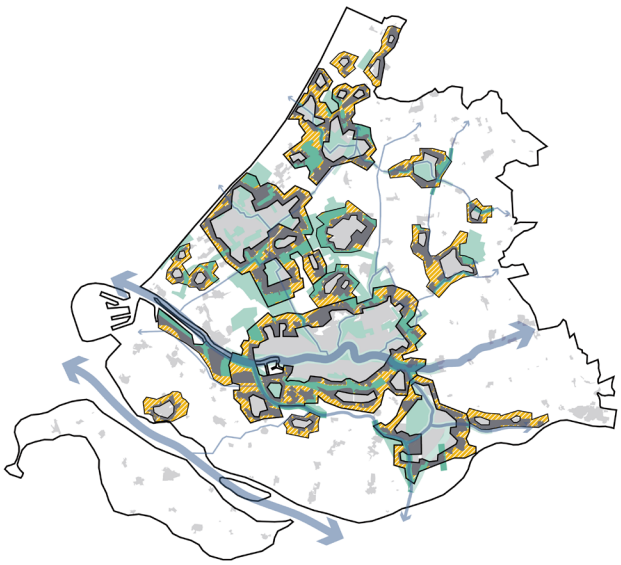


Figure 35 Living Edges concept. (Illustration by authors).

Local circularity and neighbourhood empowerment through local food production

The different edge neighbourhoods are empowered to become less vulnerable and more resilient. Communities in the edges are the starting units towards independent food circularity. Kicking start from the bypassing site, drosscape are going to be transferred into the combination of food circularity sector and community public space.

neighborhood on edges
food circularity

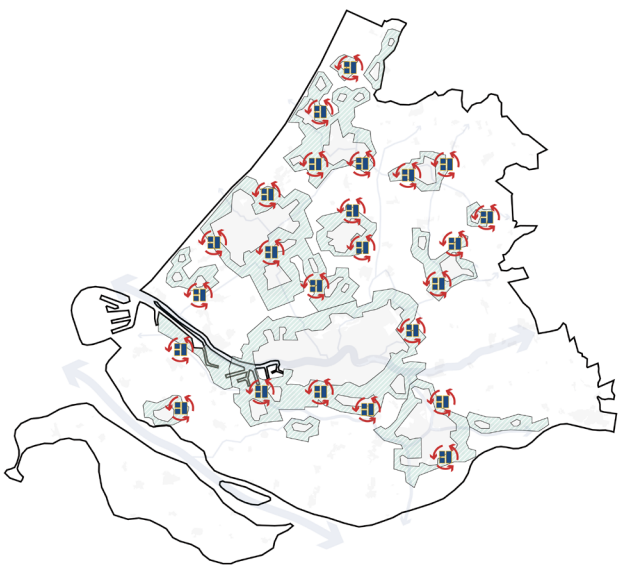
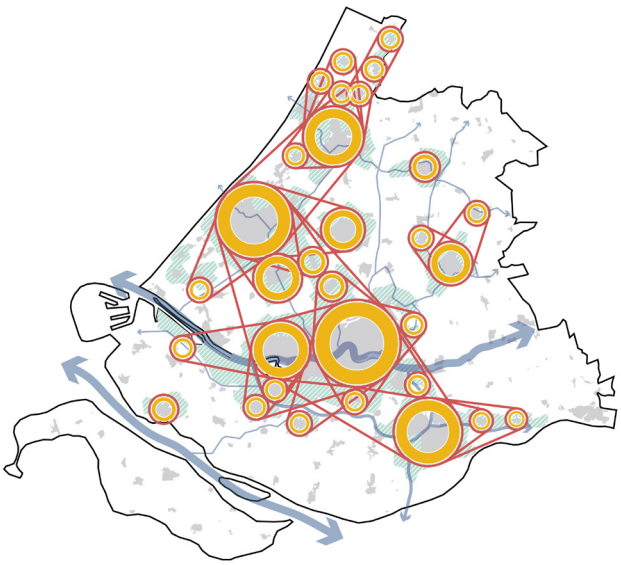


Figure 36 Circularity in neighbourhoods. (Illustration by authors).

Living Edges collaborate in circular clusters, at city and regional scale

Although the neighbourhoods are mostly circular in terms of food, it does not mean that regional cooperation has stopped. The level of the circularity still varies according to the size and development of the urban cluster. They will continue to collaborate, share knowledge, and form larger networks of food material flows that move toward regional circularity.



circular cluster
connection

Figure 37 Circular cluster of Living Edges. (Illustration by authors).

The vision of Zuid-Holland in food circularity is an organic combination of the above layers. It provides a development framework for regional landscape change, which aim at embracing adaptability as opportunity for creating living edges. Adaptability is to deal with the potential future climate and flood crisis, and the spatial changes caused by this response and the change of agricultural production from linear to circular are synchronized to some extent. The large area of intensive farmland that existed in outskirt of the city due to linear production should transform to ecological buffer against the crisis. So the new agricultural land is going to be on the edge of the city, gradually moving towards the city.

The Living edges are our spatial vision of future food production.It will be a highly complex zone that combines theof food production and processing, coping with extreme weather, and providing public space to make Zuid-Holland more sustainable and justice.

THE LIVING EDGES

Outskirts Landscape
- coastal landscape
- Peat landscape
- Delta landscape
- Main water structure
- Area that can be flooded

Landscape Between Cities
- Aquaculture
- Permanent farmland
- Seasonal production landscape
- Vertical farming

City Edges
- Area for densification
- Area for green connection
- Area for circular agriculture

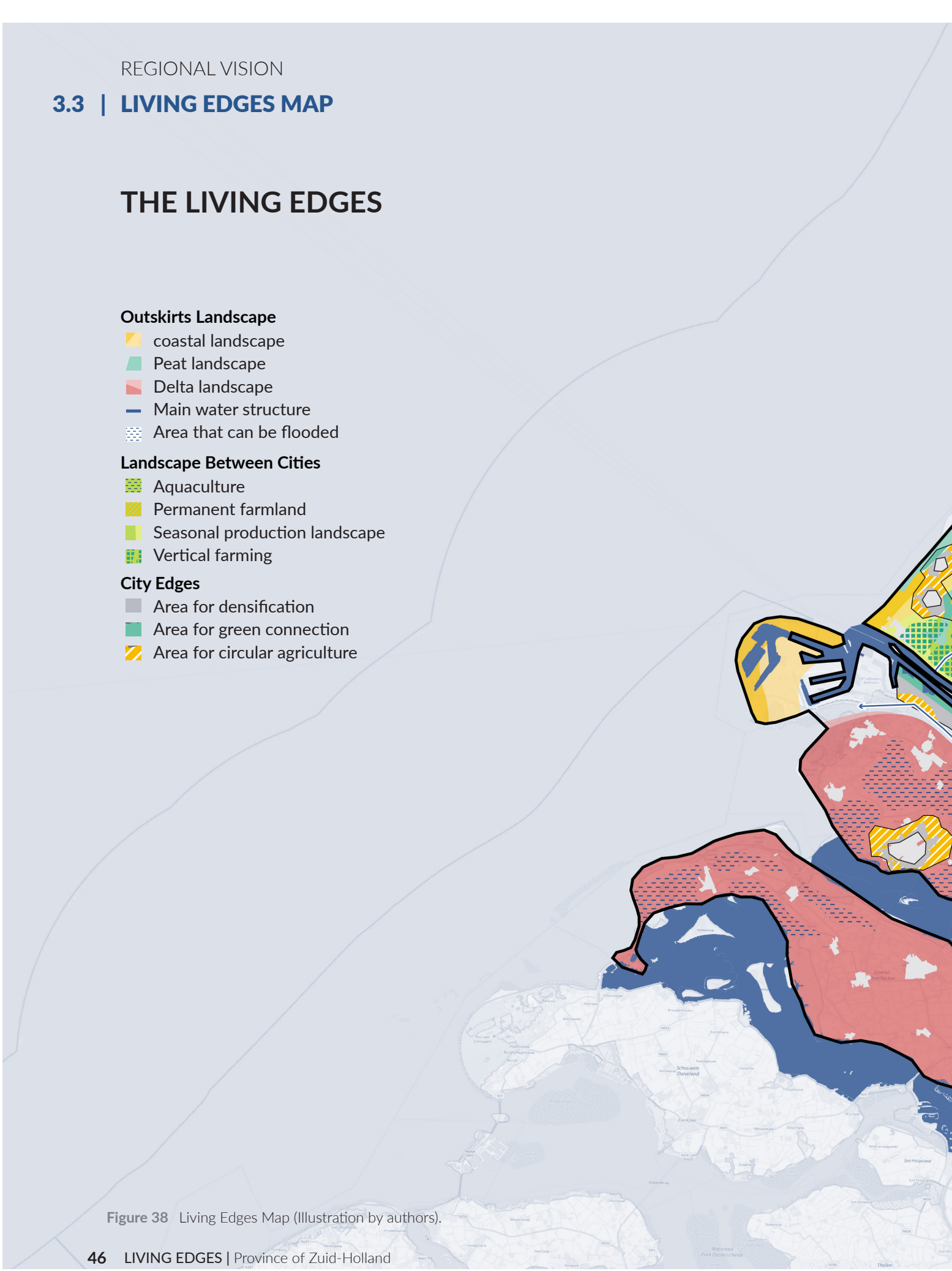
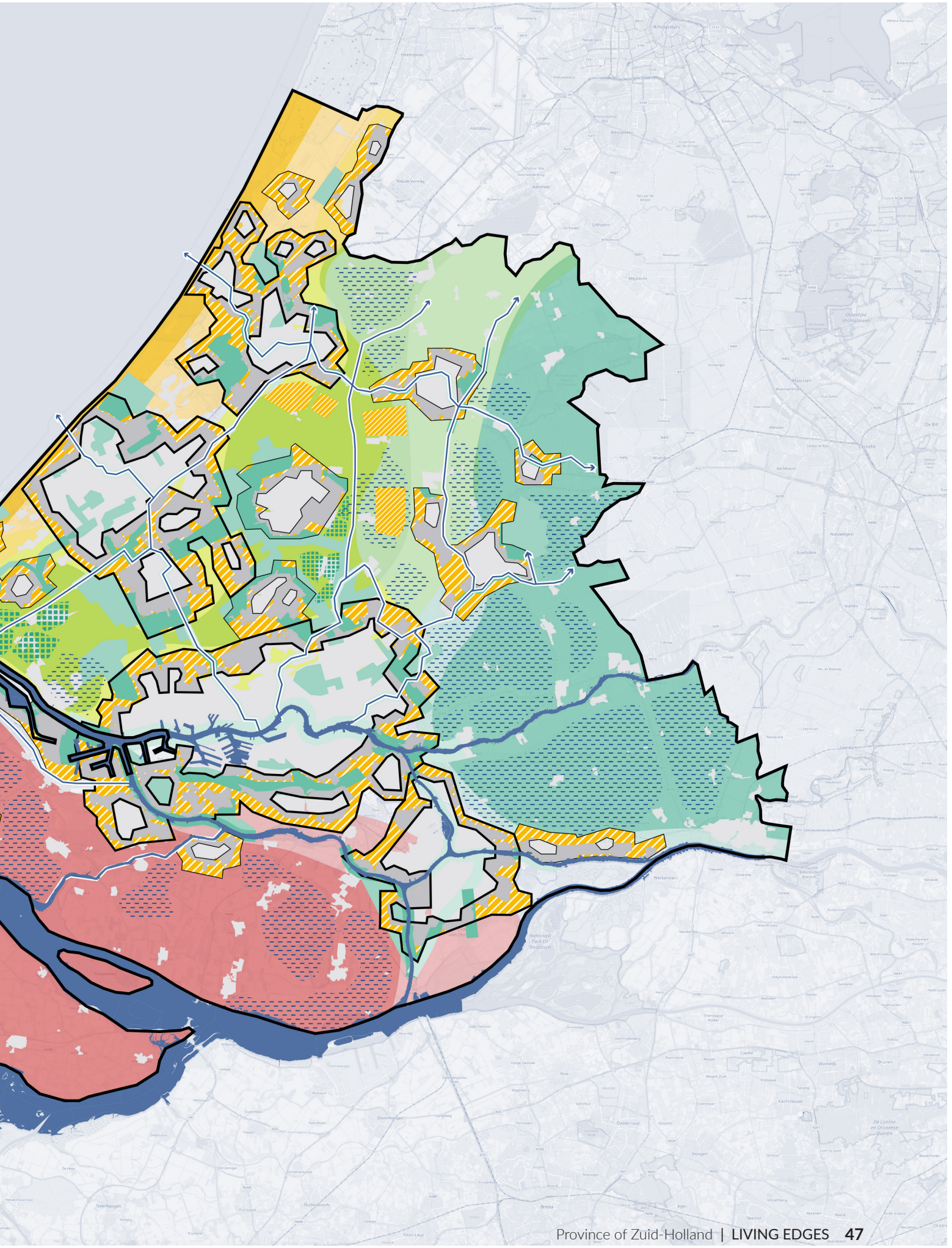
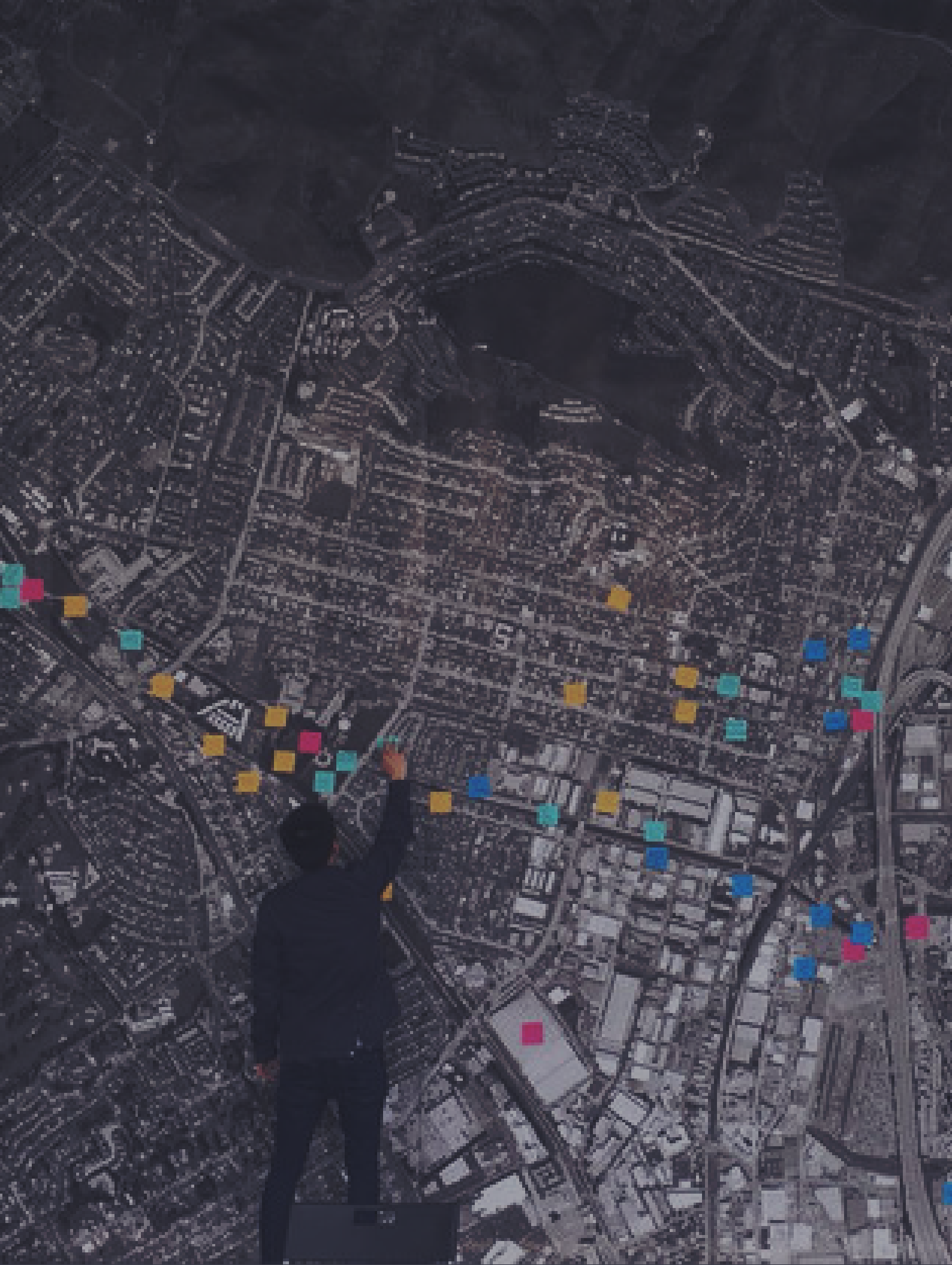


Figure 38 Living Edges Map (Illustration by authors).



3.4 | LIVING EDGES SCENARIO

Figure 39 Living Edges Scenario (Illustration by authors).



4 STRATEGY

Figure 40 Engaging stakeholders to participate in adaptation projects. (Public Sediment, 2018)

4.1 | INTRODUCTION

This chapter proposes a strategy for realising the Living Edges vision on a spatial and social level, as illustrated by Figure 41. First, the introduction analyses the challenges raised by the Living Edges vision on Circular Economy and spatial justice. Next, the strategy concept is introduced, followed by an elaboration on its three main elements and their interrelations: 1) Dynamic Adaptive Policy Pathways; 2) Stakeholder Engagement Strategy; 3) Toolbox. Finally this chapter concludes with a possible application of the strategy in the Province of Zuid-Holland.

Problematisation

As a result of the large amount of stakeholders that need to be activated, the project's reliance on a multitude of small-scale actions and the long-term focus, the strategy needs to consider deep uncertainty. On the next pages, this concept will be further introduced from both a technological and societal perspective.

Furthermore, the Living Edges vision relies on bottom-up initiatives collaborating at multiple scales. An inclusive and anticipatory governance structure is conceptualised on the next page.

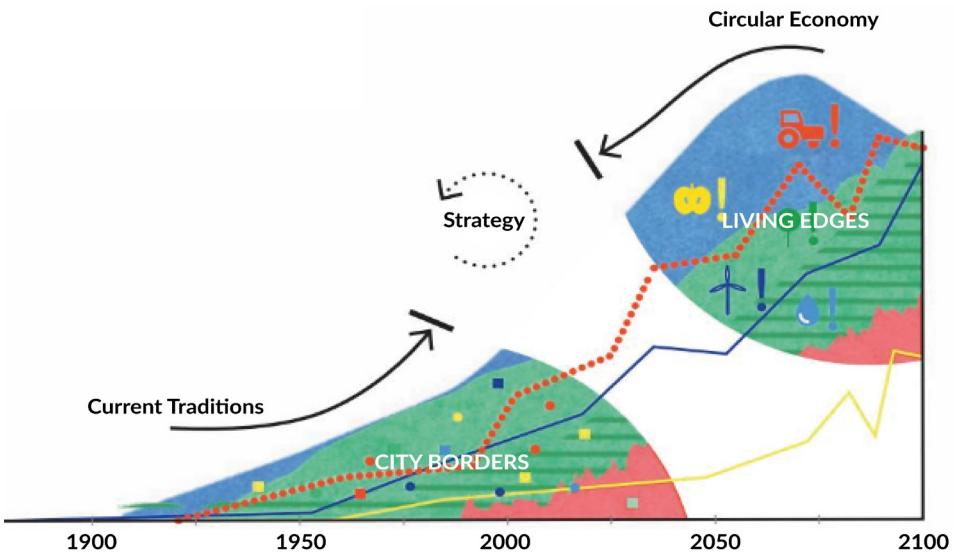


Figure 41 The strategy as instrument for creating Living Edges. (Illustration by authors, adapted from LOLA, 2018).

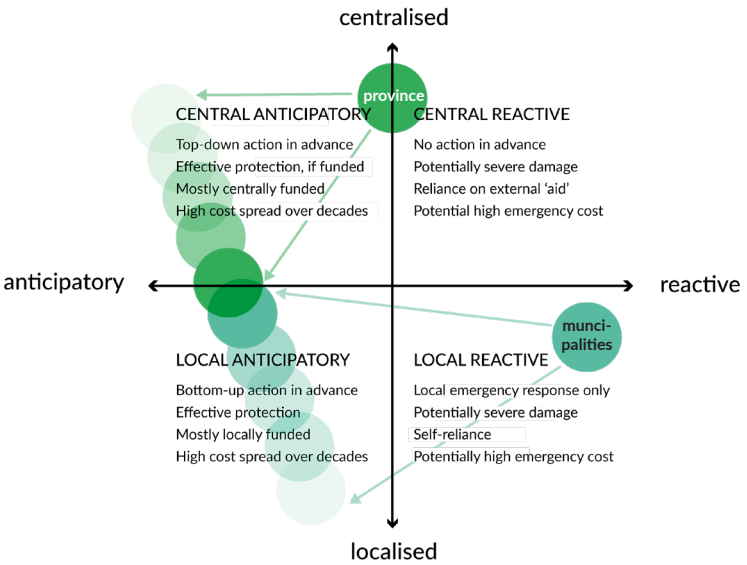


Figure 42 Organisation structures should shift to an interscalar and anticipatory approach. (Illustration by authors, based on Tompkins et al., 2018).

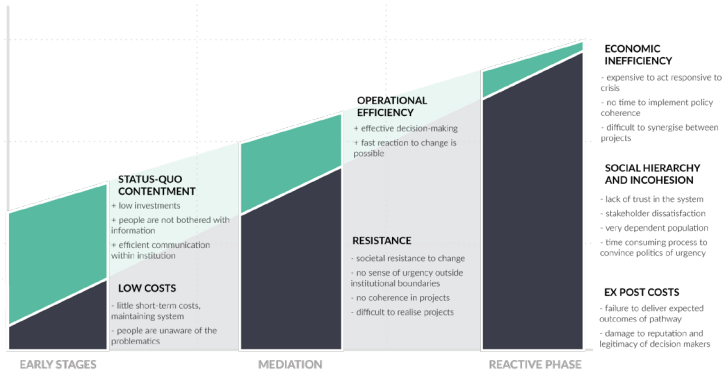


Figure 43 Cost benefit analysis of the proposed anticipatory and inclusive governance structure. (Illustration by authors, adapted from Akhmouch & Clavreul, 2016).

Governance structure

Achieving the Living Edges vision on Circular Economy and Spatial Justice depends on local actions that contribute to the larger, regional system. As Sorenson & Torfing describe:

"[a] type of governance which is a relatively stable horizontal articulation of interdependent but operationally autonomous actors who interact through negotiations which take place within a specific framework that is self-maintaining and contributes to the production of public value." (Sorenson & Torfing, 2005, 2007)

Such a governance model answers to the Sustainable Development Goals and Organisation for Economic Co-operation and Development (OECD) Principles on Water Governance. Combining the SDG's and OECD Principles "calls for promoting stakeholder engagement for informed and outcome-oriented contribution to water policy design and implementation" (Akhmouch and Clavreul, 2016). In Figure 42 the governance structure is illustrated, it visualises that a paradigm shift is needed towards interscalar stakeholder engagement and anticipatory governance is needed in order to realise the Living Edges.

The Living Edges strategy should include the OECD Governance Principles for improving the feasibility of the project through lowering the costs and increasing the benefits in the long run. Figure 43 compares the costs and benefits of the current governance structure and the proposed, inclusive structure. The intitial costs of the inclusive organisational structure are higher, but the investment pays off in the long run when there is more capacity and support for the Living Edges projects. Opposed to the current hierarchical and reactive governance model, for which Akhmouch & Clavreul (2016) state that it is threatened societal 'fatigue' and a lack of capacity in critical stakeholders.

Deep Uncertainty

The Living Edges strategy does not only need to combine social and technological aspects, but it also has to incorporate the deeply uncertain future of the big systems it is related to. Including the notion of deep uncertainty in policy making includes the complexity of the uncertain future and an evolving context (Walker et. al, 2013). Deep uncertainty was categorised into Technological- and Societal Uncertainty for the Living Edges strategy.

"The problem is that we do not know how the future will unfold. Despite this uncertainty decisions need to be taken, because impacts may be significant and the implementation of policies takes time." (Haasnoot et al., 2012).

Technological Uncertainty

The policies of the Living Edges are in the first place determined by current knowledge about existing problems, but also by future-predictions based on scientific models. First, threats such as sea level rise in relation to climate change are identified and calculated by research institutions. Figure 44 illustrates three possible climate change scenarios and their increasingly uncertain associated meters of sea level rise (Haasnoot et al., 2018). The figure shows that a strategy for the province should incorporate the uncertainty caused by problem development to be reliable to ensure a safe region.

Societal Uncertainty

Furthermore, "some strategies may be feasible today but not in the future (in particular those that involve spatial planning)" (Haasnoot et al., 2012). This can be explained through the softer side of policy making. Figure 45 shows the complexity caused by a multitude of stakeholders; changing (national and international) political contexts, varying attitudes towards change and technological evolutions. For example, Ribeiro and Gonçalves (2019) identified four attitudes towards change that impact the way a society translates a problem into policies and actions: resist, recover, adapt and transform.

The complexity, dynamics and uncertainty described above are incorporated in the strategy concept, which will be further explained on the next pages.

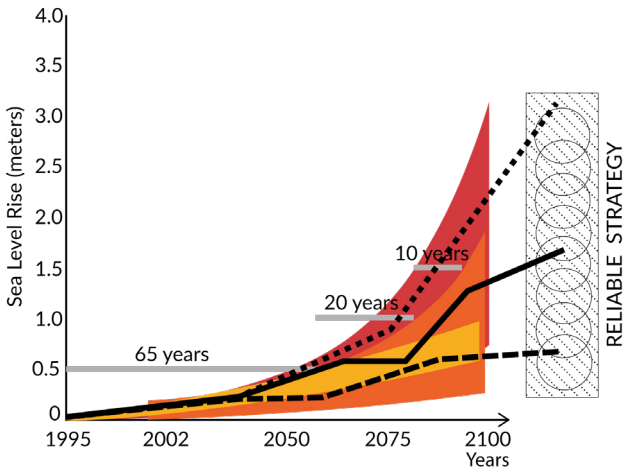


Figure 44 Incorporating the unpredictability of sea level rise in three climate change scenarios in a reliable strategy. (Illustration by authors, adapted from: Deltares, 2019).

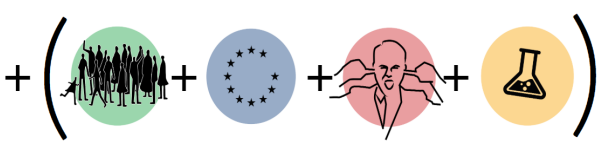


Figure 45 The dynamics of the societal and technological context contribute to Deep Uncertainty of future technological and societal context. (Illustration by authors).

The Strategy Concept for realising Living Edges incorporates the challenges of deep uncertainty in societal and technological context. The strategy consists of three main elements:

1. Dynamic Adaptive Policy Pathways;
2. Stakeholder Engagement Strategy;
3. Toolbox.

These elements that are first individually explained on a conceptual level, then synthesised into the Strategy Concept. Next, the strategy proposes a possible application of the concepts for realising the Living Edges in the Province of Zuid-Holland. Last, Chapter 5 elaborates on the spatial implications of the strategy on the local and regional scale.

Dynamic Adaptive Policy Pathways

The concept of Dynamic Adaptive Policy Pathways (DAPP) was first introduced by Haasnoot et al. (2012) in the research institude Deltares. The DAPP as illustrated in Figure 44 offers policy makers a tool for developing an adaptation roadmap. The DAPP illustrates multiple pathways for different actions suitable to adapting the system to the future changing conditions. The speed at which certain interventions are no longer sufficient, depends on the rate at which the problem evolves (the Changing Conditions in Figure 44).

In addition, the costs and benefits of certain pathway (combinations) can be evaluated for different climate change scenarios. The direct and indirect effects of the pathways can be visualised through scenario planning, giving decision-makers and stakeholders a better insight in the future implications of a decision. An example for the regional Living Edges strategy DAPP is shown in Figure 63 on page 65.

For the Living Edges Strategy, the pathways can be created and evaluated by an interscalar network of stakeholders. In this way, the DAPP can be used as a decision-makers roadmap for ensuring public goods, despite changing contexts and it can be used for creating awareness and understanding in society, so people are more accepting towards taking a new Pathway. The dynamic use of the DAPP is explained on the next page in Figure 47.

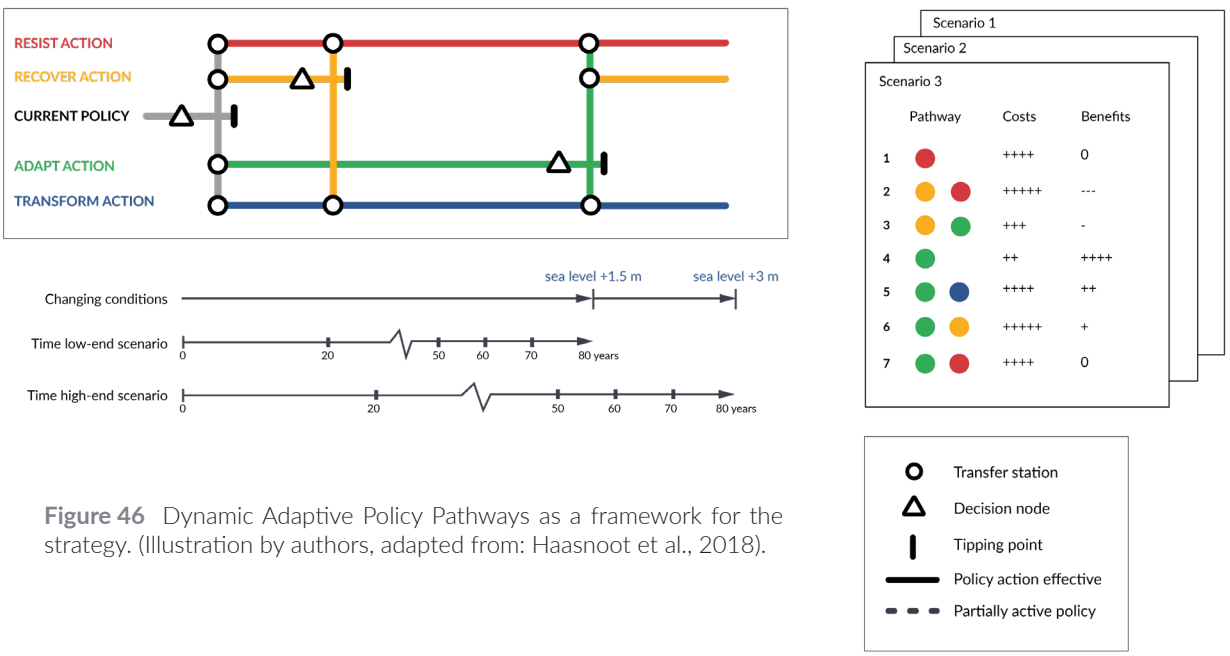


Figure 46 Dynamic Adaptive Policy Pathways as a framework for the strategy. (Illustration by authors, adapted from: Haasnoot et al., 2018).

Living Edges Strategy Concept

The Living Edges Strategy (Figure 47) emphasizes on the importance of the interrelations between the DAPP, different governance scales, a network of stakeholders and the toolbox. This paragraph will further elaborate on the system of the strategy.

Essential Stakeholders

As mentioned earlier, the project depends on the activation and engagement of stakeholders and their collaborations. Existing networks should be strengthened, and through time, new connections can be forged. The stakeholder network influences the creation and evaluation of the DAPP through the Stakeholder Engagement Strategy (see page 58). Decision-making happens through representation, but will be better received by society.

Interscalar DAPP for Project Synergies

The strategy concept distinguishes different responsibilities for the different scales. The region is focused on larger systems such as the mitigation of water pressures, whereas the municipality is more focused on the local occupation and (food) production. The municipal DAPP is created within the preferred regional pathway, and is influenced by local problems, traditions and people. In turn, the Living Edges projects use various pathways of the municipal DAPP, related to the stakeholders engaged in the projects and site-specific characteristics. Through a cyclical process, which will be elaborated on page 12, the performances of the local projects and their synergies will be evaluated in relation to the regional pathway.

Toolbox: from policy to action

To translate the policy pathways to real Living Edge projects that complement and collaborate, a toolbox should be provided. The region and researchers develop high-tech demand driven adaptation technologies, that can be accessed by all. Consequently, the Living Edges projects function as testing grounds and are the input for new research.

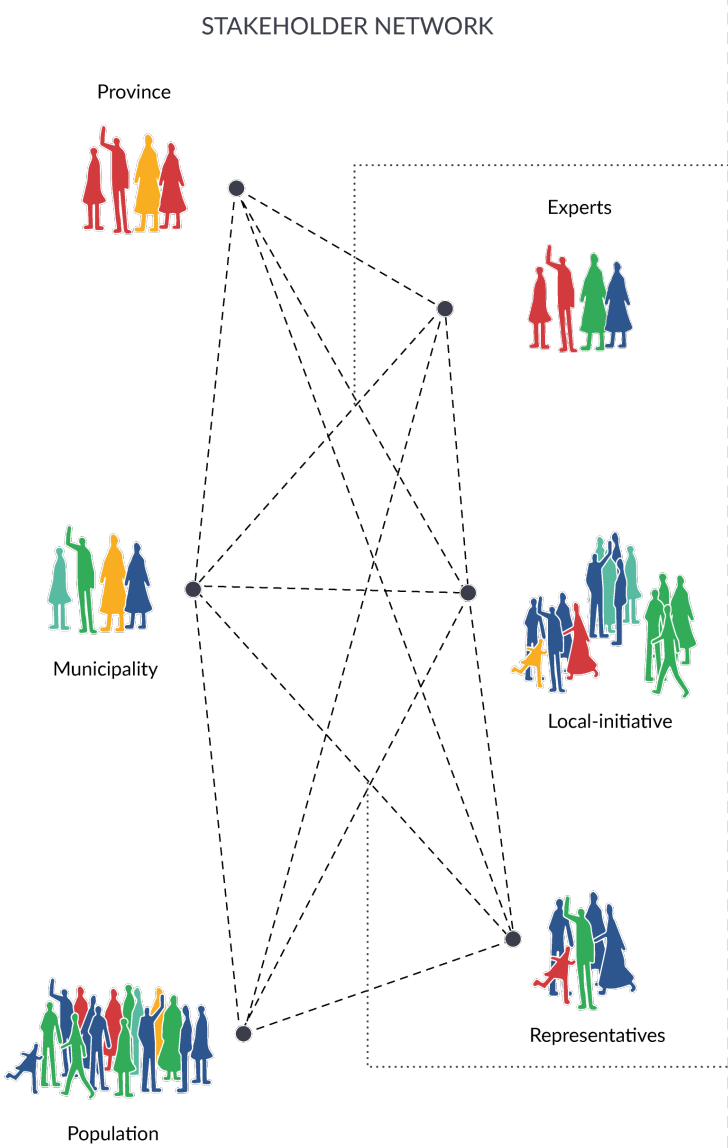
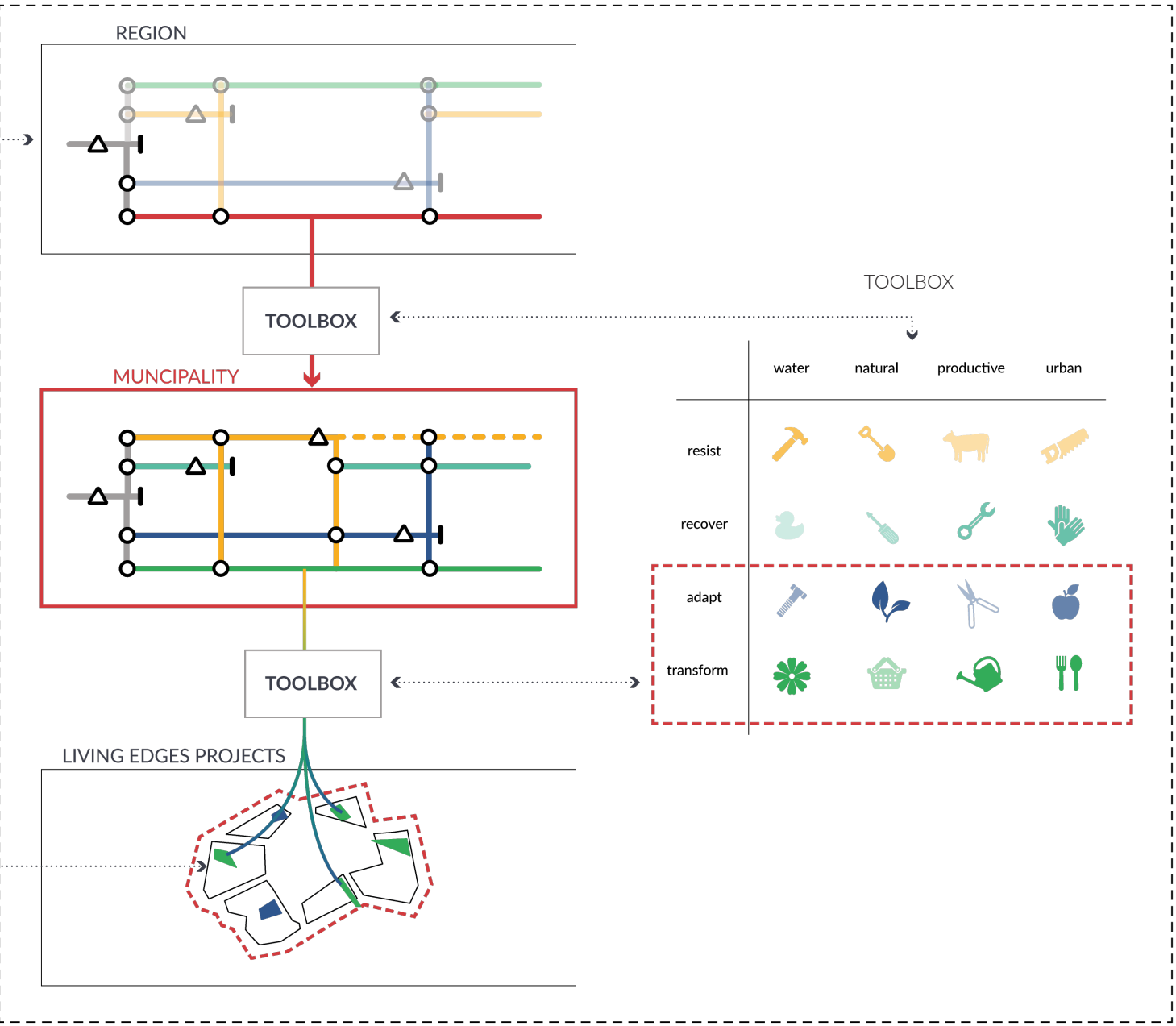


Figure 47 The Living Edges Strategy Concept. Applying the Dynamic Adaptive Policy Pathways at multiple scales. Stakeholders, policies and projects interact through a network. Project synergies and collaborations are possible through using the toolbox. (Illustration by authors).


REGION
TOOLBOX
MUNCIPALITY
TOOLBOX
TOOLBOX
water
natural
productive
urban
resist
recover
adapt
transform
LIVING EDGES PROJECTS

4.3 | STAKEHOLDER ENGAGEMENT STRATEGY

From linear to circular

As described earlier, the Living Edges Strategy depends on engaging stakeholders to embrace adaptability as opportunity. Local projects are the backbone of the circular, local and regenerative agro-food sector. The stakeholders of the agro-food sector are localised in Figure 50. This illustrates that the Living Edges vision bypasses some of the existing big stakeholders on the one hand and on the other hand empowers local initiatives.

The Power-Interest matrix in Figure 48 shows that especially farmers and households should be activated in order to adapt their present behavior to more sustainable alternatives. Whereas linear stakeholders such as distributors and processors are threatened to become obsolete and have to radically change their businesses to a more diverse, local and inclusive practise.

Stakeholder Network

The diagram in Figure 49 illustrates the network of stakeholders that were inventorised in Figure 48 and localised in Figure 50. The existing linear system is characterised by the distribution and processing bottleneck. Consumers and producers are both systemically and physically disconnected. The Living Edges projects and the associated stakeholder collaborations achieve a more direct connection between consumption and production.

As the densified network of stakeholders branches out, it strenthens the capacity for more circular and local food production. The phasing of different stakeholder network engagement strategies to implement the DAPP is elaborated in Figure 51 on page 60.

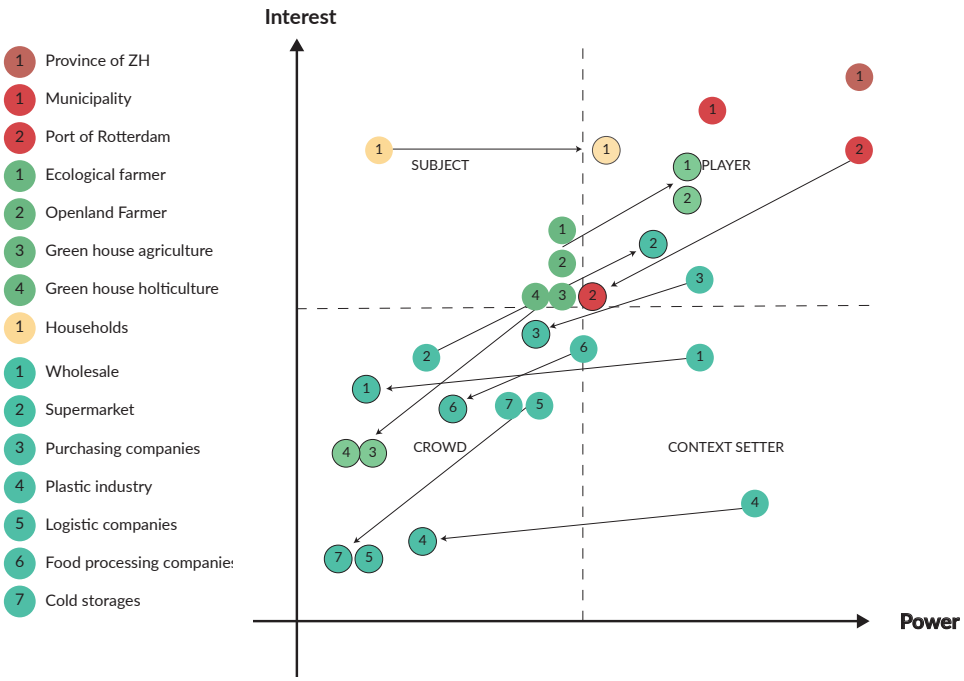


Figure 48 Power-Interest Matrix. (Illustration by authors).

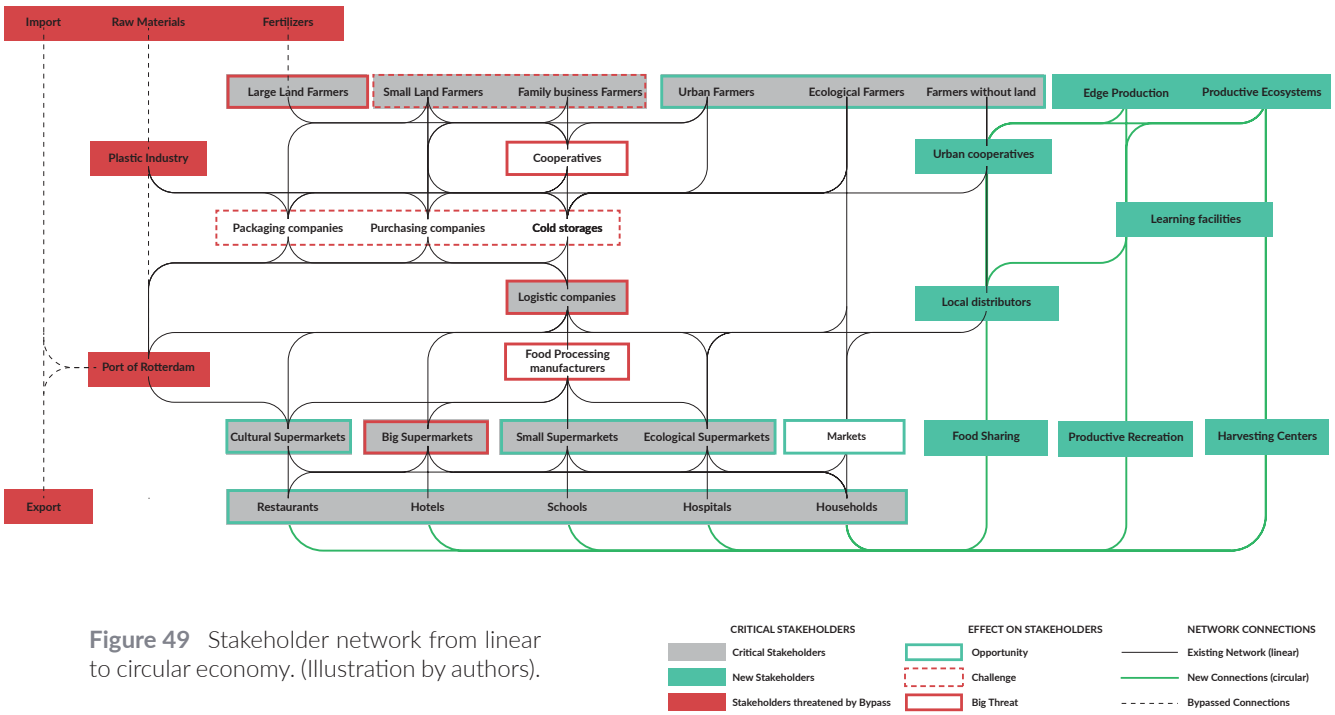


Figure 49 Stakeholder network from linear to circular economy. (Illustration by authors).

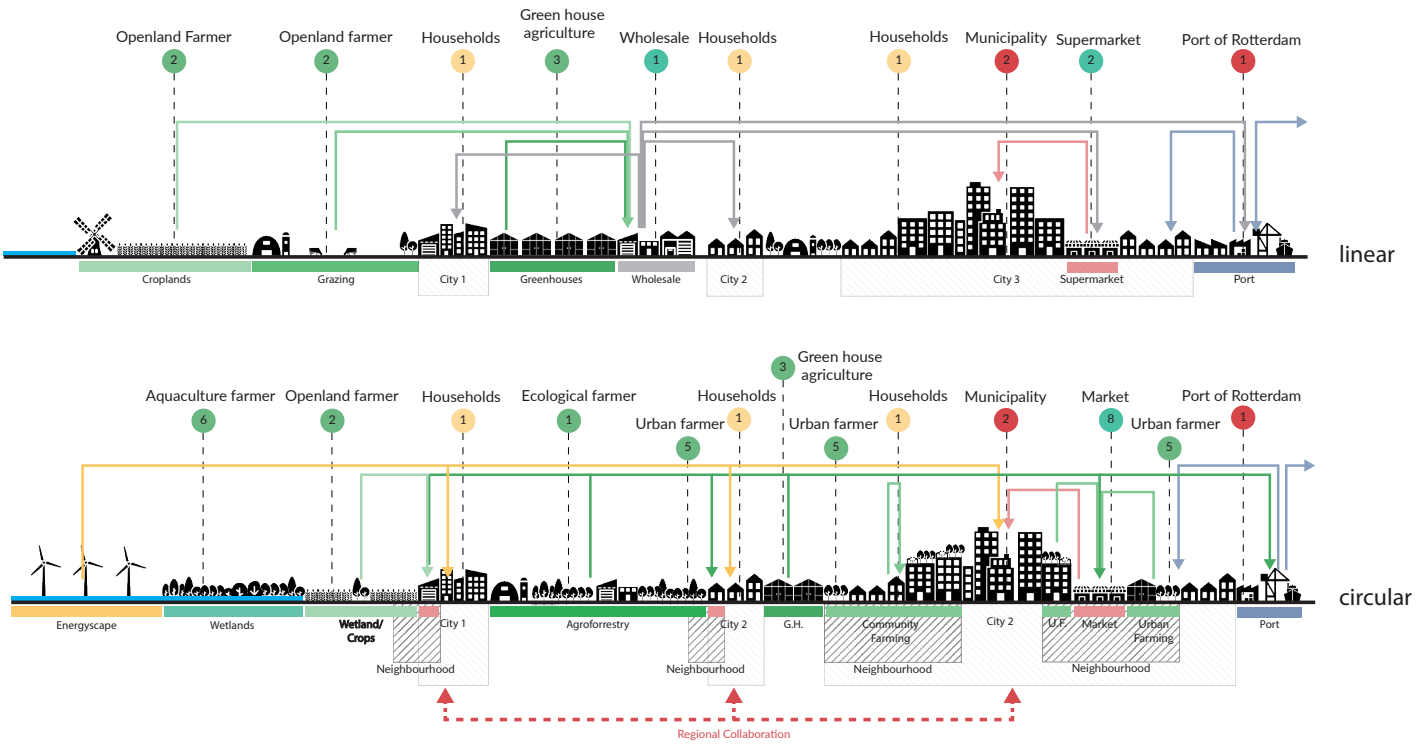


Figure 50 Stakeholders in the systemic section of the linear (top) and circular (bottom) agro-food system. (Illustration by authors).

4.4 | STAKEHOLDER ENGAGEMENT PHASING

Stakeholder Engagement Phasing

The vision for the Living Edges strategy involves an interscalar and inclusive approach. This strategy aims to activate a wide range of stakeholders to contribute to the Living Edges. Figure 51 shows the management cycle for a just implementation of the DAPP strategy. It distinguishes three stages: the Early Stages for stakeholder engagement; the Implementation, where public-private collaborations realise projects; and the Evaluation which concerns regional responsibilities. The stakeholder engagement action-typologies are explained for each phase. The phases are based on Tompkins' (2008) engagement principles and are focused on knowledge sharing, activation, collaborations and project synergies.

Figure 52 Experimenting with adaptative technology. (De Swart, 2018)

Figure 53 Measurements on ecology and water quality (van de Veen, n.d.)

Figure 54 Measurements on ecology and water quality (Resilient by Design, 2018)

Figure 55 Stimulating partnerships using network and financial stimuli (Resilient by Design, 2018)

Figure 56 Improving local concepts. (De Swart, 2018)

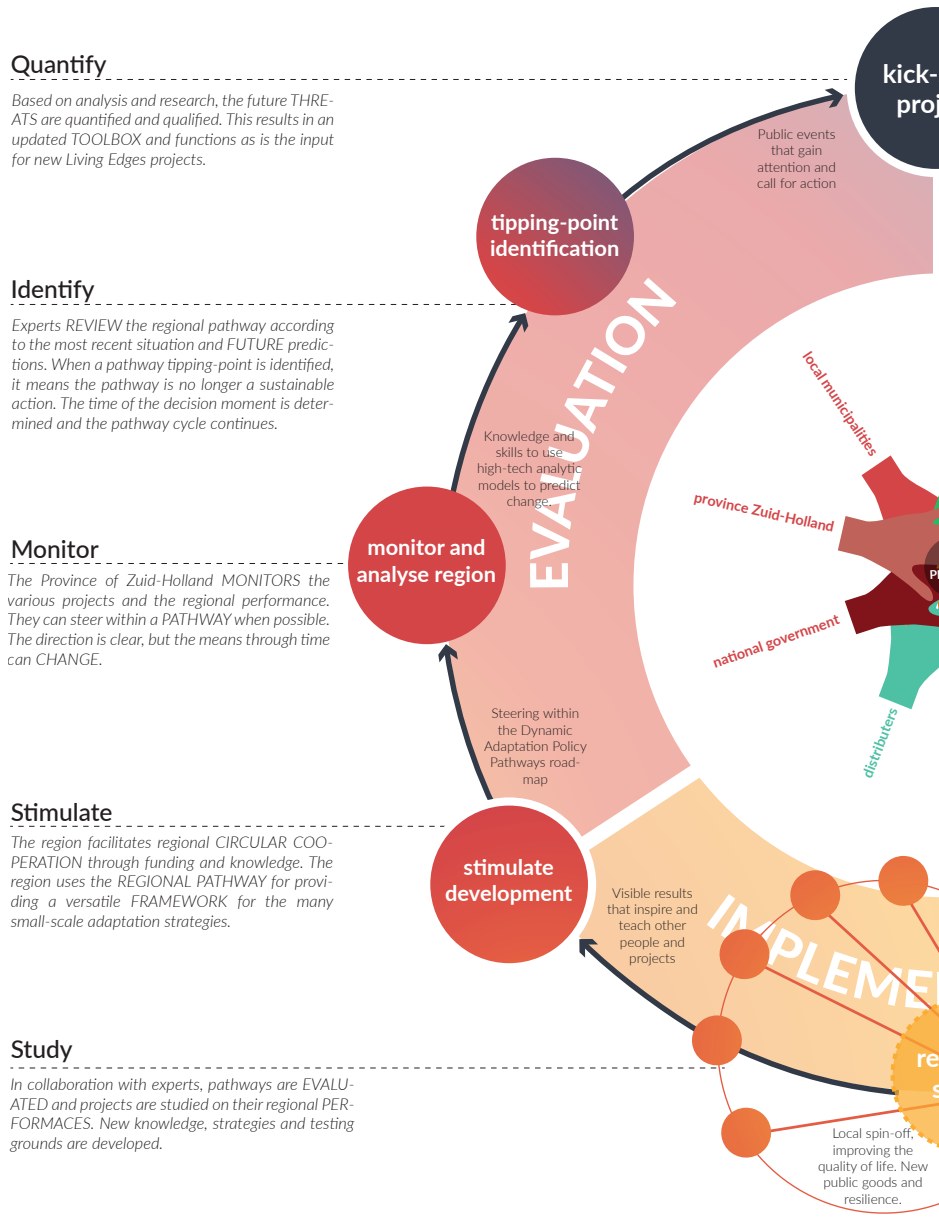


Figure 51 The Just Process Management Cycle. (Illustration by authors, based on Tompkins, 2008 and Resilient by Design, 2018).

A Just Process

The different elements for the stakeholder engagement activities were based on the Resilient by Design (2017) strategy for the San Francisco Bay Area. The Just Process should be:

"a social design process which builds community capacity and ecoliteracy to address the challenges of coastal adaptation and resilience planning, especially in vulnerable communities" (Resilient by Design, 2017).

When communities collaborate with private and public partners equally, it will 'improve and not displace community members.' By integrating local knowledge and technical expertise, regional adaptation projects become meaningful Living Edge projects. The interscalar, networked engagement strategy results in the deveopment of Living Edges that are socially and ecologically strong through integrative and creative co-creation.

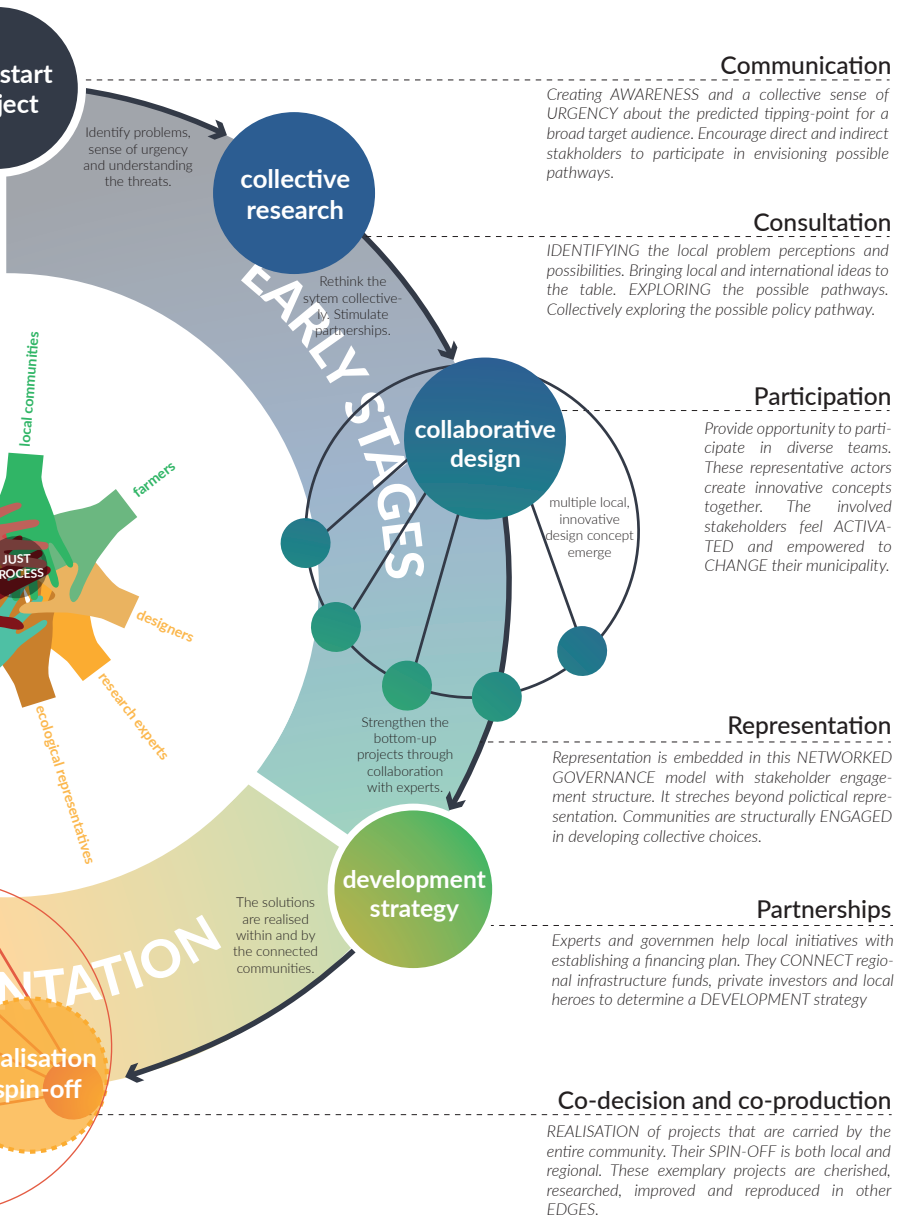


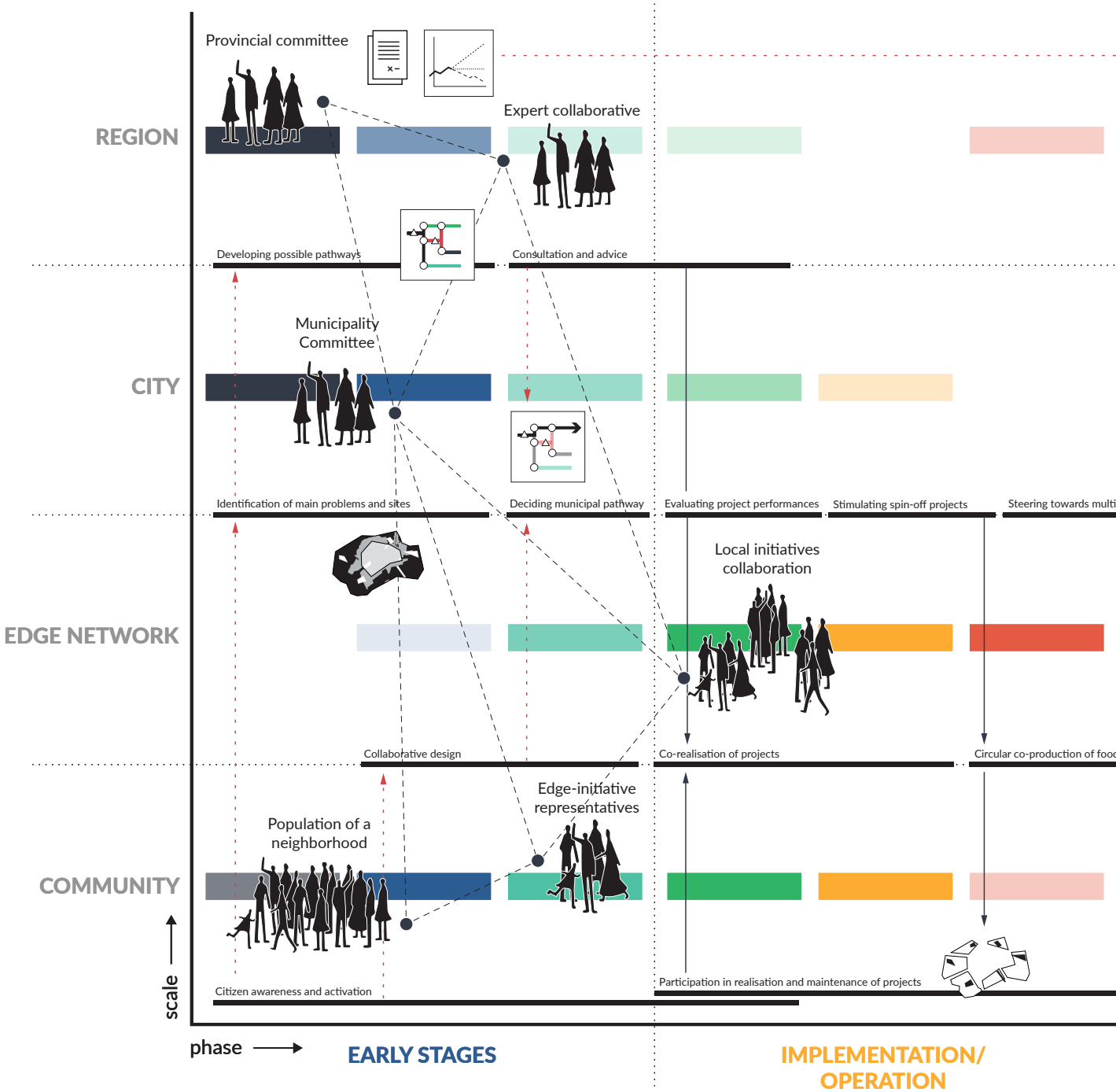
Figure 57 Starting by informing locals (P+SET, n.d.)

Figure 58 Consulting community on vulnerabilities and sites to improve (Public Sediment, 2018)

Figure 59 Communities and experts in collaborative design phase (P+SET, n.d.)

Figure 60 Partnerships empower projects in development phase (Resilient by Design, 2018)

Figure 61 Proud locals realise project. (van Abeelen, 2019)

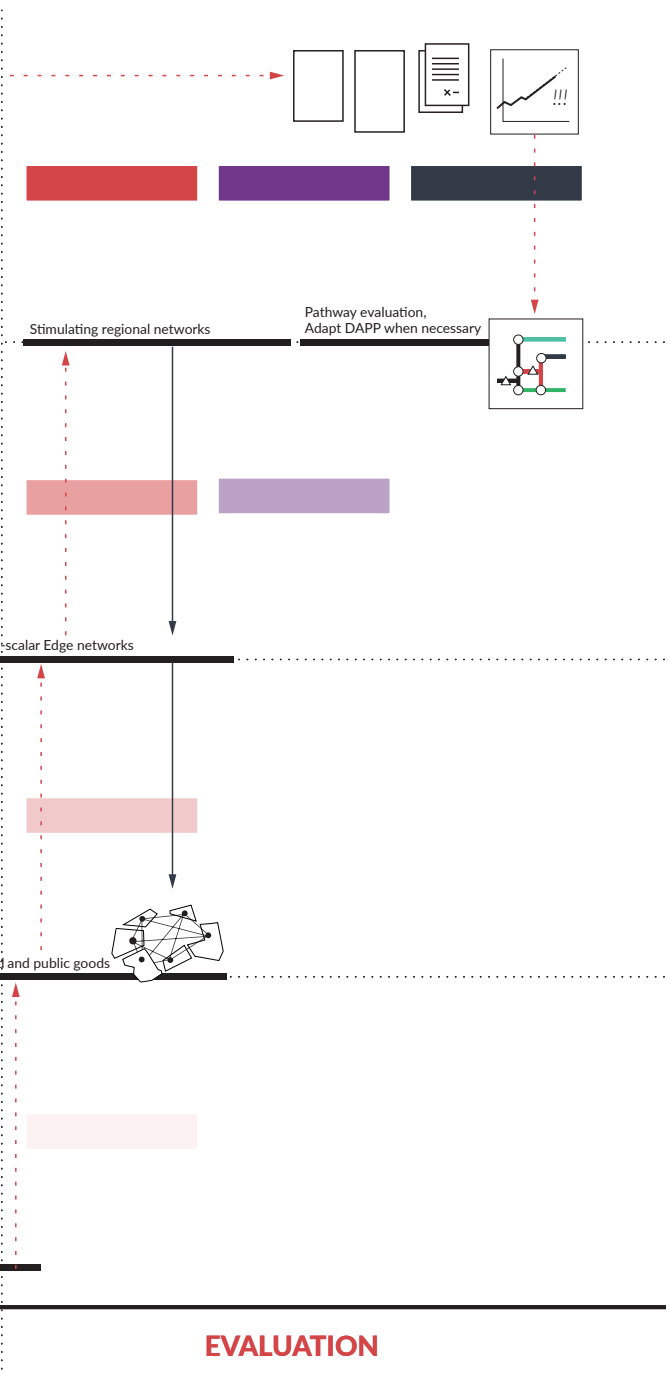

Provincial committee
Expert collaborative
REGION
Developing possible pathways
Consultation and advice
Municipality Committee
CITY
Identification of main problems and sites
Deciding municipal pathway
Evaluating project performances
Stimulating spin-off projects
Steering towards multi
Local initiatives collaboration
EDGE NETWORK
Collaborative design
Co-realisation of projects
Circular co-production of food
Edge-initiative representatives
Population of a neighborhood
COMMUNITY
Citizen awareness and activation
Participation in realisation and maintenance of projects
scale
phase
EARLY STAGES
IMPLEMENTATION/ OPERATION

Multi-scalar, Networked Stakeholder Engagement Strategy

The stakeholder engagement strategy consists of multiple phases in which different combinations of stakeholders collaborate in creating different documents and products that focus on different scales. This interscalar interaction between stakeholders and projects is visualised in Figure 62.

Figure 62 illustrates how the envisioned stakeholder network participates in different phases based on the colored hatches. As Figure 51 also explains, the region has a facilitating and organising role. To create the regional DAPP, the Province collaborates with municipalities that are informed by local community networks. Consequently, the municipalities identify the main problems, threats and opportunities in the city edges: connecting with locals and creating capacity for Living Edges Projects.

The Living Edges collaboratives that result from these initial phases are supported by the Toolbox with export knowledge and funding for projects that contribute to the regional Adaptation Pathway. In turn, the city and region monitor, study, stimulate, connect Edges. Combining local knowledge and regional expertise, the region is able to navigate within the DAPP: dynamically adapting to changing conditions together.



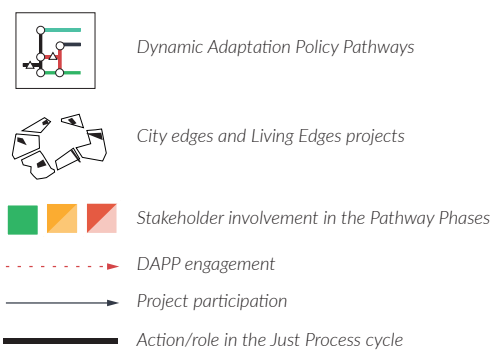


Figure 62 Multiscalar, networked stakeholder engagement strategy in the three stages of the DAPP-application. Interaction between different collaboratives for research, design, development and evaluation. (Illustration by authors, based on: Sha, 2018 and Resilient by Design, 2018).

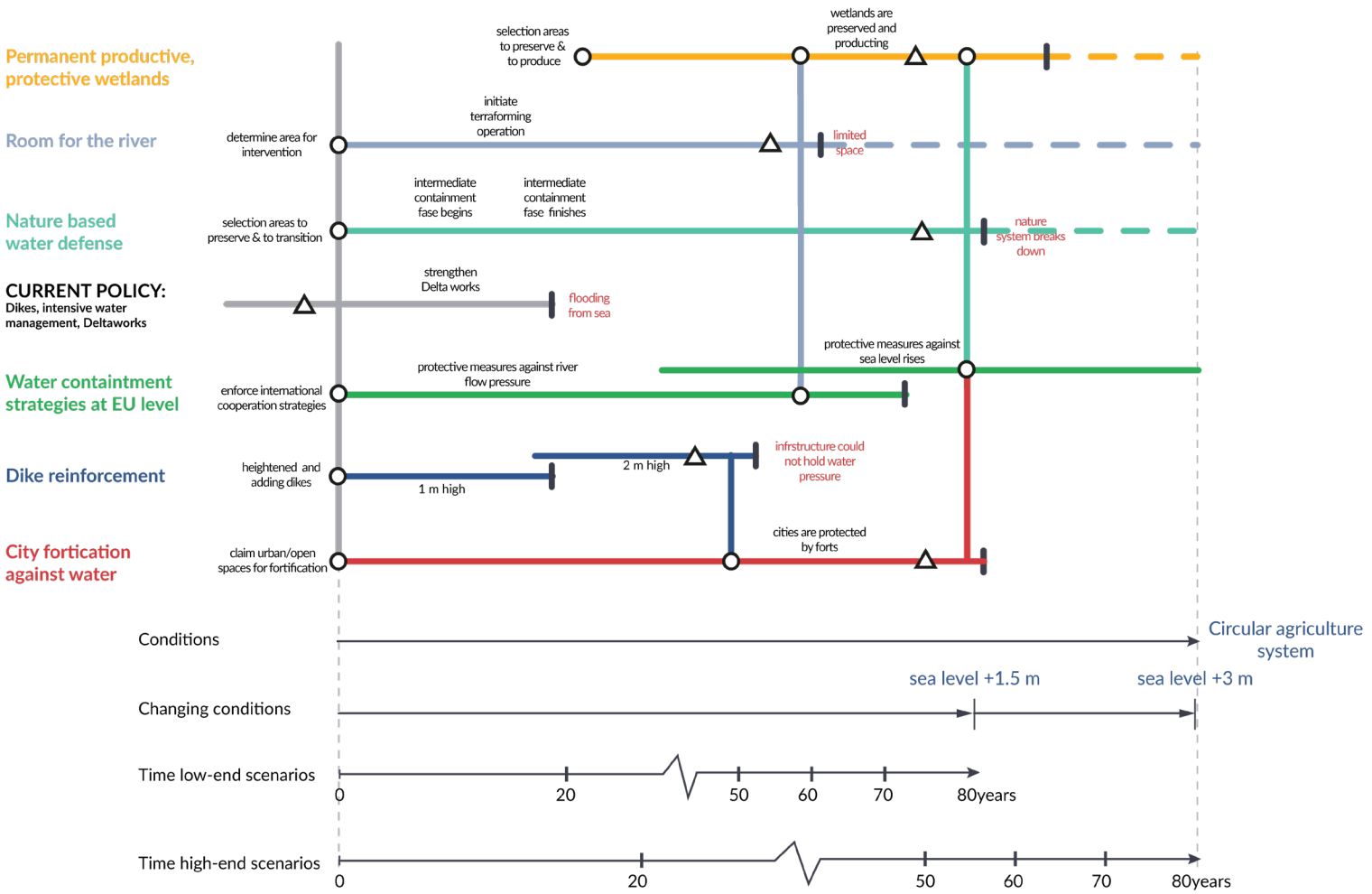
4.5 | PROVINCIAL PATHWAYS

The concept of deep uncertainty is embedded in the DAPP concept (Haasnoot et al, 2012). As explained in the introduction, the dynamics between the societal and technological context and problem evolution contribute to deep uncertainty. In the first place, the speed at which the Province has to navigate through the pathways is flexible and depends on the rate at which he problem evolves. In the second place, the dynamics of the technological and societal context are embedded in the concept by creating multiple Pathways.

Each Pathway that was developed for the Provincial DAPP in Figure 63 will suit a certain context better. While all Pathways will in the end adapt the systems in Zuid-Holland to the changing conditions, some actions are more focussed on embracing change, whereas others resist (Ribeiro and Gonçalves (2019).

Provincial Responsibilities

The Living Edges Strategy envisions an organisational, facilitating, stimulating and monitoring role for the Province of Zuid-Holland. The strategy largely relies on local, networked projects that together can realise the provincial adaptation ambitions. In this governance structure, the Province focusses on adapting the larger landscape systems to changing conditions. It can adapt the landscape to the effects of climate change and steer the local adaptation of the (agricultural)



occupation to the circular economy.

After identifying an Adaptation Tipping Point, the Province can use the Stakeholder Engagement Strategy to map the possible pathways. Together with locals and regional experts, the Province can use Scenario Planning to visualise the timelines and spatial implications for each of the pathways.

Informed Evaluation and Decisions

Some actions impact certain areas of the Province more than others, whereas others may put pressure on a specific group of stakeholders. To evaluate these different implications more objectively, the Province can use a structured Pathway Evaluation. Figure 64 gives an example of such an evaluation, identifying the costs and benefits of different pathways for key elements of the Provincial Living Edges vision.

In the end, it depends on the political context and investment possibilities to decide what the preferred pathway will be. However, as the pathways have been created in an inclusive and just way, there will be more support and understanding at the local scale when the Policy Pathways are finally translated into local Living Edges Projects (Akhmouch & Clavreul, 2016 and Resilient by Design, 2017).

	PATHWAY	ATTITUDE	COSTS	BENEFITS	
				PEOPLE	PLANET
EMBRACE	1	EMBRACE	++	landscape typology change leads to shift in the existing systems (jobs, ownership)	increase biodiversity, less pressure on water and climate change
	2	EMBRACE	++	landscape typology change leads to shift in the existing systems (jobs, ownership)	increase biodiversity, less pressure on water and climate change
	3	EMBRACE - RESIST	+++	have to compromise to some existing ownership of land	increase biodiversity, pressure on non EU countries
	4	EMBRACE - RESIST	+++	have to compromise to some existing ownership of land	increase biodiversity, pressure on non EU countries
	5	EMBRACE	++	people are safe inside country without having to compromise existing own land	pressure on non-EU countries
RESIST	6	ADAPT - EMBRACE - ADAPT	++++	connection to cities become less accessible as it's enclosed by infrastructre, people are safe without having to compromise their ownership	water pressure on non EU countries and outside Netherlands
	7	ADAPT - EMBRACE	++++	connection to cities become less accessible as it's enclosed by infrastructre, people are safe without having to compromise their ownership of the land	water pressure on non EU countries and outside Netherlands

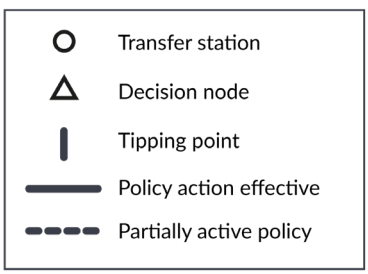


Figure 63 Dynamic Adaptive Policy Pathway for the scale of the Province of Zuid-Holland. It illustrates multiple pathways for adapting the landscape and water systems to the rising sea levels. Some pathways are more robust, others more flexible (but will eventually need to be replaced). Illustration by authors, based on: Haasnoot, 2018.

Figure 64 Evaluation of different pathway combinations for their costs and benefits for the key elements of the Living Edges vision. (Illustration by authors, based on: Haasnoot, 2018).

4.6 | TOOLBOX

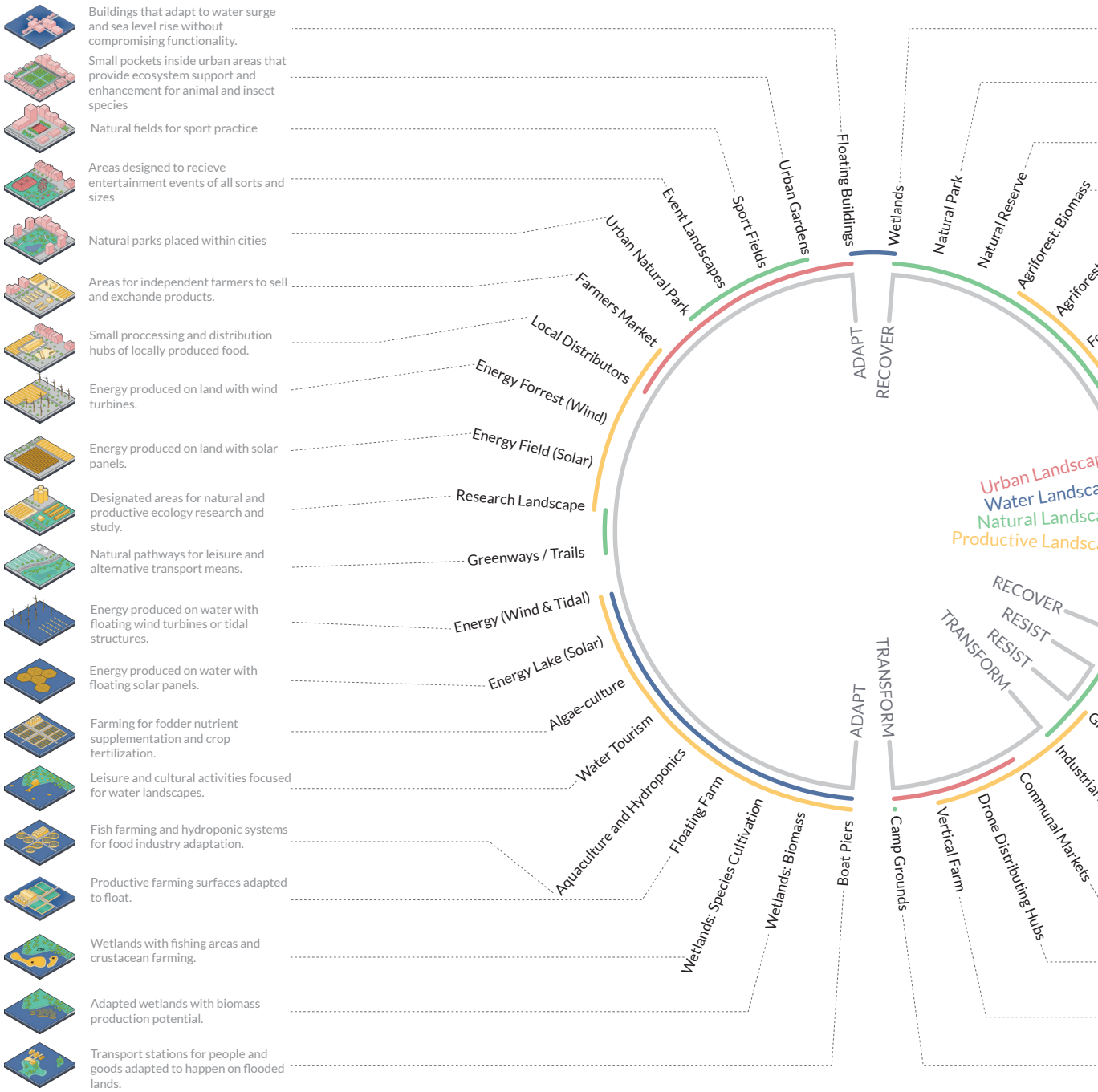
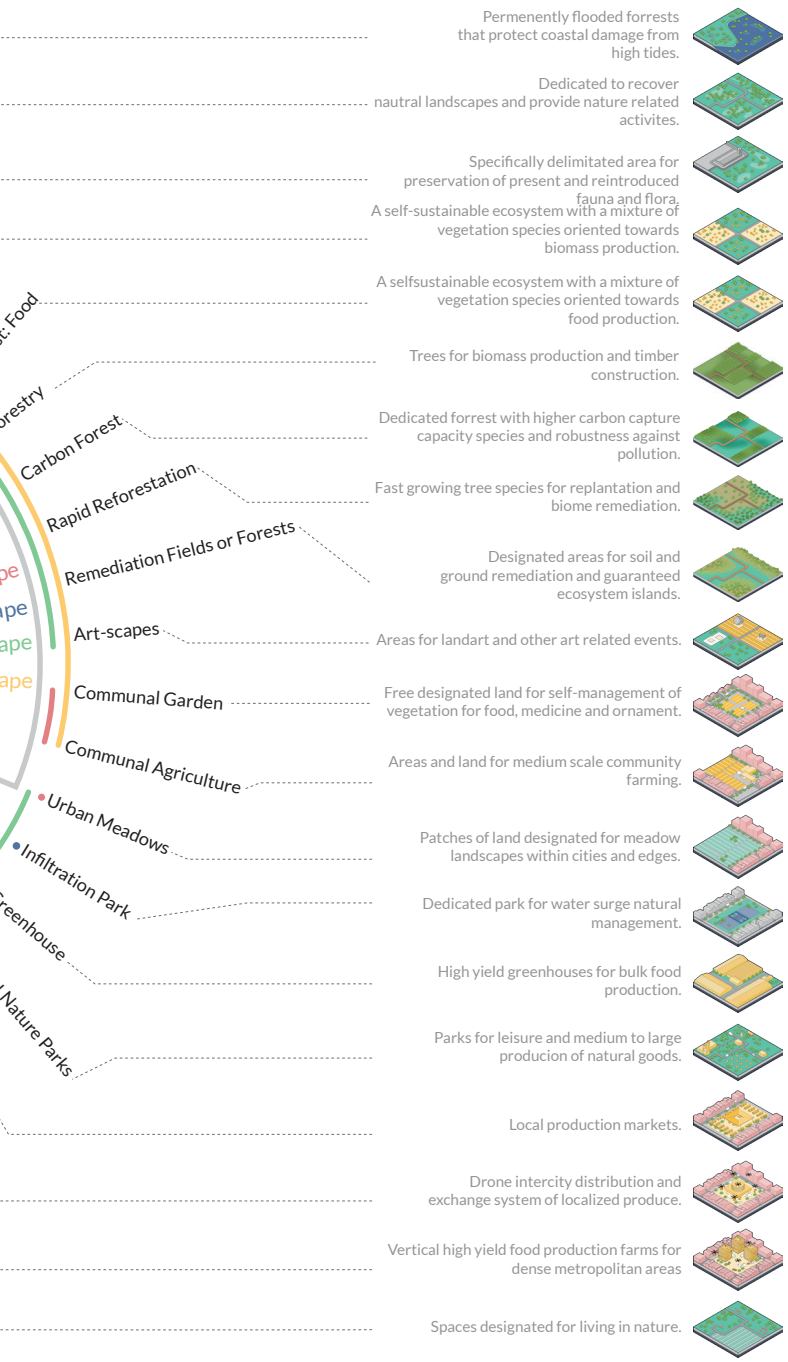


Figure 65 The Toolbox offers tools, inspiration and knowledge for translating the Policy Pathway into actions at the local and regional scale. The tools are categorised for the four landscape types from the vision map and the four attitutes towards change (adapt, recover, transform and resist. (Illustration by authors.)



Toolbox

Finally the strategic policy pathways are translated to real Living Edges Projects using a Toolbox. This toolbox offers a broad selection of tools that local initiatives can easily access and implement with their community. The tools should be created using researchers' expertise as well as local knowledge, which are complementary as a result of the Stakeholder Engagement Strategy.

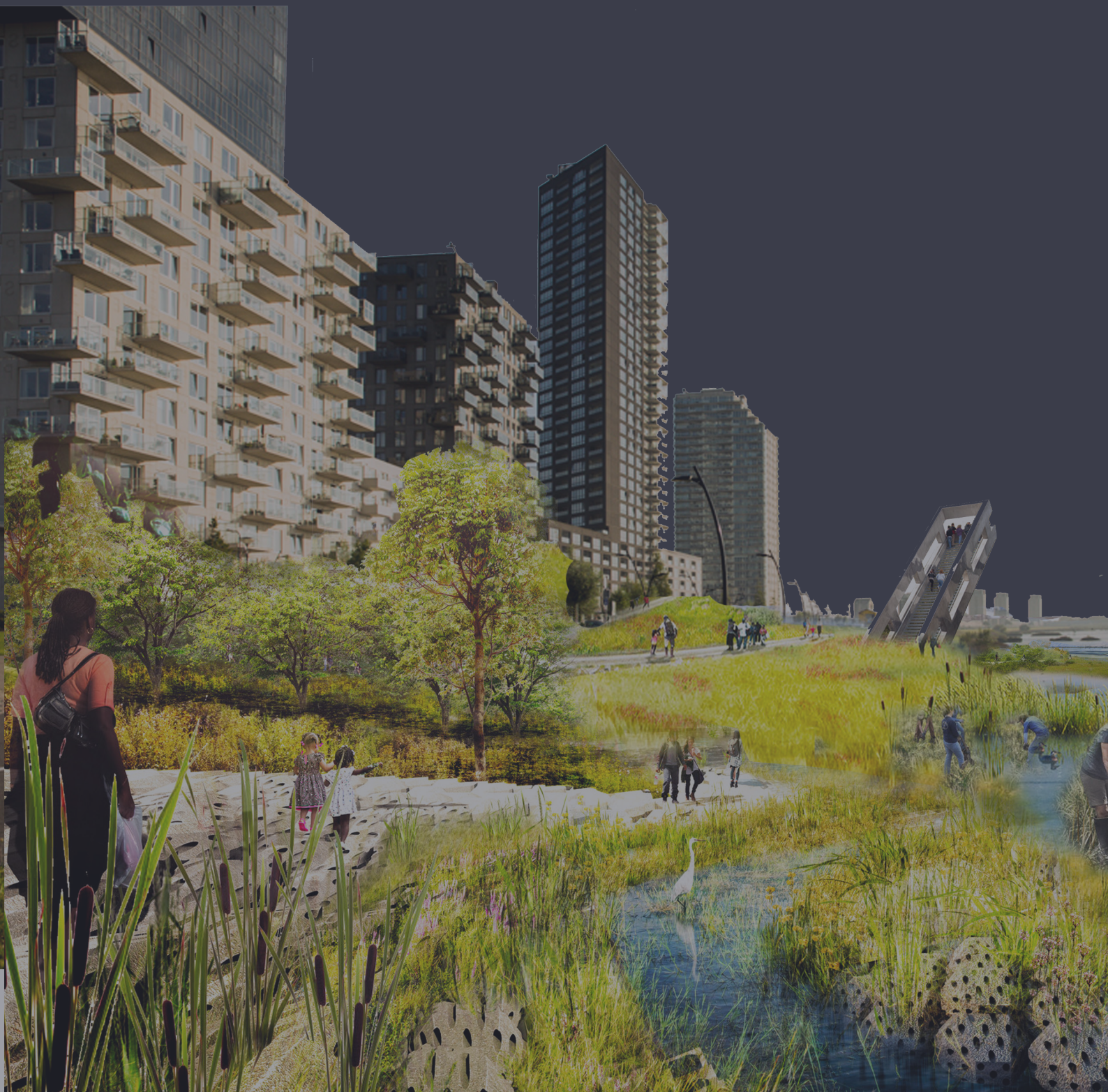
The Province can connect the Living Edges Initiatives with site-specific tools in the Development Phase. Therefore the tools in Figure 65 are categorised for the four different landscape types. These different landscapes all have varying challenges as a result of their situation in the Hollandse Delta. Furthermore, the tools are also categorised for the different 'Change Attitudes', which were introduced on page 54. These Change Attitudes are what will eventually determine the type of Policy Pathway the decision-makers will take.

A Dynamic Toolbox

Making use of the toolbox is beneficial for both the developers as the local projects (Rosenfield, 2014). Accessing the knowledge of the toolbox should be free and funding should be granted for projects that truly contribute to the regional pathway. Simultaneously, the Living Edges that are realised function as testing grounds, which inspire and teach the region on how to use adaptation as opportunity.

Project Synergies for Regional Coherence

When increasingly more Living Edges projects are realised, they start contributing to the regional Adaptive Pathway. The Toolbox elements can be developed in such a way thay the differnent tools synergise, resulting in a connected and collaborative Province. The Province can also steer the direction of the projects through using infrastructure investments to support and connect the Living Edges.



5

LIVING EDGES PROJECT

Figure 66 Living Edges in Spijkenisse. (Illustration by authors).

5.1 | KICK START EDGES

Introduction

This chapter elaborates more on how the Dynamic Adaptive Policy Pathway is applied in the municipal level, specifically in one location in the Province of Zuid-Holland. Intervention will take place in the city edges (Figure 67), which is based on theory by LOLA (2011) as mentioned before in the analysis chapter (page 38).

In choosing the location, analysis on the city edges are made by considering the three main problems which related to agro-food sector, socio spatial injustice and limited space. There are four elements that will be layered and analysed to select the locatin which are socio economic issues, agro-food issues, water pressure, and landscape typologies (Figure 68) .

By analysing these issues, the chosen location is evaluated as the most vulnerable area, the location then will be a kick start edges of the Living Edges project.

In the realisation of the project, there are four core aspects that will be explained further in this chapter, which are

1. Municipal Dynamic Adaptive Policy Pathway (DAPP),
2. Phasing edges strategies,
3. Toolbox implementation, and
4. Spatial visualisation.

To finalise, the role of the living edges for the neighbourhoods and the region itself will be explained in the conclusion part of the Living Edges project.

Figure 67 City Edge (Illustration by authors, data source: LISA Data, EduGis)

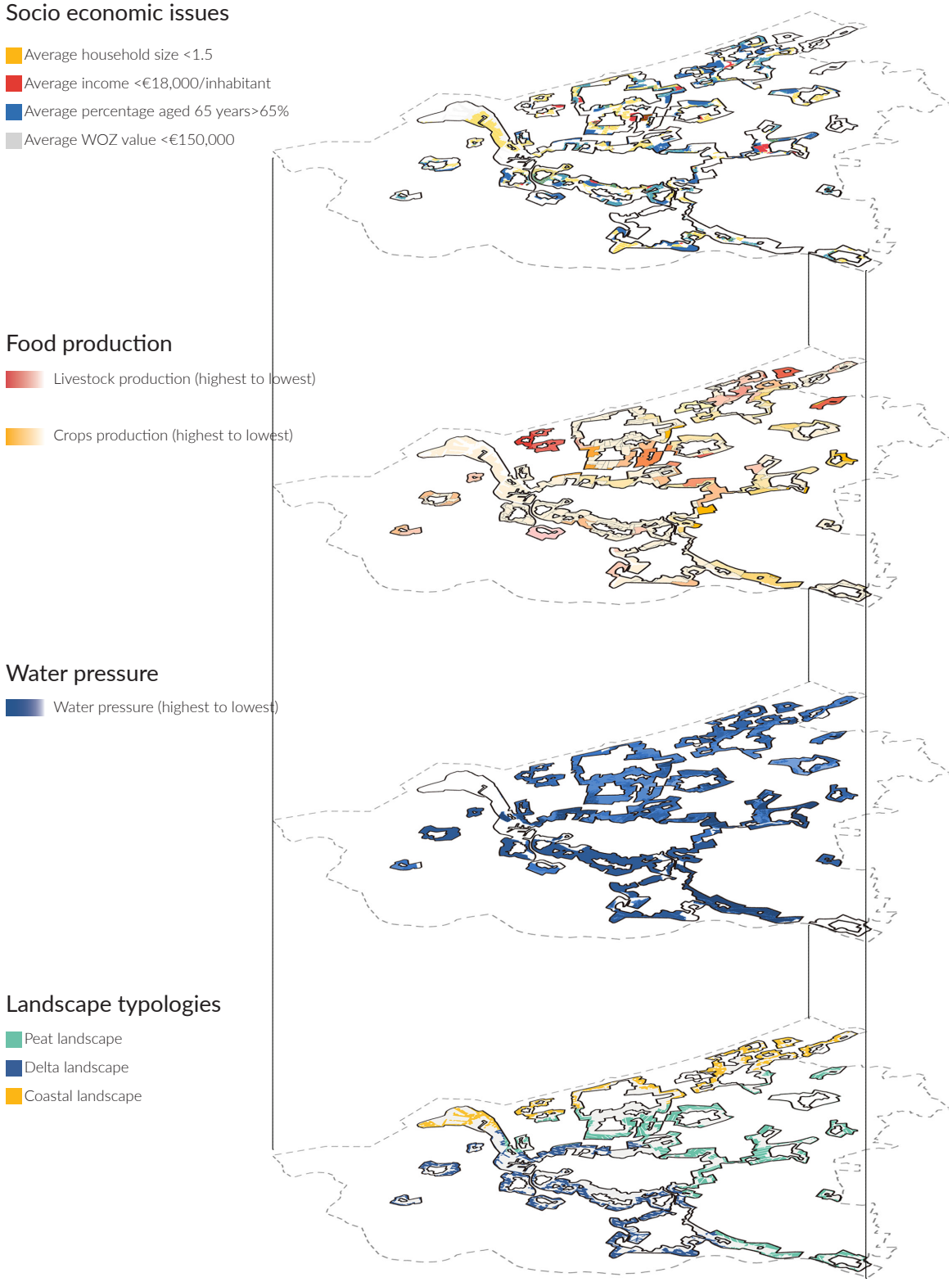


Figure 68 Axonometry of city edges issues maps
(Illustration by authors, data source: LISA Data, EduGis)

Selecting the Kick Start Edges

The first analysis step in the location selection is based on the socio economic & food issues map. Then the selected locations will be reduced based on the three landscape typologies as the key factor Lastly, the final selection is determined by analysing the area wwith highest water risk through the water pressure maps.

1.

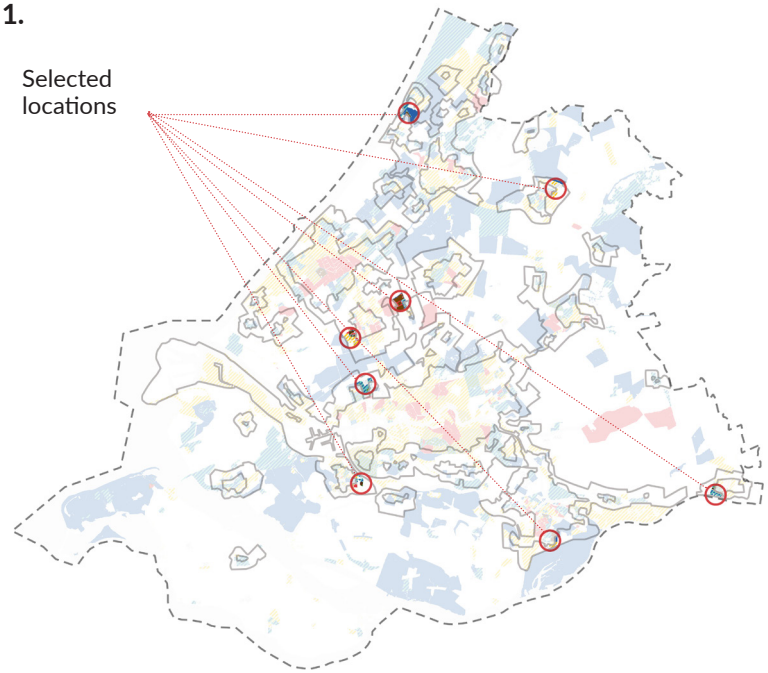


Figure 69 Neighbourhoods with socio economic issues. (Illustration by authors) .

Socio eonomic

Based on the socio economic issues, eight locations are assessed as neighbourhoods with most combination of the socio economic problems, such as the low income, high number of eldery inhabitants, low WOZ value, and low average household sizes.

In achieving the goal of healthy life, neighbourhoods with these issues has the most visible problems such as obesity, loneliness, and lack of access to healthy food.

2.

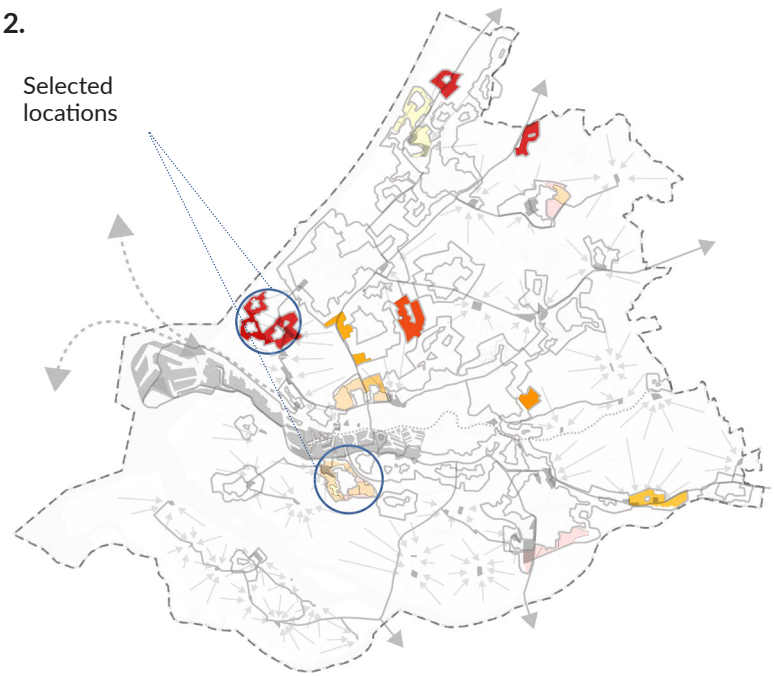


Figure 70 Food production with ditribution flow. (Illustration by authors).

Food production

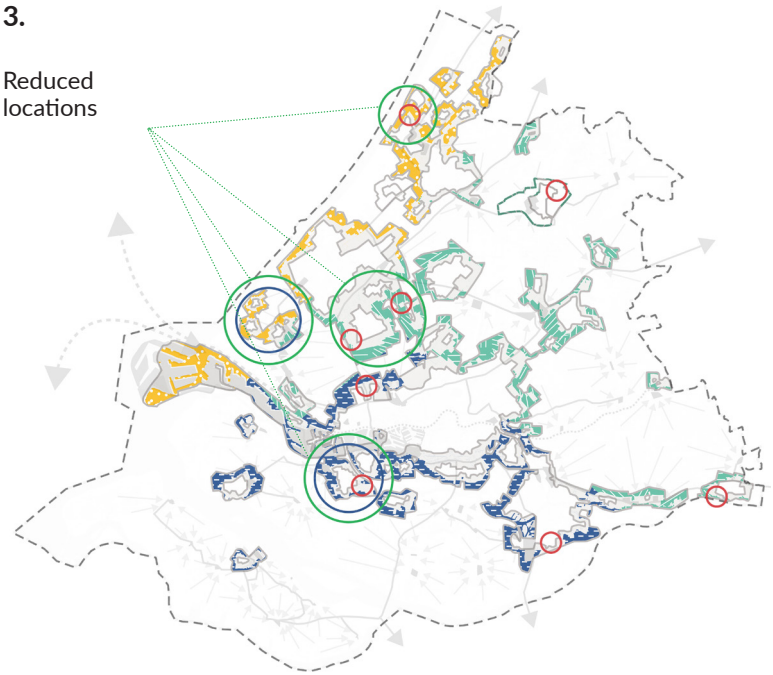
Considering the food production (Figure 118), neighbourhoods with highest and lowest food production are selected. High food production shows possible wastescape and low food production has challenge in achieving local production food.

Then, the distribution flow layer is added. Area that is near concentrated distribution flow shows possible wastescape as food production become more local in shifting toward circular food system.

Based on this issues, there are two locations selected.

3.

Reduced locations



Landscape typologies

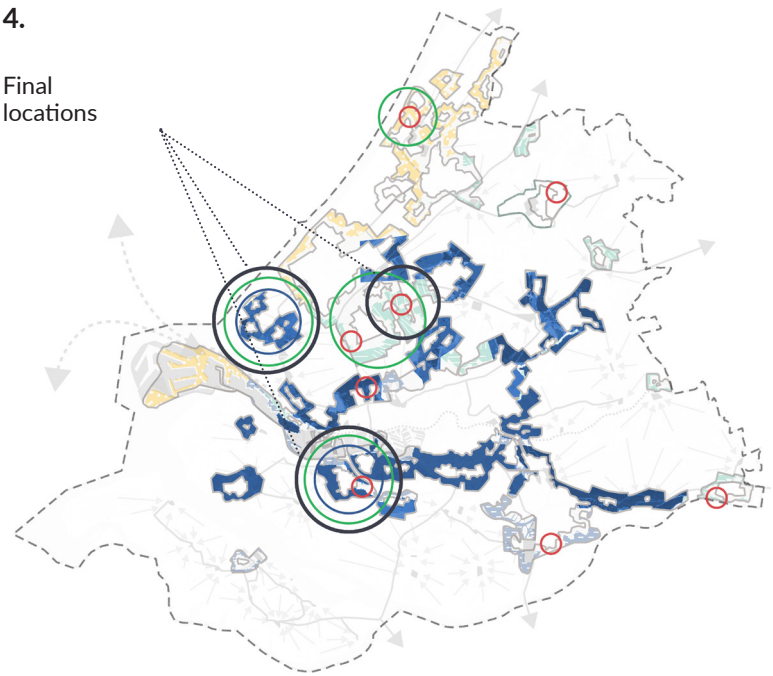
In this step, the previous selected locations are reduced by layering it with the landscape typologies.

The city edges has three landscape typologies, therefore, areas that has similar problems with same landscape typologies are eliminated. To conclude, there are four reduced locations at the moment.

Figure 71 Socio economic & food production issues with landscape typologies. (Illustration by authors).

4.

Final locations



Water pressure

Finally, the last determining element is the water pressure. Embrace attitude toward facing the water pressure in the coming future is an important value in this project. Therefore, the neighbourhoods with higher water pressure are chosen as it shows the most vulnerable neighbourhoods.

The final locations that are chosen are Westland (left), Alphen aan de Rijn (right) and Spijkenisse (bottom).

However, only one location will be selected due to the limitaion of time, which is Spijkenisse.

Figure 72 Combined problems are layered with water pressure map. (Illustration by authors).

5.2 | IDENTIFYING THE EDGES

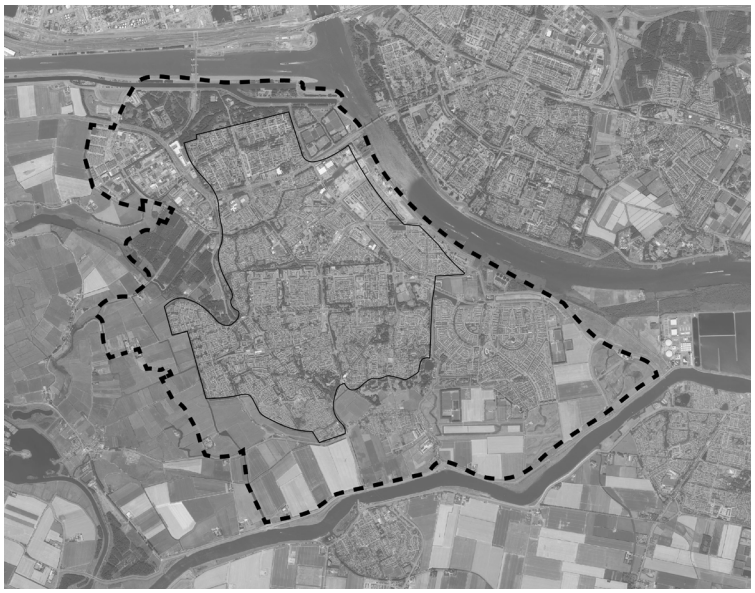


Figure 73 Spijkenisse Map. (Source: Google Earth)

Identifying Spijkenisse

Spijkenisse is the location that is chosen in this project among other two locations because it covers the three main issues of socio economic, food production, and highest water pressure among the others.

To add, Spijkenisse also has an urbanisation challenge of 600+ homes needed in the future (De Zwarte Hond, 2017).

City center

City edges border

Agro-food sector

Figure 74 Agro-food issues. (Source: Open Street Map landuse).

Consumption area

Production area

Spijkenisse has low livestock and crops production areas (Figure 57Figure 48 on page 58). Considering the limited space, the food production area has to be coupled with other function in order for it to be efficient. For example, utilize food forest where production could also be recreational.

Socio economic

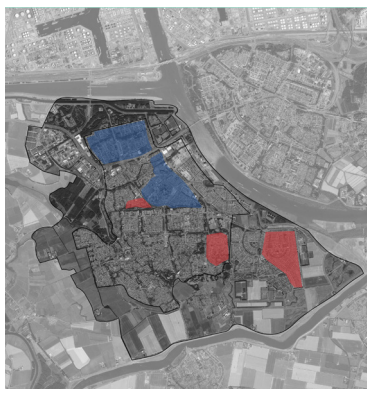


Figure 75 Socio economic issues. (Source: www.cbs.nl).

High elderly inhabitants

Low income neighbourhooods

Neighbourhoods with elderly people has loneliness issues (RIVM, 2018). Also, there are some neighbourhoods with low income. Less wealthy people live nine years shorter than wealthier people (Van den Berg, I, n.d). Therefore, the projects should tackle these issues by creating community through food and equal access to healthy food.

Water pressure

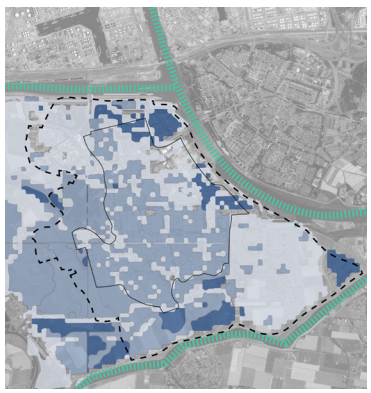


Figure 76 Water pressure. (Source: EduGis).

High risk area

Medium risk area

Low risk area

There are high water pressure in Spijkenisse, in this map the water pressure is identified as three level of risk area in order to understand what is the possible strategy that could be chosen in embracing the water pressure from the river.

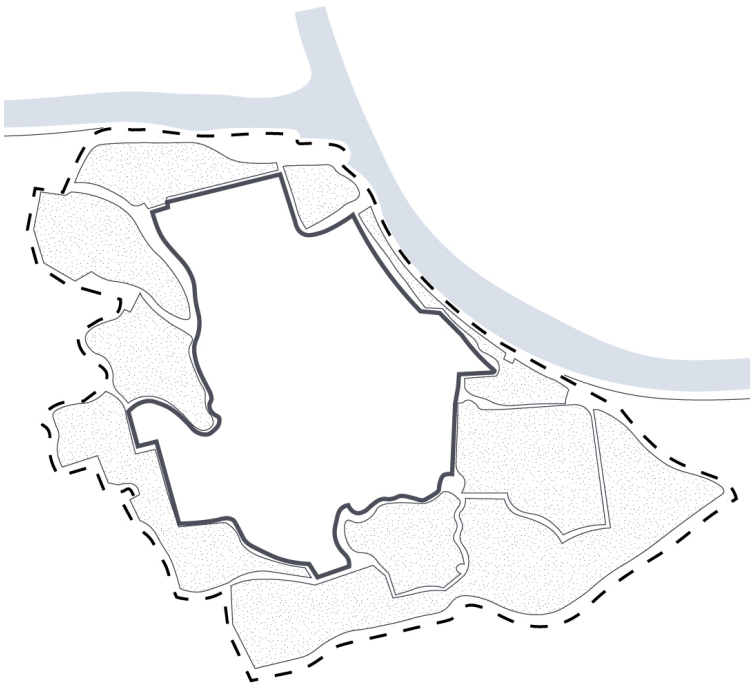


Figure 77 City Edges Border. (Illustration by authors).

City Edges Border

As stated before, the city edges will be the area of intervention and where the strategy will be applied. It shows the inner border of the city edges which is the ciity center and the outer of the edges.

However, this border will not limit the possible extention of the interventions, as the idea is to be able to make a collaborative project within the edges between one city to the other.

Figure 78 Typologies of City Edges. (Illustration by authors).

City Edges Typologies

Each city edges has a distinct function compare to the others. Therefore, the edges typologies are identified based on its functions.

Existing city edges typologies are very monofunctional and sometimes these edges has no connection at all between each other. For example, industrial and recreational greenery which are located next to each other.

5.3 | MUNICIPAL DAPP

Municipal DAPP

In applying strategies to the city edges, the Municipality develops a Dynamic Adaptive Policy Pathway which is based on the Regional Path as explained in the strategy Living Edge concept on page 56.

Considering the regional vision of embracing the water pressure, each municipality could use this Municipal DAPP to draw their own plan depends on each situation that they are facing. Eventhough each municipalities will take different path but all the path will lead them to a safe neighbourhoods from water pressure and equal access to healthy food as food production become more local.

To add, in drawing this Municipal DAPP for the long term, the municipality also take into consideration the toolbox that is design based on four principles that are adapt, transform, resist, and recover (see Figure 65 on page 66).

Stakeholder engagement

Considering the stakeholder strategy plan, the selection of chosen pathways will be discused among different scale and hierarchy of stakeholders. In conclusion the municipality together with local stakeholders such as farmers, citizens, and entrepreneurs, could contribute together through different steps in stakeholder involvement *(refer to diagram)* to achieve circular food system and manage water pressure.

Next, the phasing strategy will explain further on how these strategy could be implemented to the city edges through phasing.

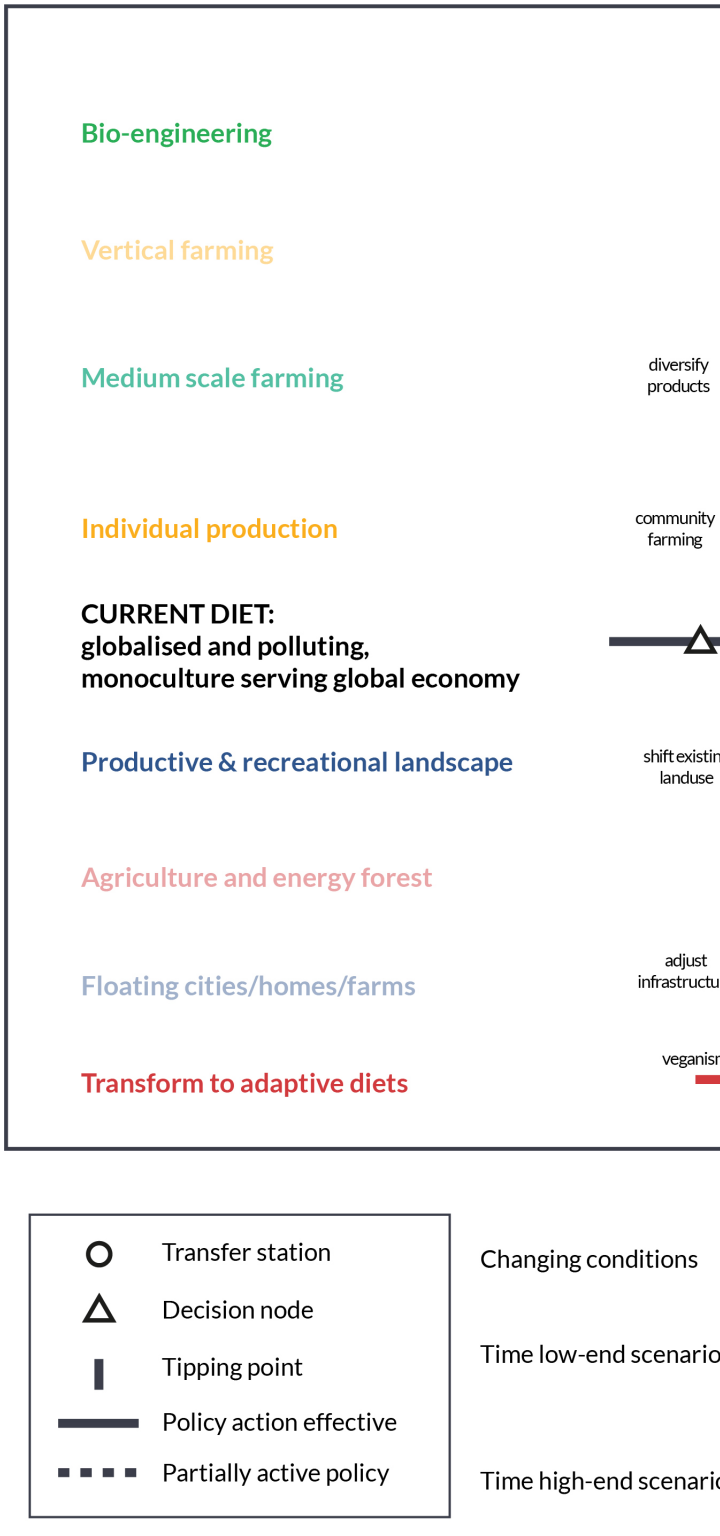
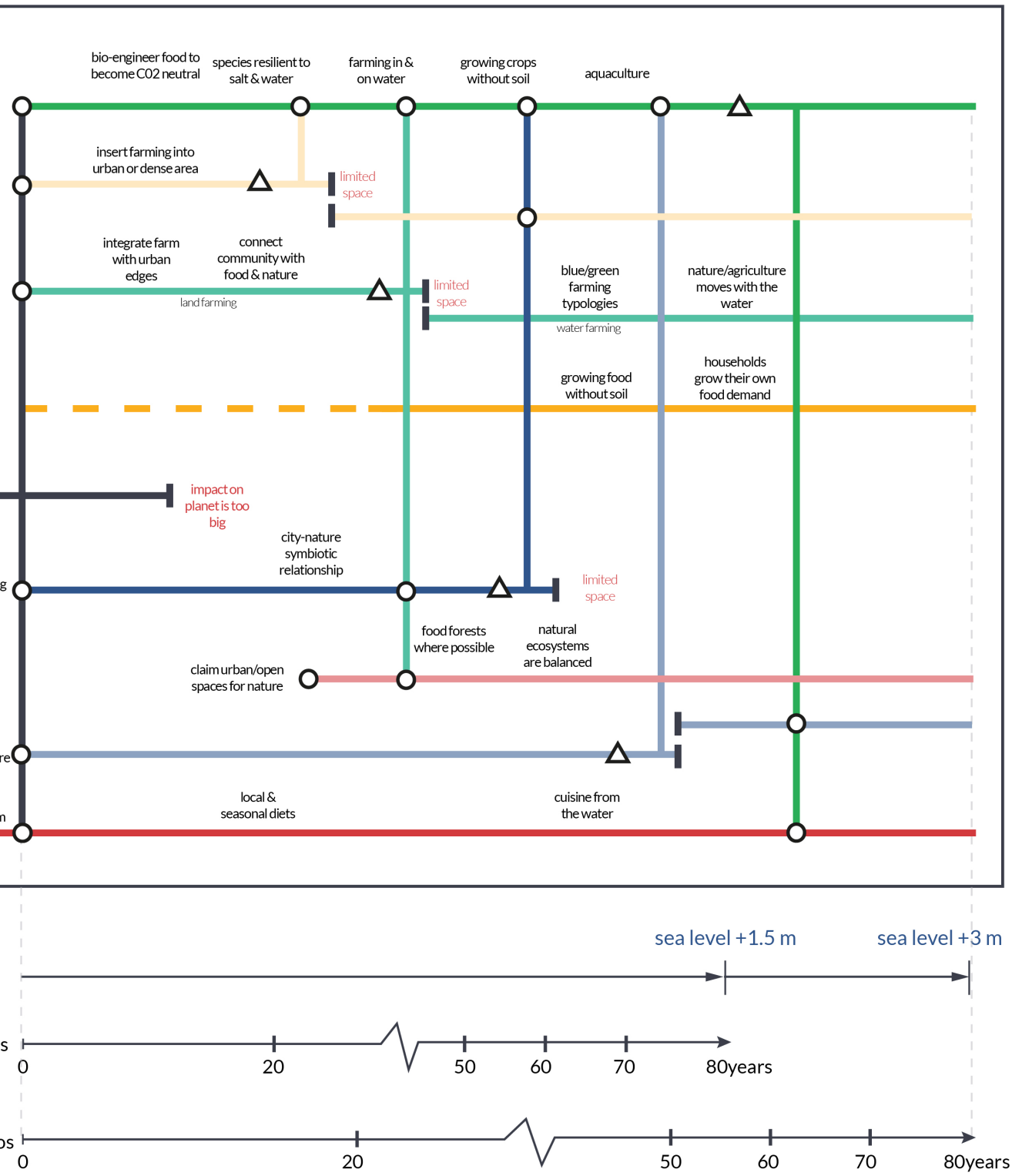


Figure 79 Municipal Dynamic Adaptive Policy Pathways (DAPP). (Illustration by authors).


bio-engineer food to become C02 neutral
species resilient to salt & water
farming in & on water
growing crops without soil
aquaculture
insert farming into urban or dense area
limited space
integrate farm with urban edges
connect community with food & nature
land farming
limited space
blue/green farming typologies
water farming
nature/agriculture moves with the water
growing food without soil
households grow their own food demand
impact on planet is too big
city-nature symbiotic relationship
limited space
food forests where possible
natural ecosystems are balanced
claim urban/open spaces for nature
local & seasonal diets
cuisine from the water

sea level +1.5 m
sea level +3 m
0
20
50
60
70
80years
0
20
50
60
70
80years

5.4 | PHASING EDGES

Phasing Edges Strategy

Dynamic Adaptive Policy Pathway is designed for a long -term strategy plan. Therefore, the implementation of the DAPP is happening steps by steps whenever the municipality needs make a turn in the DAPP path (adapt and transform to the changing condition). This phasing diagram elaborate on how the DAPP path could take places in the city edges.

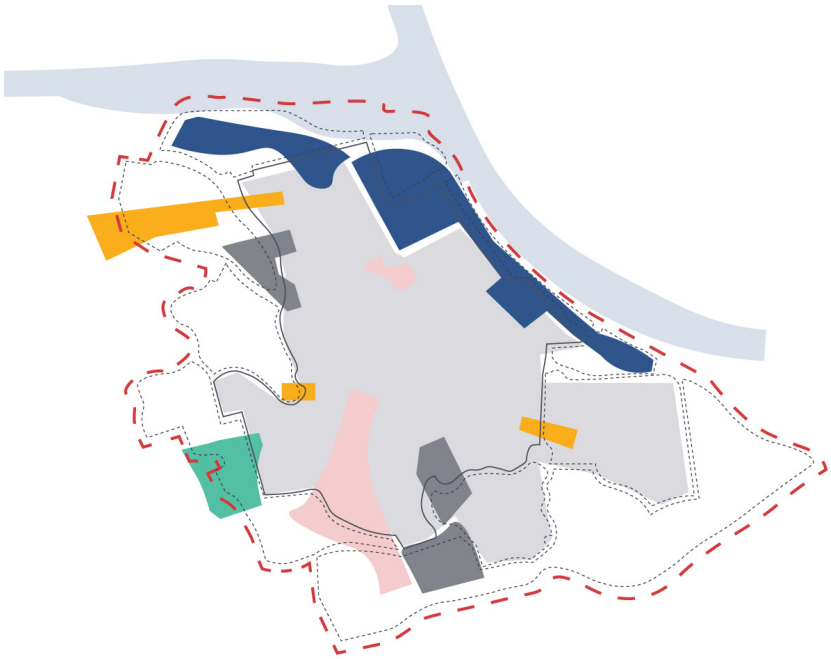


Figure 80 Kick start edges phase.(Illustration by authors).

Figure 81 Spin-off edges.(Illustration b

Kick Start Edges

Based on the municipal DAPP, the municipality together with local stakeholders could choose several pathways to achieve a circular food system and managing water pressure. The kick-start projects take multiple pathways and then apply it to the city edges depending on their issue context regarding socio economic, water pressure, and food production.

For instance, In the north of Spijkenisse, a productive and recreative landscape through wetland is implemented considering the high risk water pressure (Figure 76 on page 74). Existing monofunction industrial area (Figure 78 on page 75) in the north east is adapted into local distribution area.

City center
Outer city edges border
City center
River
Urbanisation
New urbanisation area

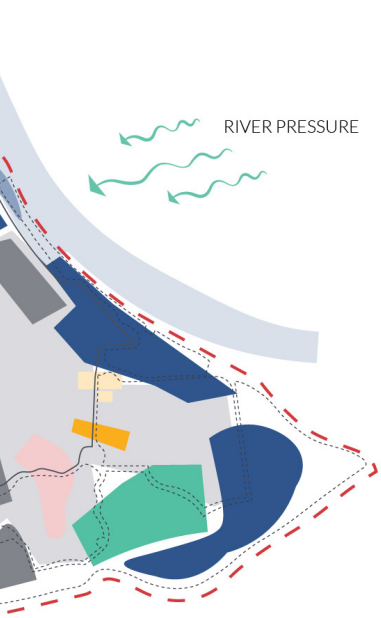
DAPP Project Phase 1
Wetlands
Agriculture
Medium scale farming
Distribution

Spin-off Edges

In the coming future, when mo
water pressure, spin-off proje
adapt from earlier projects and
projects and infrastructure.

For example, as water pressur
high, the wetlands area will ne
challenge (.....,2020) adds
space. Therefore, a coupled str
food production could be more
farm and vertical farm is imple

DAPP Project Phase 1
Vertical farm
Floating farm



by authors).

ore edges need to adapt to the
cts are realised. They learn to
d build a network from existing

re from the river keeps getting
ed to adapt. Also, urbanisation
more pressure to the limited
ategy has to be realised where
e efficient. Therefore, a floating
mented.

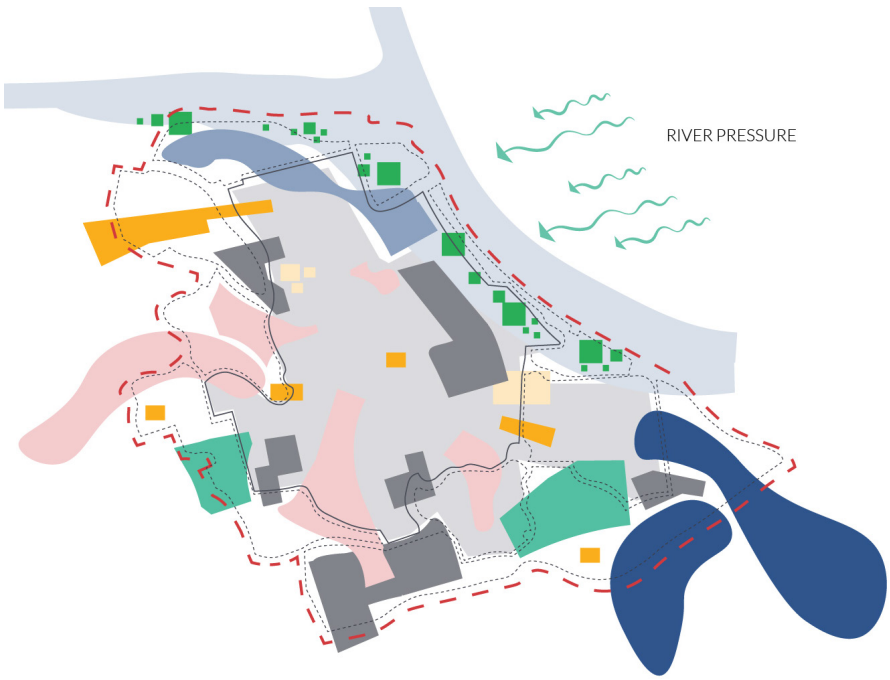


Figure 82 Collaborative edges. (Illustration by authors).

Collaborative Edges

Lastly, as the new systems has started to settle, only minimum changes will be add if necessary.

In the last phase, it shows the scenario of water taking over some parts of the land. Therefore, the existing system needs to adapt and aquaculture added.

Also, diverse functions of the living edges start collaborating more with each other. The edges project could extent further and create a connection with other city edges in achieving circular food system and water resilient landscape.

DAPP Project Phase 3

Aquaculture

5.5 | TOOLBOX IMPLEMENTATION

Toolbox Implementation

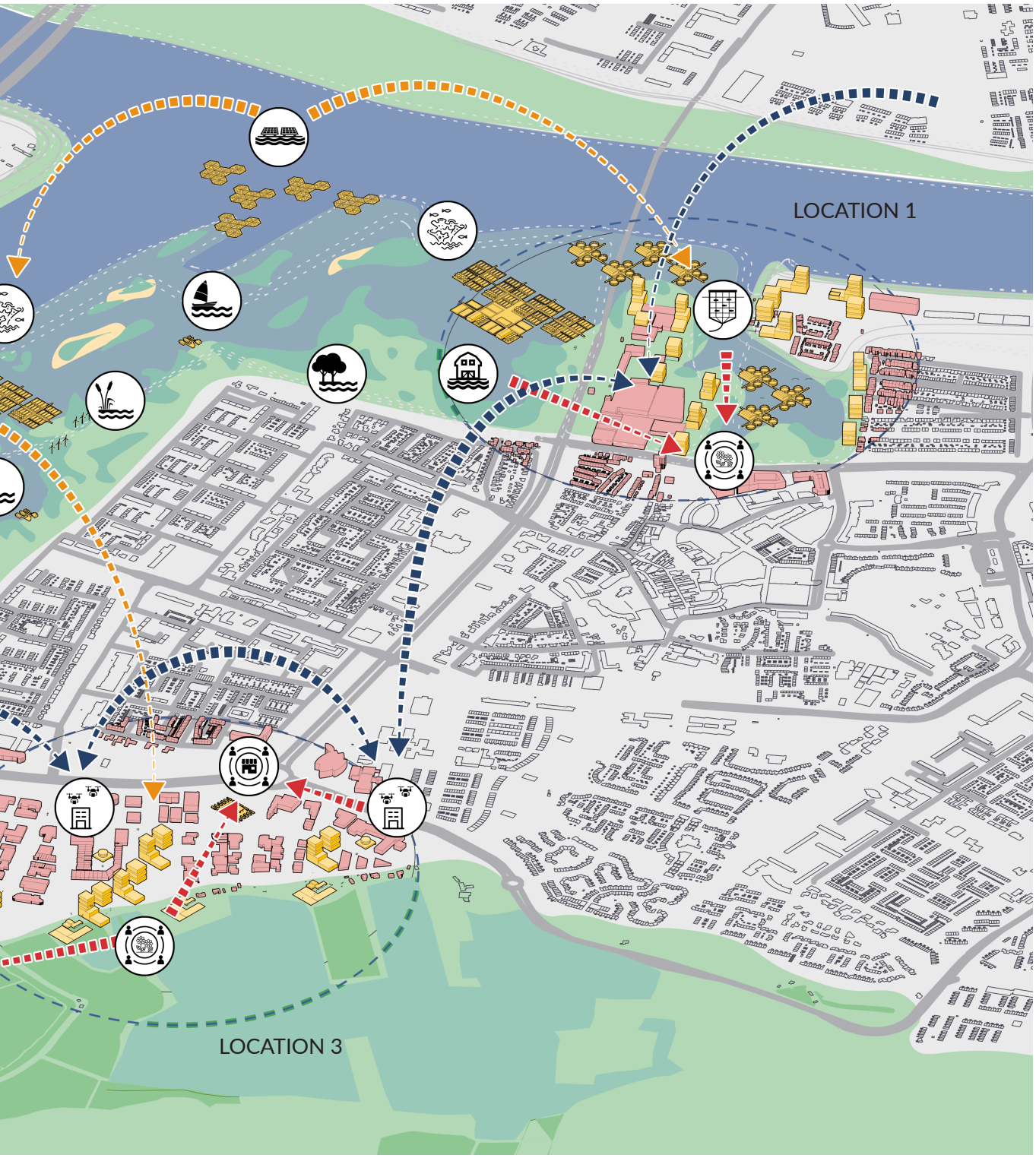
The different path of the municipal DAPP will lead to different projects with different attitude (adapt or transform). This part will elaborate on how the toolbox (Figure 65 on page 66) could be implemented in the neighbourhood scale.

In the phasing strategy before, it demonstrates scenario of the possible chosen pathways. This axonometry is showing the implemented projects (showing in red). The projects in the city edges collaborate and have connection with each other in order to achieve circular food system.

There are three locations in Spijkenisse which will show specifically on how the toolbox are implemented. These locations are chosen due to its different landuse. The existing landuses are waterfront area, industrial area, and agricultural area. Through these different locations, it shows how diverse and inclusive the DAPP pathways are.

The neighbourhood itself will also have connection with surrounding through its distribution flow, where neighbourhoods are connected through the city in regional scale. In conclusion, the Living Edges project will in the end create a circular food system through intervention in the edges.

Figure 83 Spatial system axonometry in Spijkenisse. (Illustration by authors).


LOCATION 1
LOCATION 3

First location - waterfront area

Figure 84 Toolbox implementation on waterfront area. (Illustration by authors).

1

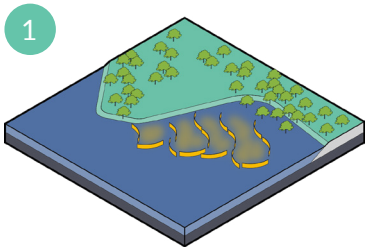


Figure 85 Wetlands. (Illustration by authors).

Due to the water pressure from the river, the waterfront landscape will need to change to a wetland as a first barrier of the city from the coming water. This wetland also serves as an recreational area for the people as it provides greenery.

2

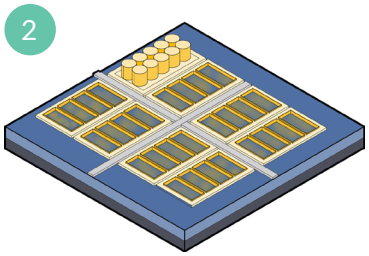


Figure 86 Algaeculture (Illustration by authors).

Algaeculture is implemented considering the limited space available for food production. It shows how primary production could utilize water as opportunity instead of threat.

3

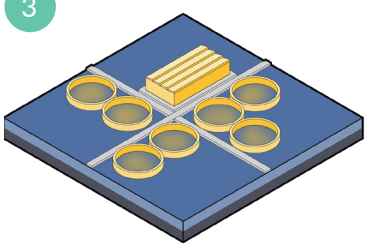


Figure 87 Floating farm & aquaculture. (Illustration by authors).

As water started to claim the land, food production needs to take place in water due to the limited space. Therefore, aquaculture & floating farm are implemented.

4

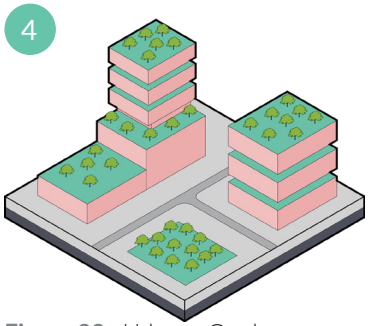


Figure 88 Urban Garden (Illustration by authors).

Urbanisation adds another pressure in Spijkenisse. In answering the housing demand, the toolbox makes sure that people will still have access to green through implementing urban garden in the urbanised area.

Second location - industrial area

Figure 89 Toolbox implementation on industrial area. (Illustration by authors).

1

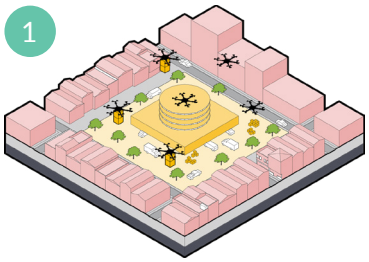


Figure 90 Drone distribution hub. (Illustration by authors).

Drone distribution hub is applied considering technology development in the future and promoting efficiency. This feature will provide easier access of fresh and healthy food to people.

2

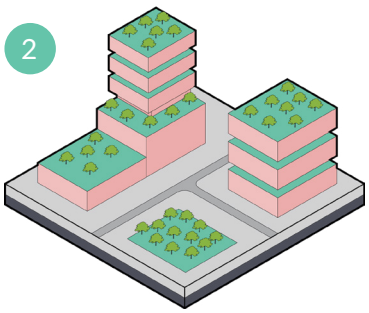


Figure 91 Urban garden (Illustration by authors).

In the future, urbanisation will take place not only in the city center, but also in the edges area such as industrial area. Therefore, the implementation of urban garden is to give access of green eventhough it is located in the industrial district.

3

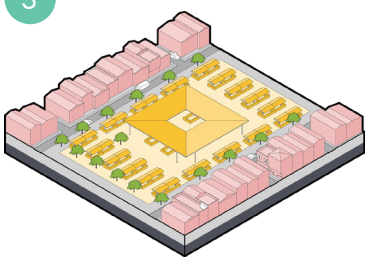


Figure 92 Communal market. (Illustration by authors).

Though there is a drone distribution hub, the main food distribution area is still happening in the communal market. The communal market will be available for each neighbourhoods, instead of having one big market in the center.

3

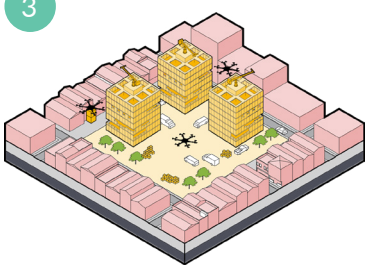


Figure 93 Vertical farm. (Illustration by authors).

Considering the limited space in the future, food production has to be highly efficient. Therefore, vertical farm is implemented here as Spijkenisse has low food production area.

Third location - agricultural land

Figure 94 Toolbox implementation on agricultural land. (Illustration by authors).

1

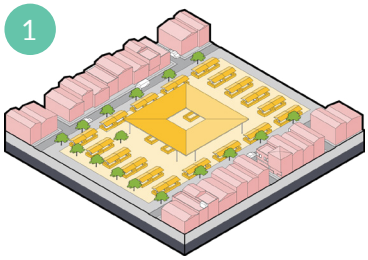


Figure 95 Communal market. (Illustration by authors).

As stated before, communal market is implemented throughout neighbourhoods. This intervention will improve local communities and people engagement.

2

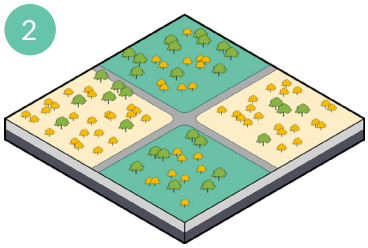


Figure 96 Food forest (Illustration by authors).

This greenery in the edges will not only provide green itself, but at the same time it will also producing. This is an example of how agriculture landuse could be coupled with recreational and green connections.

3

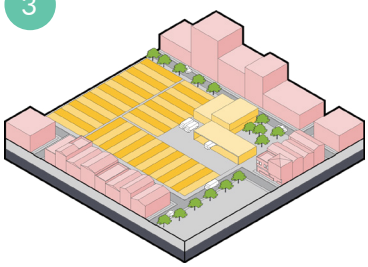


Figure 97 Medium scale farming. (Illustration by authors).

The existing agricultural land will shift towards medium scale farming as the goal is to make food production become more local.

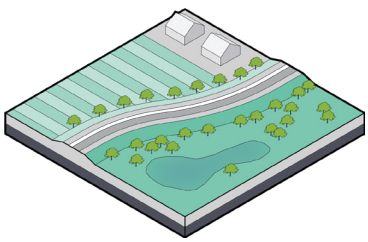


Figure 98 Green trails. (Illustration by authors).

The existing greenery of the agricultural land will be extended to the inner city area creating a green fringes that connects the edges and city center.

5.5 | SPATIAL VISUALISATION

Introduction

In the chapter, three different locations in Spijkenisse that are mentioned before will be visualised. First, each locations will show existing condition and some visible issues in it. Then, the future spatial scenarios through the Living Edges project is drawn.

Therefore, please enjoy the experience of life in the city edges.

Waterfront area

The current situation of the Spijkennise waterfront is a place that has a strong visual division of natural (water) and built environement (urbanisation).

Through the project, it will be a place where the landscape becomes productive, where food production could take place on the water with floating farm and aquaculture.

Also, this new ecosystem will create communities for the people in producing local goods and bringing people closer to the nature as the nature itself is protecting and producing..

Figure 99 Existing waterfront area in Spijkenisse. (Source: Go

oogle Street View)

Figure 100 Recreational and Producing Waterfront. (Illustration by authors).


Urbanisation
Waterfront
munity
Wetlands

Figure 101 Existing industrial area. (Source: Google Earth)

Industrial area

The industrial area (global transit center) is very monofunctional and has no connection with the inhabitants as shown in the picture.

Then...

This area will be a place where distribution of food is happening close from producers to consumers through local and communal markets. The products are produced through vertical farming and food park, which will create a green connection between inner city and its edges

Figure 102 Producing area with distribution hub and communal market. (Illustration by authors).


Drone distribution hub
Vertical Farming
Green-blue connection

Agriculture land

The open farmland is also disconnected with the people. Eventhough it is crutial for the life of the people, there are no distinct activities of the inhabitants except the farmers.

By creating medium scale farming with projects and events people will be engage people to take part in activities in the nature In the end local communities will grow and raise more awareness for the nature which will increase biodiversity and also give room for the water.

Figure 103 Existing agricultural land. (Source: Google Street View).


Disconnected agriculture
land with neighbourhoods

Figure 104 Scenario of activity from local community. (Illustration by authors).

Figure 105 Local Community and Market Integrated with Agriculture Land


Medium scale farming

5.6 | ROLE OF THE EDGES

Productive Edges

The Living Edges will allow society to reconnect with nature in a symbiotic relationship (Figure 107). As described before, there are many types of Living Edge projects (Figure 108), based on the context. Due to the use of the DAPP, multiple local and regional objectives are achieved through adapting the Edges.

To test the feasibility of projects and investigate the challenges, the costs, benefits and co-benefits were calculated for the different circular and linear agriculture typologies. Often the circular adaptions need an initial big investment, but research proves that this pays off in the long run (Figure 106). The full calculations can be found in the Appendix.

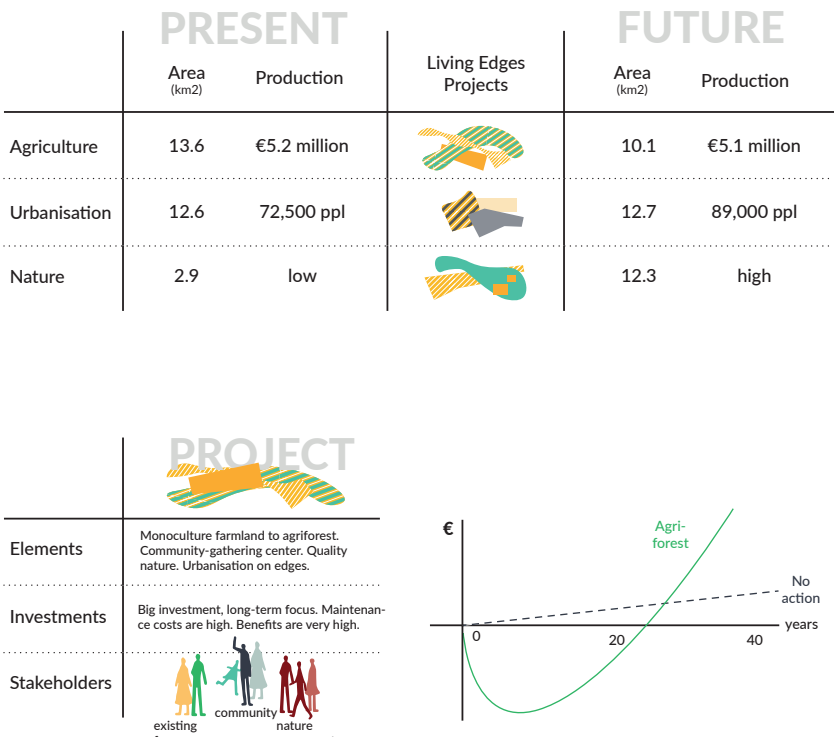
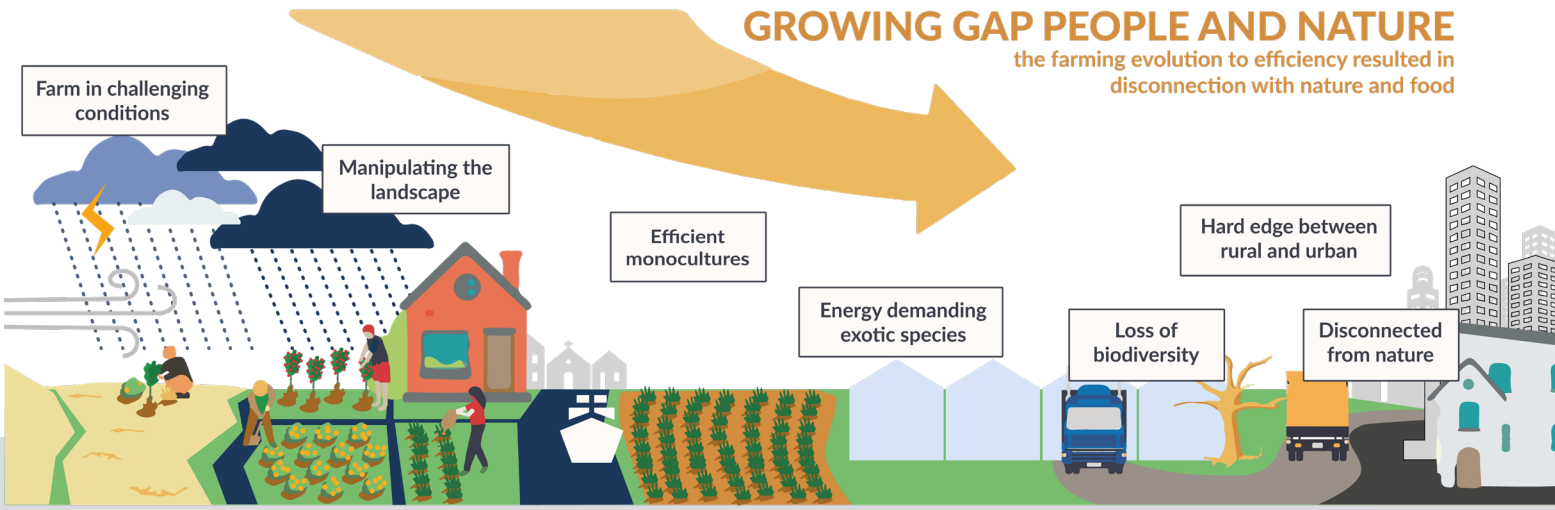


Figure 106 Productivity calculations for the Edges of Spijkenisse. (Illustration by authors, based on the calculations in the Appendix.)



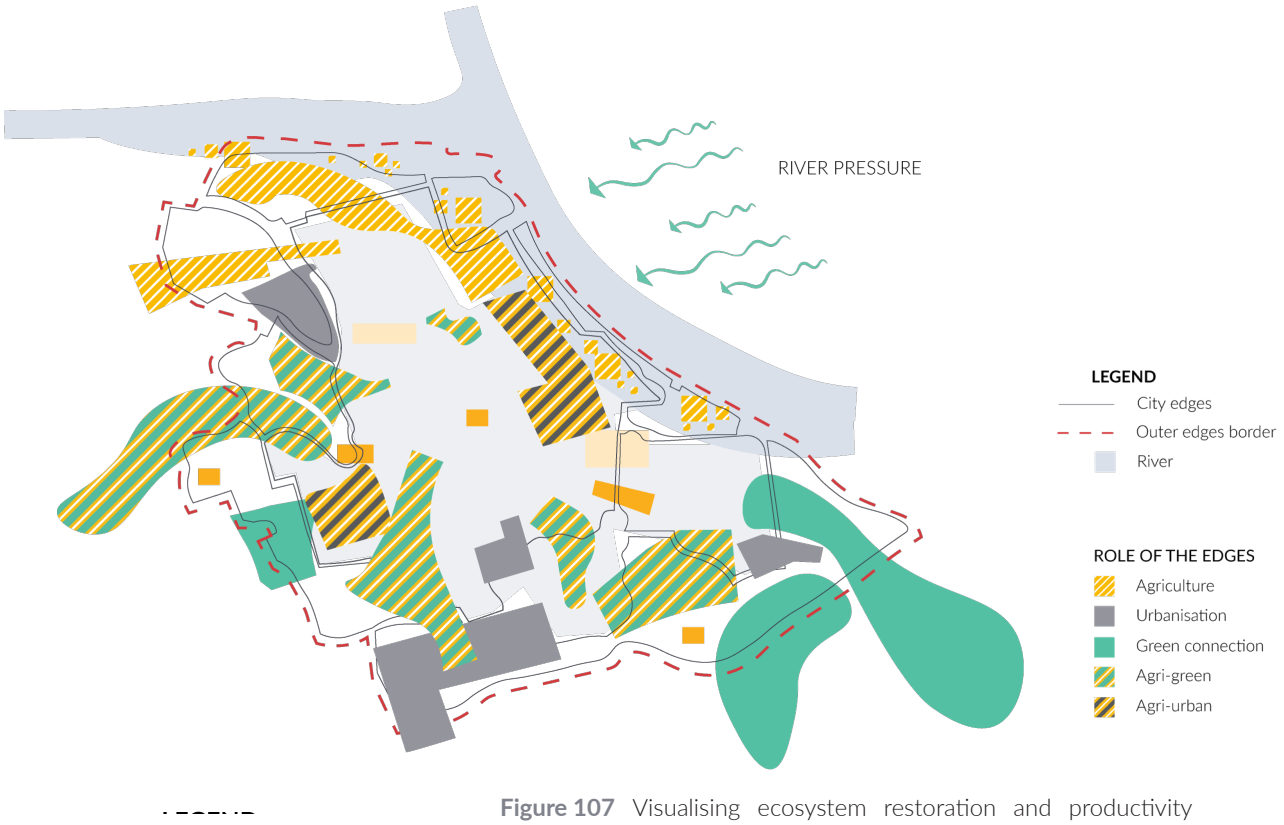


Figure 107 Visualising ecosystem restoration and productivity integrated in the Living Edges. (Illustration by authors).

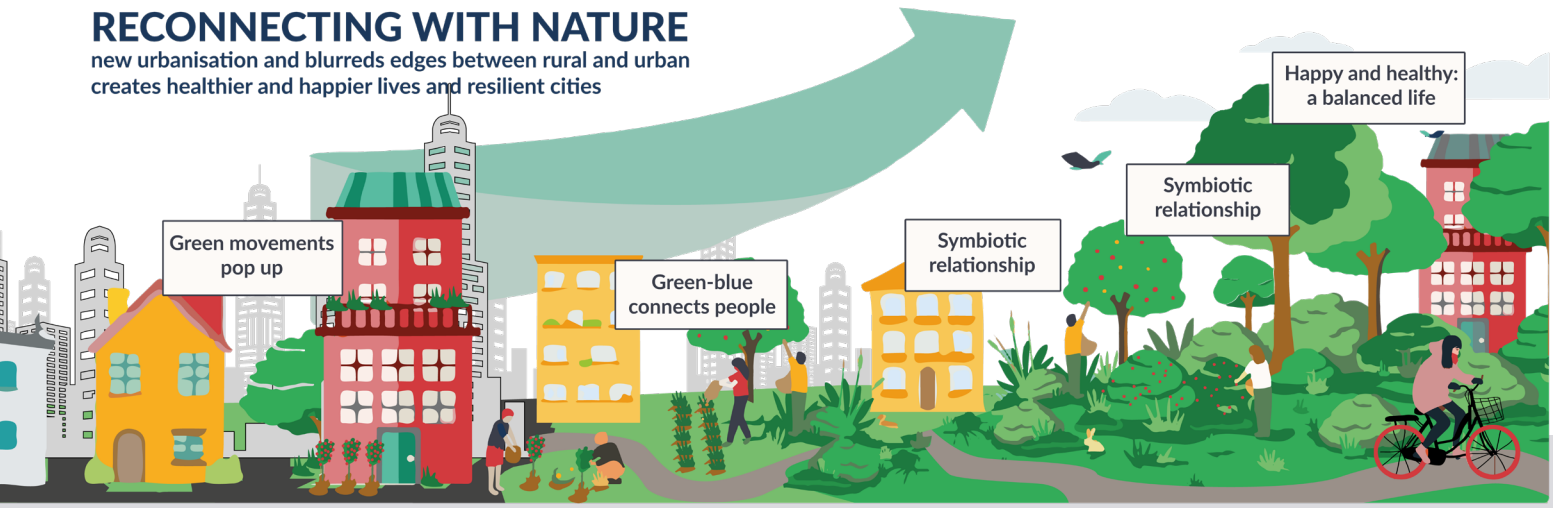


Figure 108 Soft CIty Edges that reconnect communities with food and nature. (Illustration by authors).

Efficient Restorative Ecosystems

Living Edges are more productive than traditional agricultural practises. The calculations in the Appendix which were summarised in Figure 109, prove that circular agri types are 185% more efficient than monocultures. As a result, 55% of the existing famland could become available for regenerative and protective landscapes, which is illustrated in Figure 113.

As housing density increases simultaneous to the diverse productivity in the city edges, the region becomes more independent. Agricultural landscapes are layered with functions, resulting in additional social captial.

To conclude, Figure 110 shows how production moves from depleting, wide-stretches monocultures to local and efficient production. Creating room for nature.

	MONO			DIVERSE			
	Open Land Farming	Grassland (Livestock)	Green-houses	Urban Farming	Community Farming	Agro-forestry	Aqua-culture
Profit (€/ha/y)	3,885	845	73,000	1,900	4,800	6,300	3,400
Investment return-time (y)	-	-	-	40	7	20	10
Ecological performance	low	low	negative	medium	medium	high	medium
Present use (%)	39%	57%	4%	-	-	-	-
Living Edges (%)	5%	5%	4%	8%	10%	43%	17%
Spatial qualities							

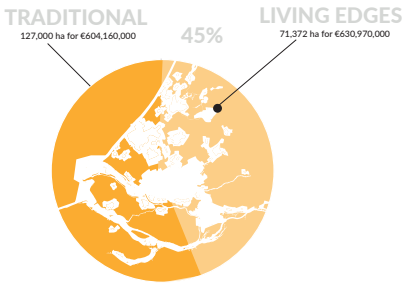
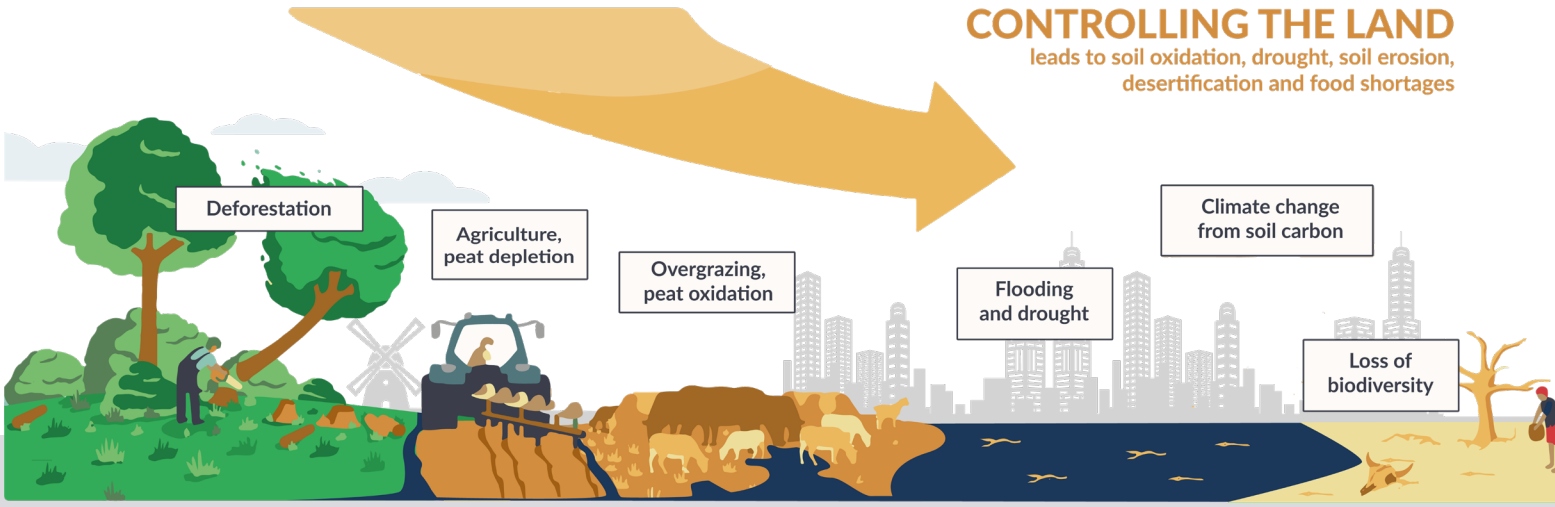


Figure 109 A comparison of multiple agricultural typologies, it was calculated that a mature Living Edges system demands less space than the traditional farming practises. (Illustration by authors, based on the calculations in the Appendix.)



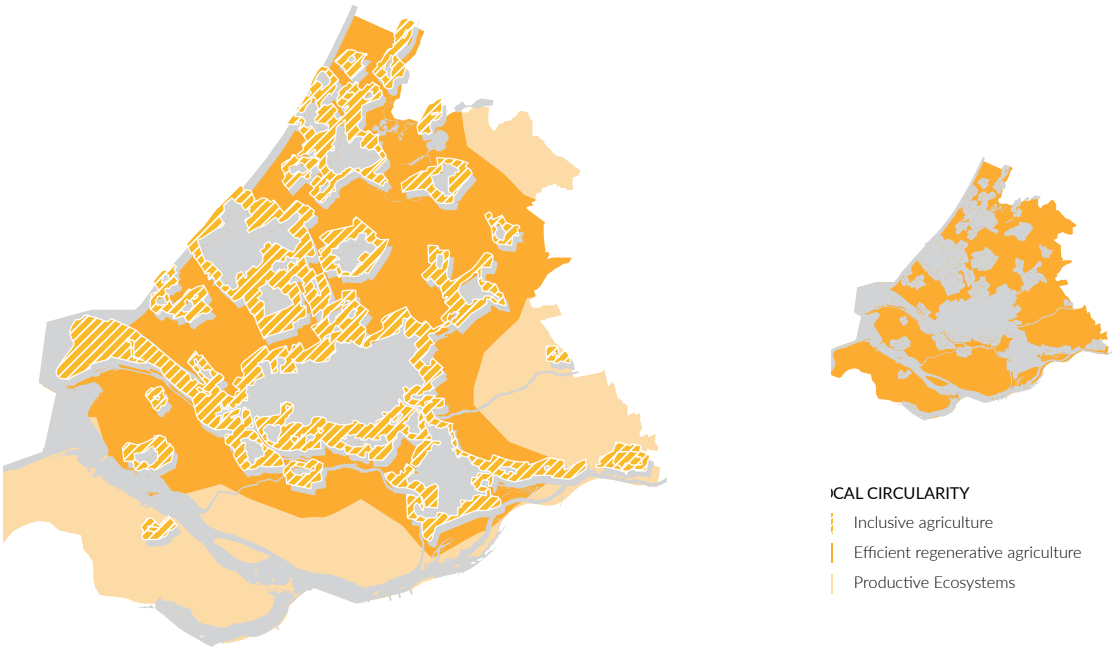


Figure 110 Visualising ecosystem restoration and productivity integrated in the Living Edges. (Illustration by authors).

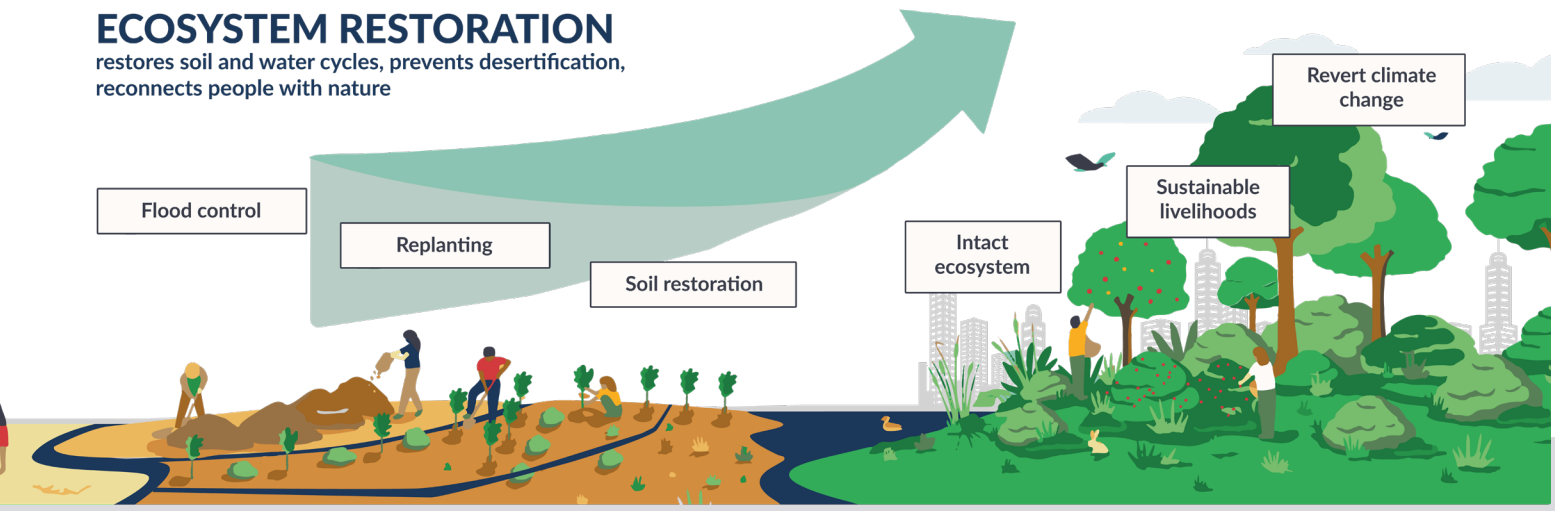


Figure 111 Regenerative ecosystems that contribute to reverting climate change, regional production, and resilience. (Illustration by authors, adapted from Wahl, 2019).

Embracing Adaptability: Nature Based-Solutions

The Policy Pathways are categorised for multiple attitudes towards change, as was described in the strategy. For the regional spatial implications, it was decided to visualise on the most radical scenario: fully embracing change (Figure 113). On the next pages the phasing snapshots will illustrate the spatial effects of the scenario.
The previous paragraph proved that more space will become available for nature as a result of the increased efficiency. Figure 114 shows how nature will additionally also become more integrated into the urban fabric, as Living Edges introduce green diversity. It is Figure 112 illustrated in what the 'embrace' scenario means for the local strategy. By layering interests and functions, stakeholders can reallise quality together.

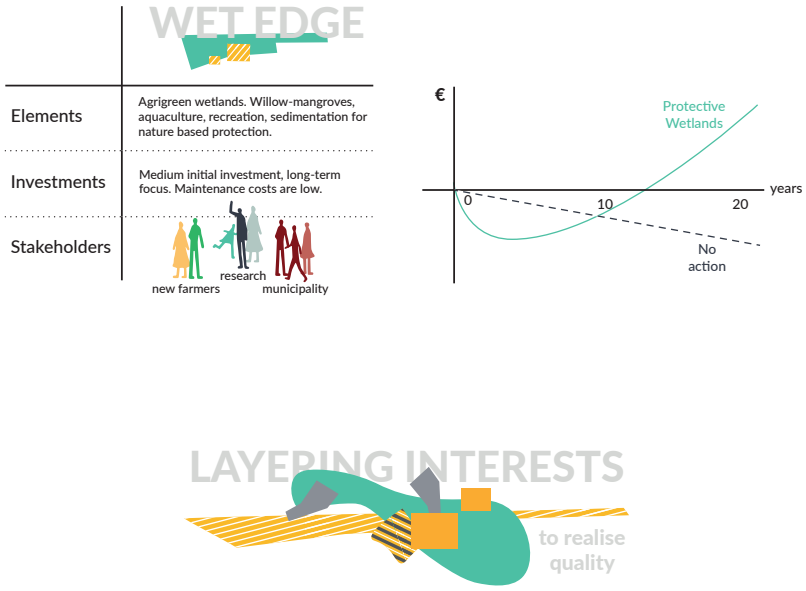


Figure 112 The investments and stakeholders for realising a Wet Living Edge Project. Through layering interests, the new and existing stakeholders can realise local quality. (Illustration by authors, based on the calculations in the Appendix.)

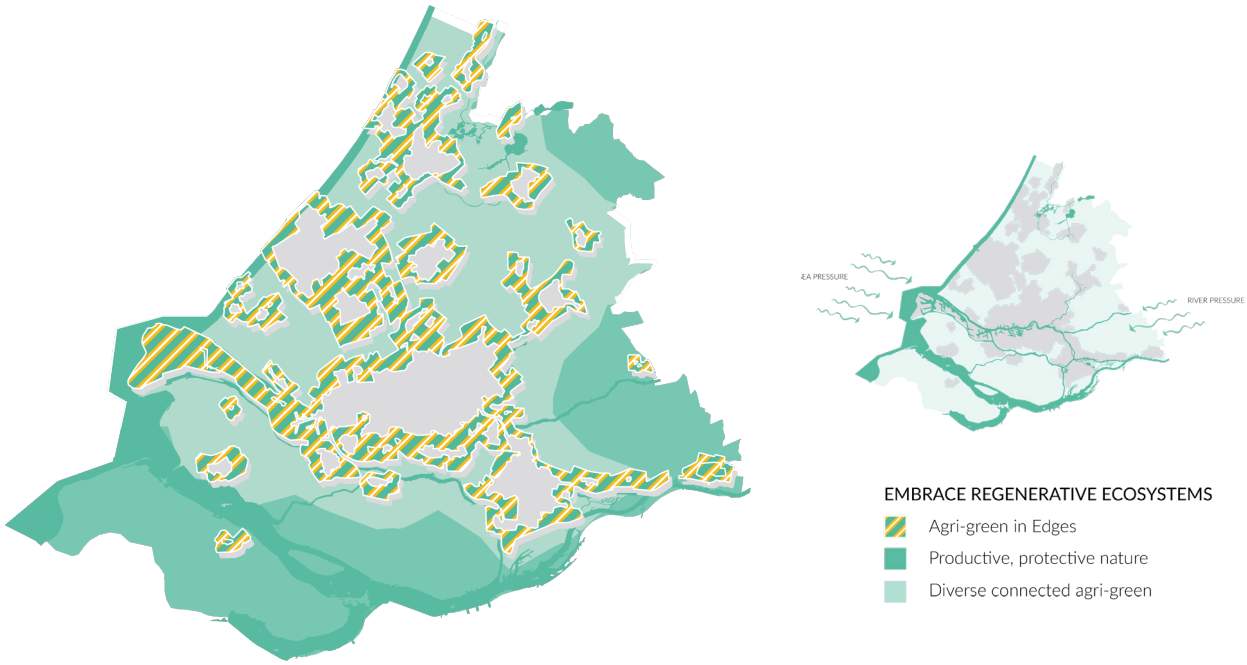


Figure 114 Due to increased productivity within the urban edges, the Province creates more space for natural systems, which can protect and produce for the region. (Illustration by authors).

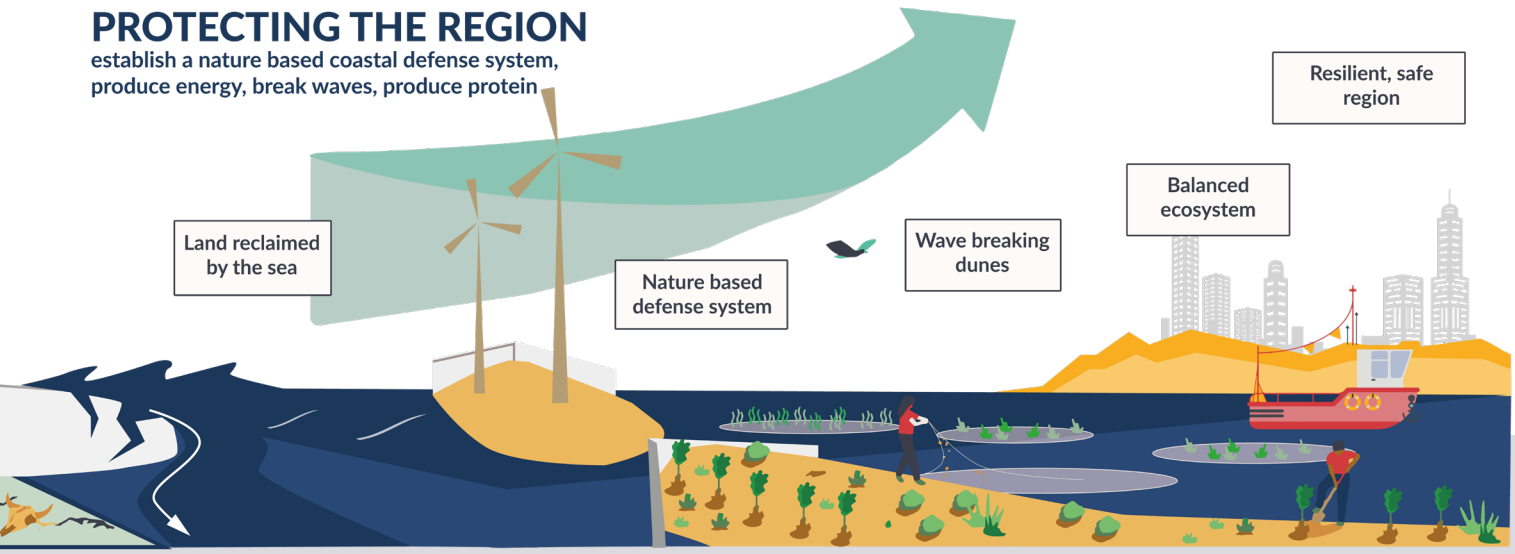
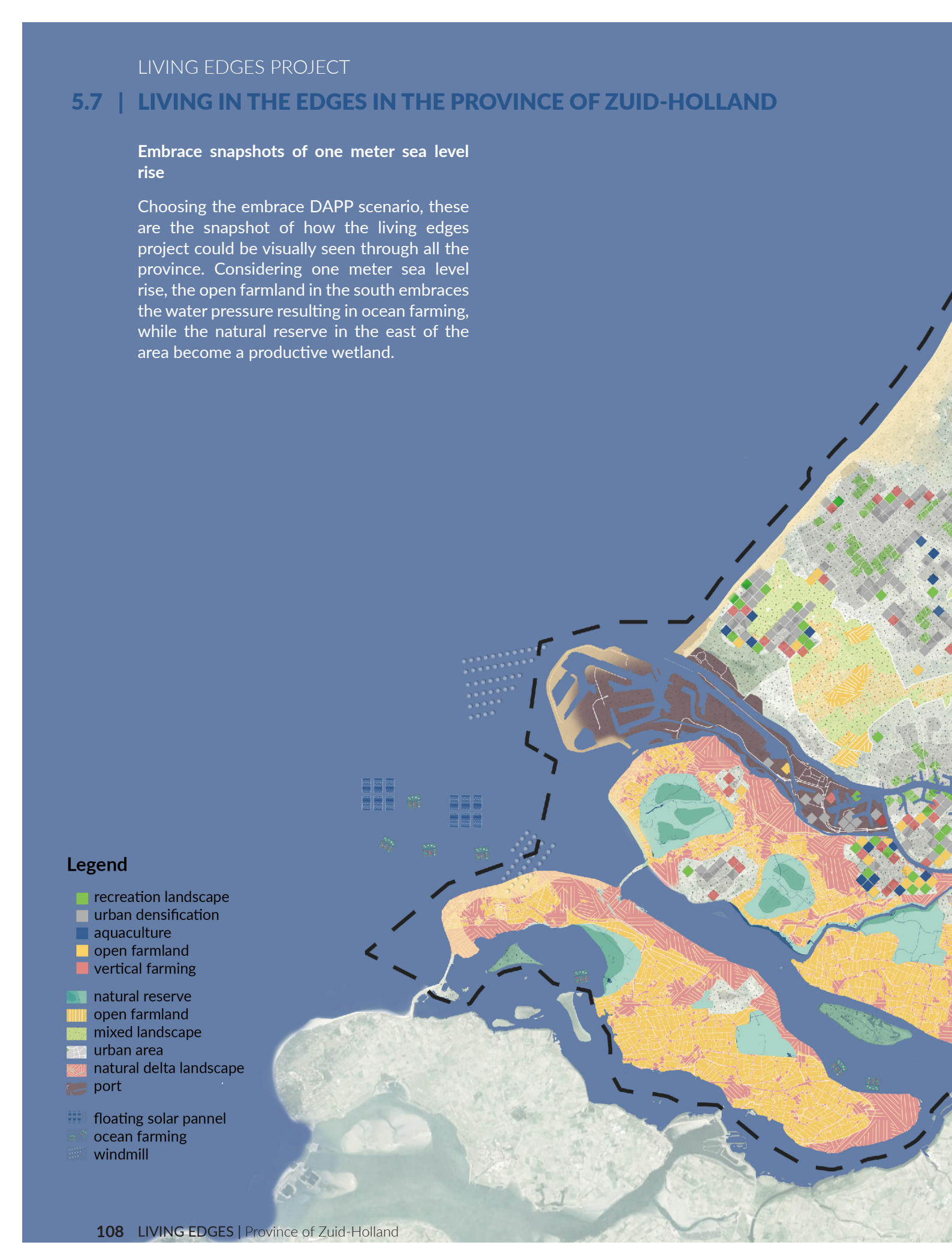


Figure 113 Future paradigms towards living with nature and using waterscapes as sites for production and ecology. (Illustration by authors).

5.7 | LIVING IN THE EDGES IN THE PROVINCE OF ZUID-HOLLAND

Embrace snapshots of one meter sea level rise

Choosing the embrace DAPP scenario, these are the snapshot of how the living edges project could be visually seen through all the province. Considering one meter sea level rise, the open farmland in the south embraces the water pressure resulting in ocean farming, while the natural reserve in the east of the area become a productive wetland.



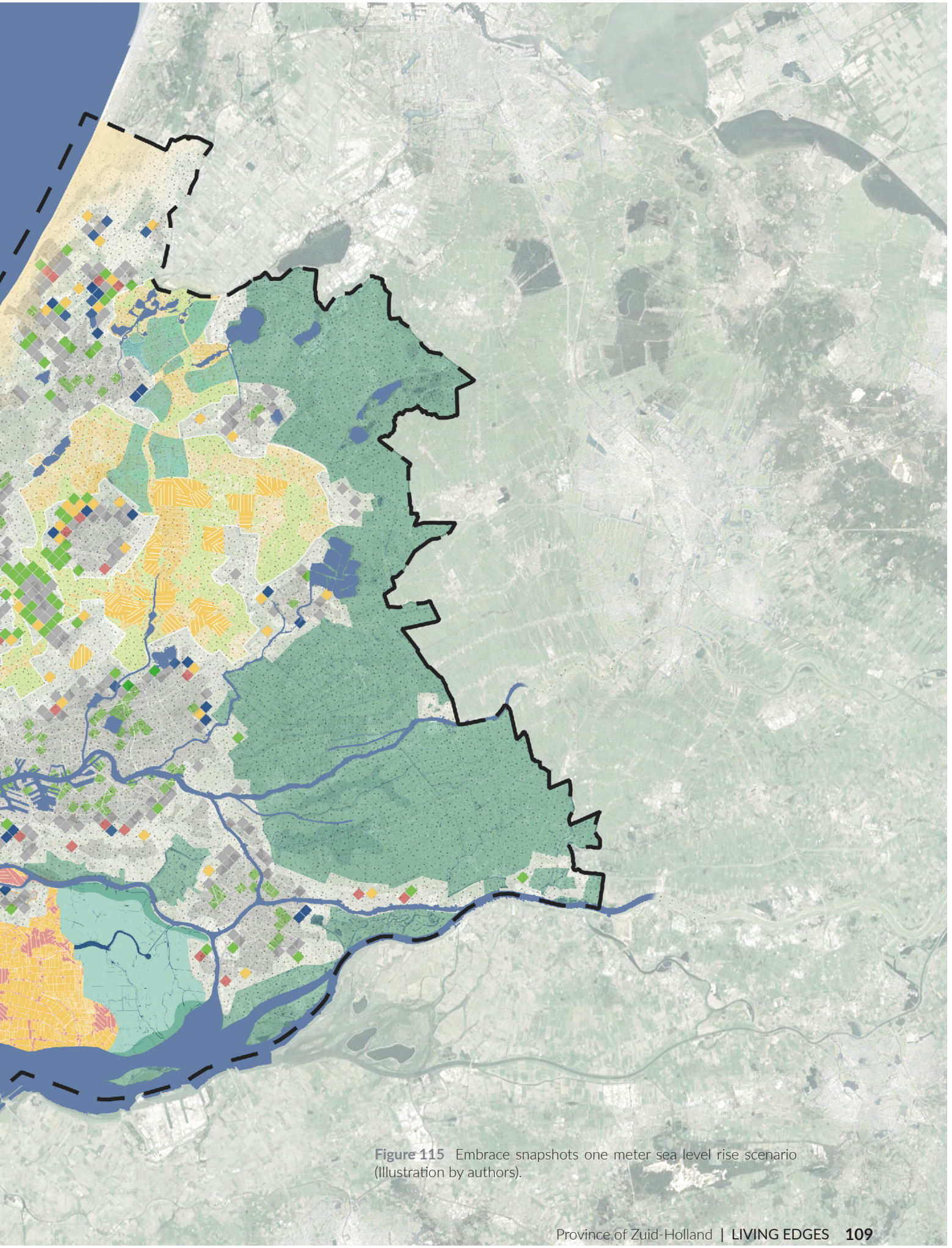


Figure 115 Embrace snapshots one meter sea level rise scenario (Illustration by authors).

5.7 | LIVING IN THE EDGES IN THE PROVINCE OF ZUID-HOLLAND

Embrace snapshots of two meter sea level rise

As the water pressure gets higher, some areas will adapt and transform into resilient landscape while still functioning well to support the people with producing primary food production and energy.

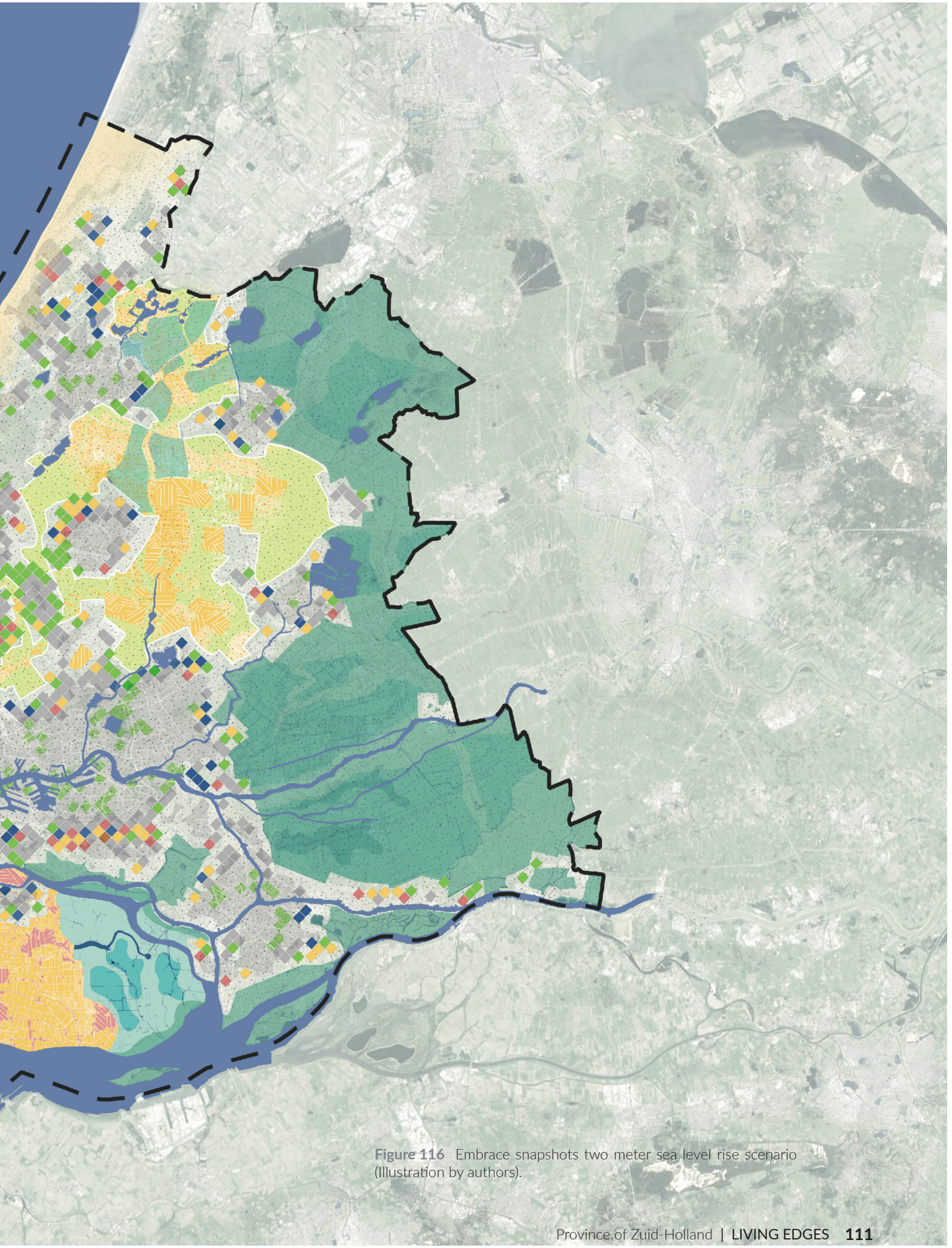


Figure 116 Embrace snapshots two meter sea level rise scenario (Illustration by authors).

5.7 | LIVING IN THE EDGES IN THE PROVINCE OF ZUID-HOLLAND

Embrace snapshots of three meter sea level rise

If the sea level rise is keep on going, by that time the landscapes are ready to keep protecting and producing. In the end, the people of Zuid-Holland will be provided sufficiently through its circular food system and to live a life where urbanisation is not separated but strongly connected with nature.

To live a life in the edges in the Province of Zuid-Holland.

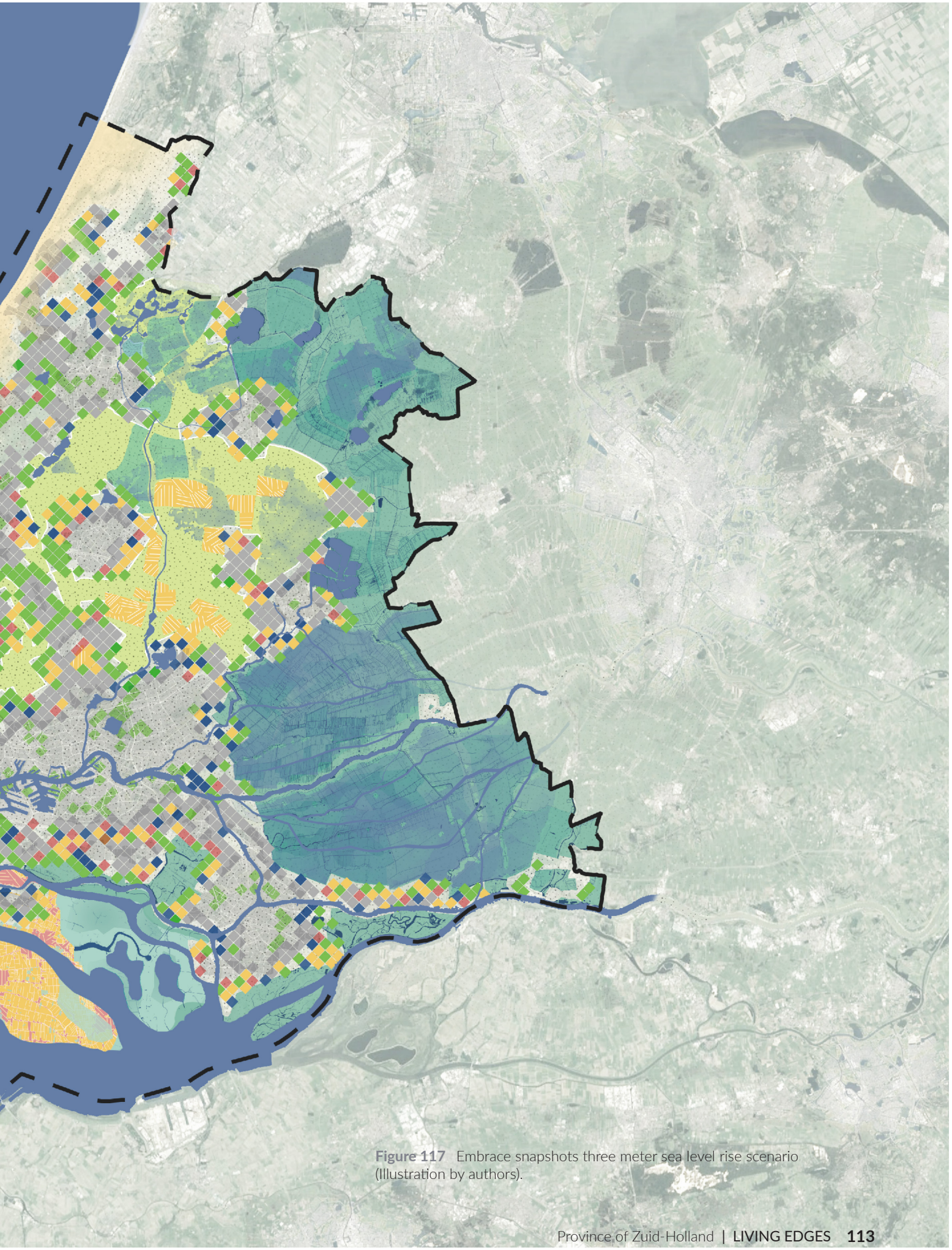


Figure 117 Embrace snapshots three meter sea level rise scenario (Illustration by authors).

6

CONCLUSION

6.1 | SUMMARY

The Living Edges project envisions a strategy for an equitable and just transition of the agro-food sector of the Province of Zuid-Holland to the Circular Economy. In this paragraph the main findings of the project will be summarised.

The main conclusion of the Living Edges is that the Province should use the agro-food sector transition as an opportunity for solving multiple other existing and future challenges. Using Communicative Planning, stakeholder engagement in an inclusive strategy, the Province can collaborate with stakeholders to add layers of interest and quality to the transition interventions. In doing so, the adaptation projects will contribute to socio-spatial, economic and environmental sustainability. Simultaneously, the concept of layered productivity in landscapes solves the critical issue of the limited space in Zuid-Holland.

As a framework for the vision, the project builds on the City Edges concept by LOLA (2011). Our analysis identified the city edges as areas with a high potential for redevelopment, while at the same time the city edges are areas that presently experience social problems. The Living Edges project build on the body of knowledge of the City Edges Concept, by proving their potential for food production, urbanisation and improving spatial quality and quality of life in cities.

The concept of Circular Economy lies at the heart of the Living Edges. The project offers the Province spatial tools, proposes stakeholder activation strategies and visualises of the circular region. Using circular and diverse agricultural typologies can increse efficiency by 187% and when the entire sector transitions, this means the agricultural sector will use only 45% of the existing land-use. As a result, more space is available for spatial pressures by water, regenerative ecosystems and urbanisation.

Finally, the Living Edges project is a call for action for policy makers in the Netherlands. For many years the country has been focused on economic growth, depleting its own landscapes and causing food inequality abroad. As one of the wealthiest countries in the world, it is time to take our responsibily and start acting on climate change and inequality. Transition to local from global, to circular from linear and connect in stead of divide.

Embracing adaptability as opportunity for creating Living Edges.

This chapter concludes on the main findings of Living Edges project by addressing the main research question and its related sub-questions. Finally, this chapter discusses the scientific and societal relevance, and evaluates the project's performances to the main challenges of the project (spatial justice, 230.000 homes and circular economy).

Considering the future spatial pressures on Zuid-Holland, how will the Province achieve socio-spatial justice when transitioning its own agro-food industry towards an adaptive and circular system?

The Living Edges project provides the space and tools for achieving socio-spatial justice. By adapting the region to the future spatial pressures in an inclusive and communicative way (Johnson, 2005), circularity adaptation becomes a regional and local opportunity. Using the under-used city eges (LOLA, 2011) as a starting point, the Province of Zuid-Holland solves existing and future problems and realises its circularity and urbanisation ambitions. When agriculture is reintegrated in society through regenerative, local, circular and efficient farming typologies, the region is able to take its responsibility to break the global linear food production chain. In doing so, spatial justice is achieved regionally and internationally: solving food inequality and empowering local communities by redistributing power and profit.

Sub-questions have been explored for the elements contributing to the Tension Field in the research question. These questions will be answered in the To answer the sub-question we look at the integration questions asked in the research question paragraph.

How does socio-spatial justice relate to the circular economy?

By transforming to a circular economy power and profit are distributed in a fair way and other socio-spatial problems, such as loneliness and the feeling of stress, are countered.

How can the transition to a circular economy promote more efficient use of the limited space?

Because the circular economy is much more space efficient, hectares become available to facilitate different challenges related to the limited space problem. By transition ingto a circular economy, the Province of Zuid-Holland will not have to rely on other countries for the import and export of agricultural products.

How can a transition to a circular agri-food sector be beneficial for the Province of Zuid-Holland?

The Province can achieve socio-spatial justice which is beneficial for both producers and consumers. The vision entails a bypass in the linear production line, which empowers locals. Land can be uses more efficiently, creating more space for other climate adaptation ambtions such as the increased river water pressure.

Finally, the project will be evaluated on the key elements of the vision below:

1. Local Food, Circular Economy
By implementing the Living Edges, food will be produced on a local scale. This will form the base for a local food circular economy.

2. Fair Distribution of Food
When food is produced increasingly more local and connected to the urban fabric, the agri-food sector is reintroduced in societies, creating better access to healthy affordable food to all.

3. Improve Lives in the Edges
The Living Edges increase diversity, stimulate community and promote equal acces to healthy food. Reconnecting through nature improves quality of life, especially in more vulnerable neighborhoods.

4. Climate Adaptation
Due to nature-inclusive agricultural typologies, ecosystems are restored. As a result of increased efficiency, more space is available for other climate adaptation functions in the landscape.

In striving to achieve the vision elements, the project builds upon multiple existing bodies of knowledge. The findings resulting from these applications to regional design and the interrelations between the different concepts will be discussed in this paragraph.

The first main concept which the project contributes to is the spatialisation of the policies by the UN, national government, and the Province (GAP, 2020; Ministerie van I & M, 2015); Provincie Zuid-Holland, 2019) about reversing climate change and transitioning to the circular economy. The concept of circular economy is translated into spatial elements and systems such as: water, waste, energy, heat and nutrients. The Living Edges can be regarded as an spatial experiment on what the local and regional qualities could be of the transition to the circular economy.

Next, the project strives to achieve Resilience by Design. This entails integrating nature-based solutions in the natural and uran landscapes in an inclusive way (Resilience by Design, 2018). This originally US concept is applied in the Living Edges project in a Dutch context. This inclused a multi-scalar and -actor approach to vision and strategy development. In the project, tools are offered to implement stakeholder engagement strategies in the Netherlands. Furthermore, the implementation of a networked and multiscalar governance typology is tested in the stakeholder engagement strategy. However, in the context of our project of the governance typology is integrated in the stakeholder engagement strategy, but this would need further testing with local stakeholders.

Futhermore, the Livng Edges project elaborates on the integration of socio-spatial, economic and environmental sustainability. The Living Edges vision proves that a transition to a circular food economy can solve more than the problem of abundant waste. In fact, the project should inspire policy-makers and farmers to rethink the agricultural sector and integrate social and environmental quality in projects to make more efficient use of the limited space

As a concept for making efficient use of the limited space, the project builds on the City Edges concept by LOLA (2011). The project quantifies the potential of the city edges and it visualises the resulting spatial quality. Furthermore, the toolbox and stakeholder engagement strategy are directed at the population and spatial characteristics of the city edges. Further research could be conducted to test potential and threats amongst stakeholders in the edges.

Finally, the strategy concept of the Living Edges is based on the concept of Deep Uncertainty. This concept is analysed for the Province, and integrated in the strategy. The concept of Dynamic Adaptive Policy Pathways (Haasnoot, 2018) incorporates deep uncertainty especially for the field of water management. The DAPP was used as a framework for the strategy and was applied to the diverse programmes at the regional and local scale. The Living Edges proposes a phasing and governance structure to use the DAPP in the region for building stakeholder capacity and flexibility into the core of policy concepts. Nevertheless, the Pathways that were proposed in the strategy of Living Edges should not be used directly as a roadmap for the Province, because their core strength lies in collaborative development. Also, it depends on the political context whether the Province can accept bottom-up approaches for regional water- and economic safety projects.

To conclude, the Living Edges synthesise multiple concepts to create a circular Province. The new concepts that resulted from the project should be researched more in-depth in order to determine their feasibility.

6.3 | DISCUSSION | Societal Relevance, Scope and Limitations

In this pragraph the societal relevance of the Living Edges Project will be discussed. The illustration in Figure 1 illustrates how Living Edges focuses on creating strong sustainability through integrating multiple goals within one project. The Sustainable Development Goals by the UN Habitat (2016) have been used to structure the different elements for each of the problem triangle elements.

First of all, the Living Edges show people, farmers and other edge initiators how to start using adaptability as opportunity. This can be used by people to strengthen their ideas and make them future proof. Although this project is conducted on a regional scale it is built based on small initiatives such as urban farming and agriforestry. The strategy of the project offers local intiatives the knowledge, funding and space to scale up and create regional project synergies.

Although awareness amongst citizens about climate change is rising, many people do not know how to act based on the awareness. By creating a sense of urgency through the stakeholder engagement strategy, and offering concrete tools for action, locals are empowered to make a change.

The local Living Edges create strong and adaptive city edges, where in addition to circular food production, locals can counter site-specific problems such as obesity and loneliness by connecting people based on agriculture. In doing so we offer a fair distribution of profit to farmers and show them agriculture can be performed in a more efficient way, offering up space to further urbanisation. Furthermore, reintegrating nature in the urban fabric can reduce the level of stress in the cities, while will simultaneously counter the loss of biodiversity.

Infrastructural investments can be given more meaning by layering objectives and functions in it. By connecting people to problems and challenges in stead of solving everything behind the scenes, the Province can create more awareness about for example the water pressure. In this project we visualised what the embracing the water scenario would look like. From now on it not only supports the embracing of the water but also the way we keep our regions connected and the way we use the water as a means of producing food and public goods.

We choose not to start off at hot spots with a lot of attention but to start off at unknown vulnerable neighbourhoods where we would have the most impact. By choosing these vulnerable neighbourhoods we address existing societal issues. While addressing these issues we tackle regional technological problems. We ask authorities to take responsibility for ethical decisions that go beyond national boundaries. In this project the importance of silent stakeholders, such as vulnerable neighbourhoods, are emphasized.

Finally, by transitioning to the local circular economy, the Province of Zuid-Holland will take its responsibility in breaking from the global food chain. In doing so, it stops contributing to depleting mono-cultures and global food inequality. In stead of exporting processed goods, the future of the Province of Zuid-Holland may lie in exporting knowledge and expertise to countries that face the biggest threats for hunger by climate change.

The UN habitat sustainable development goals involved in the project are: no poverty (1), Zero hunger (2), good health and well-being (3), quality education (4), affordable and clean energy (7), decent work and economic growth (8), industry, innovation and infrastructure (9), reduced inequalities (10), sustainable cities and communities (11), responsible consumption and production (12), climate action (13), life on land (15) and partnerships for the goals (17).

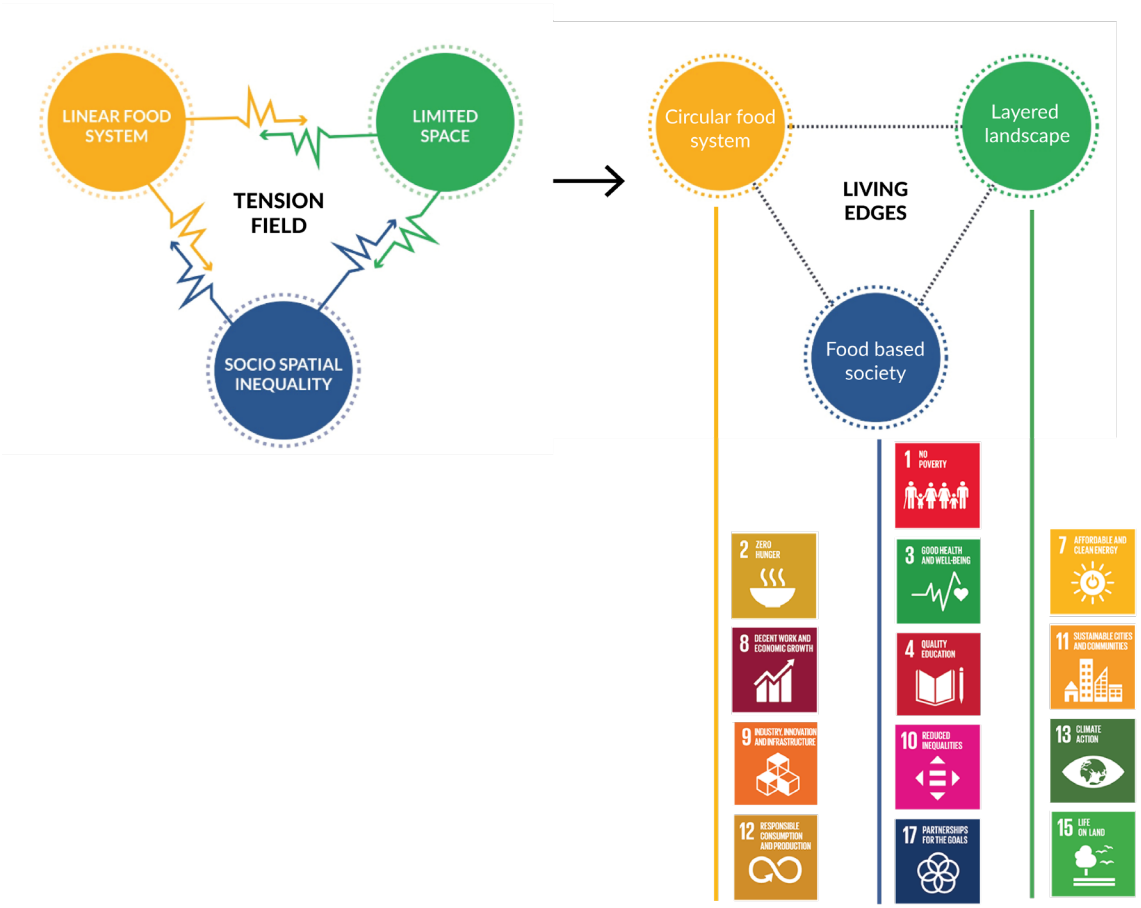


Figure 118 Strong Sustainability through acting in the Tension Field, creating Living Edges. Illustration by authors, based on (United Nations, 2016).

6.3 | DISCUSSION | Ethical Values

The Living Edges have two ethical pillars at the base of the projects. The first is the spatial inequality, which manifests mostly in the City Edges. The second being the inequal distribution of power and profit in the agriculture sector. These two themes are the topic of political debate and need to be handeled with sensitivity. This paragraph reflects on how these two pillars were incorporated in an ethical way in the designed vision and strategy.

First of all, disadvantages groups were pushed to neighbourhoods on the edge of the city. These neighbourhoods are characterised by the lack of greenery, the low level of access to healthy food and the high amount of fast food chains and cafes. This results in an unhealthy environment, and by bad choices of the residents eventually results in an unhealthy way of life. Second, because of the presence of five purchasing companies that control the agri-food sector power and profit are unequally distributed. Even though their importance in the agri-food sector, farmers received unequal financial compensation when compared to the five purchasing companies.

To combine these two topics, the vision eventually focussed on acting in the most vulnerable neighborhoods. Through the engagement strategy, an inclusive phasing of the DAPP results in kick start projects which strengthen local neighborhoods and improve their quality of life in a shorter time frame.

Furthermore, the vision spatialises the bypass of the linear monopolised food chain. Resulting in a fair distribution of profit for the farmers and neighbourhoods with equal acces to healthy food and greenery. However, some stakeholders are disadvantaged by this transition: some distribution or packaging companies will no longer be able to continue their depleting practises. However, as a similar amount of jobs will be needed in the agriculture sector, many employees are able to transition into the circular economy as well.

Next, the Living Edges strategy proposes multiple Adaptive Pathways for dealing with the increase of for example sea level rise. Increasingly more people will understand the pressures and challenges on decision makers considering scenarios that state the possibility of 3 meters sea level rise. When there is political and local acceptance towards embracing the water more, some areas will be flooded, however, if this is not the case, there are other pathways to ensure the same result: a safe and robust region in the present and in the future.

Nevertheless, when certain areas are selected in the end to be flooded, the region does deprive people of their homes and places to work. Residents of houses or companies that will be flooded in the future will be relocated to other houses or companies and will financially be compensated. Even though these people are relocated and financially compensated this is ethically the most challenging part of our project.

The living edges project can be described as controversial. The project proposes big changes both on the scale of the Province of Zuid-Holland but also on the global scale. The linear food economy will be dropped, transforming to a more local circular food economy. This will have a major impact on the global economy. The proposed transformation will take time and are planned for the long-term. This is necessary for the politics to implement the change. Economic stimulance is required for the proposed transformation to take place.

This project's purpose is to serve as a route towards a local circular agri-food sector as a sustainable alternative for the current global food chain. Its strategy defines possible pathways to implement the local circular agri-food sector while balancing social, environmental and economical consequences.

As described previously, the concept of Circular Economy lies at the heart of the Living Edges project. The Living Edges refer to the city edges where the bypass of the current linear food system will take place. Eventually this will result in circular city edges with spatial equality, urbanisation, reconnection of food and society.

However, the project is about more than the circular economy. While it focuses on the transition from a linear to a circular agri-food sector, the transition is used at a local sacle as a tool to reach social, environmental and economic goals. Following from this, for our project the circular economy should not be named as a goal in itself but should be seen as a tool to reach other goals. The circular economy plays a facilitating role for change.

We closed the loops by transforming to a more local agri food sector, which uses the high efficiency of the circular food economy. In this local agri food sector the farmer is placed in the middle. The farmer uses water, waste, energy, organic material and CO2 in closed loops. If the farmer has an abundance or shortage of something a connection is created with adjacent neighbourhoods or a city closeby. The regional connection is primarily based on where the circular economy is not sufficient enough, where regional connections are needed to close the circles.

By implementing the circular agri food sector the landscape can be used in a multifunctional way. Production landscapes can service other functions such as urbanisation or water storage. In urban areas, vertical or urban farming is used. In other areas, which are prone to flooding, production areas can be flooded but still remain active in producing.

Because the types of farming used in the circular agri food economy are low to middle scale they can be placed within societies. These farmers receive a fair distribution of profit because the linear food system is bypassed. Because the circular agri food sector is placed within societies, they form the base for furter (re)connection of people. This reconnection eventually forms the base for a food based community that counters socio-spatial elements such as loneliness and high stress levels.

Finally, the Living Edges circularity capacity was based on rough estimations, in order to achieve full closure of the loops more in depth knowledge would be necessary. Also the impact of the disconnection from the global economy is mostly based on rough calculations. In order to fully understand the impact of the transition to the circular economy, more advanced mathematical models would be necessary. Additional insights in the dynamic relationships between the mutitude of stakeholders in the agro-food sector and between other sectors would also create a more realistic conclusion.

Nevertheless, the Living Edges concept can do a big deal in transitioning to the circular economy. Through its layered concept and stakeholder interests the concept can function as a tool for the Province of kick-starting the circularity.

6.4 | LIMITATIONS AND RECOMMENDATIONS

This paragraph will discuss the limitations of the Living Edges research and design. Some limitations were the result of a lack of knowledge, others are related to the scope and focus of the project.

Limitations

First, the Living Edges strategy largely relies on bottom-up projects. The development strategy starts in the most vulnerable neighbourhoods with disadvantaged inhabitants. Although this is ethically responsible, if these kick-start projects are not supported by local inhabitants or are not economically feasible, the project will not result in a succes. Therefore more expertise would be needed in considering the most strategic and at the same time just locations to kick-start the project.

Furthermore, the strategy on water management is based on synergies between local projects. Despite using the toolbox, it remains more uncertain whether the local projects can be the solution to cope with the water challenges on a provincial scale.

Last, with rough calculations the capacity of the Edge's for circular food production was estimated. While existing circular agricultural types prove to be much more efficient than traditional types, they often remain small-scale projects. Research and test-sites are needed to experiment with agricultural efficiency on the different soil types of the Province. Also, the calculations proved the Edge's capacity for circularity, but more accurate and site-specific calculations would be neccessary.

Recommendations for futher research

First of all, by breaking the global linear food chain we envision to solve the international food inequality. Will this have the desirable effect? It is difficult to predict the economic implications due to the big amount stakeholders involved, and the dynamics between different other sectors. A more accurate simulation of the impact of Zuid-Holland breaking from the global food production chain would give better insights on whether this action achieves the desirable results.

Additionally, while our strategy does include many stakeholders, we did not elaborate sufficiently on the stakeholders that are disadvantaged by bypassing the transition towards circularity. In theory they are included in the stakeholder engagement strategy, but further research and experience would be needed to develop a feasible stakeholder engagement strategy.

In addition, the concept of Dynamic Adaptive Policy Pathways (Haasnoot, 2018) was used in our project strategy to integrate uncertainty and dynamics to the regional strategy. However, DAPP is originally developed for water management, which includes a different context than the agro-food sector. More insight in inclusive use of DAPP in a multiscalar and -actor context would provide a better argument for using DAPP for transitions to circularity.

Finally, the circular economy system of the Living Edges is proposed to be self-sufficient at the regional scale. Nevertheless, in the project it was not calculated whether the edges can produce all the nutrients needed in the balanced and diverse diets we are used to today.

GROUP REFLECTION | 6.5

One of the key concepts of the Living Edges project, was that we used the circular economy as a tool to solve different problems that we encountered in the Province of Zuid-Holland. When reflecting back on the group process, we concluded that this initially felt like overcomplicating the project. However, in the end the Living Edges concept became a very valuable tool to give meaning to the circularity transition in the Provice of Zuid-Holland.

By analysing the transition to a circular economy in relation to other challenges such as future urbanisation in the Province of Zuid-Holland, we identified multiple trends that created a tension field. However, by analysing the Province of Zuid-Holland based on the agri-food sector we found that many of these problems were all related to the agri-food sector and the amount of open space it occupies. Instead of simply closing the loops and transitioning to a circular economy we choose to use this transition for other elements as well. By transforming the agri-food sector to a circular sector other social, economical and environmental challenges were countered as well. In this sense we can conclude that we used the circular economy as a tool to counter other problems.

Our analysis showed that the food sector is becoming a hars sector for the farmers. Next to that, the opinon on farmers is changing because of the nitrogen crisis. The power and profit distribution for the farmers is unequally divided, resulting in socio-spatial inequality. The institutions dividing the profit are hard to change. Although we are no expert in this sector, we know that this unequal distribution prevents sustainable social, economical and environmental development.

As mentioned in the ethical part of the project, by transforming to a circular economy jobs will be lost. Moreover, our vision described that certain areas of the Province of Zuid-Holland will be flooded in the future. These were hard choices to make. However people without jobs will be helped to find new jobs and will receive financial compensation, this is still a element open for discussion. This is also applicable for people having to leave their house because of future floods. Nonetheless, this project tries to propose a long term strategy that in our opinion will lead to a future sustainable society.

Furthermore, due to the influences of COVID-19, the last physical meeting we as a group had was on the 19th of march, 2020. The following weeks we meeted through the internet and presentations were given using video conference software. Working from home became the new normal, which everybody adapted to in their own way. Because this was relatively new to us, this was another challenge to be overtaken. We feel that even though it was tough at the start, this eventually strengthened our team and taught us new lessons.

Concluding, we feel that the literature body supporting our project and research is present. Nevertheless, more literature and research is needed to further strengthen and define the implementation of the Living Edges. We are aware of this and consider this project as a starting point to further research and experiments on embracing adaptability as opportunity for creating Living Edges in the Province of Zuid Holland (and in the rest of the world).

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Figure 1: Own illustration.

Figure 2: Own illustration, based on: Wikkicommons.com and getty images.

Figure 3: Own illustration.

Figure 4: Own illustration.

Figure 5: Illustration retrieved from https://www.nrc.nl/nieuws/2019/02/14/kleine-groei-overslag-rotterdamse-haven-vooral-door-containers-a3654065
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Figure 6: Illustration retrieved from https://geertsines.wordpress.com/2011/12/15/hoog-water-1/
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Figure 7: Illustration retrieved from https://www.google.com/url?sa=i&url=https%3A%2F%2Ffd.nl%2Fondernemen%2F1102117%2Fthe-greenery-stoot-opnieuw-eigendommen-af&psig=AOvVaw3JrdAQWj9dZdI1HXYndtKc&ust=1585909301066000&source=images&cd=vfe-&ved=0CAMQjB1qFwoTCNii1t3CyegCFQAAAAAdAAAAABAD
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Figure 13: Illustration retrieved from Google Earth

Figure 14: Illustration retrieved from Google Earth

Figure 15: Illustration retrieved from Google Earth

Figure 17: Own illustration, based on: PBL Netherlands. (2018, 20 April). The Netherlands in 21 infographics. Retrieved from https://www.pbl.nl/en/publications/the-netherlands-in-21-infographics

Figure 18: Own illustration, based on: LISA data.

Figure 19: Own illustration, based on: LISA data.

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Figure 20: Own illustration.

Figure 21: Own illustration, based on: LISA data.

Figure 21: Own illustration, based on: LISA data.

Figure 22: Own illustration, based on: EduGis.

Figure 23: Own illustration, based on: CBS, De Zwarte Hond.

Figure 24: Own illustration.

Figure 26: Own illustration, based on: LISA data, De Agro&Food sector in Nederland and PBL Netherlands. (2018, 20 April). The Netherlands in 21 infographics. Retrieved from https://www.pbl.nl/en/publications/the-netherlands-in-21-infographics

Figure 27: Own illustration, based on: CBS, Tradingeconomics.com.

Figure 28: Own illustration, based on: PBL Netherlands. (2018, 20 April). The Netherlands in 21 infographics. Retrieved from https://www.pbl.nl/en/publications/the-netherlands-in-21-infographics

Figure 29: Own illustration, based on: LISA data.

Figure 29: Own illustration, based on: LISA data.

Figure 30: Own illustration, based on: EdiGis, LISA data.

Figure 31: Own illustration, based on: LISA data.

Figure 32: Own illustration.

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Figure 37: Own illustration.

Figure 38: Own illustration.

Figure 40: Public Sediment. (n.d.). Unlock Alameda Creek [Photograph]. Retrieved from http://www.resilientbayarea.org/public-sediment

Figure 41: Own illustration, based on LOLA landscape architects. (2011). Stadsrandenatlas van de zuidvleugel. Rotterdam, The Netherlands: LOLA landscape architects:

Figure 42: Own illustration, based on Tompkins, E. L., Few, R., & Brown, K. (2008). Scenario-based stakeholder engagement: Incorporating stakeholders preferences into coastal planning for climate change. Journal of Environmental Management,

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Figure 43: Own illustration, based on Akhmouch, A., & Clavreul, D. (2016). Stakeholder Engagement for Inclusive Water Governance: “Practicing What We Preach” with the OECD Water Governance Initiative. Water, 8(5), 204. https://doi.org/10.3390/w8050204

Figure 44: Own illustration, based on Deltares. (2019). Mogelijke gevolgen van versnelde zeespiegelstijging voor het Deltaprogramma. Delft, Nederland: Deltares.

Figure 45: Own illustration.

Figure 46: Adapted from Haasnoot, Marjolijn, Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2018). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. Global Environmental Change, 23(2), 485–498. https://doi.org/10.1016/j.gloenvcha.2012.12.006

Figure 47: Own illustration.

Figure 48: Own illustration.

Figure 49: Own illustration.

Figure 50: Own illustration.

Figure 51: Own illustration, based on Tompkins, E. L., Few, R., & Brown, K. (2008). Scenario-based stakeholder engagement: Incorporating stakeholders preferences into coastal planning for climate change. Journal of Environmental Management, 88(4), 1580–1592. https://doi.org/10.1016/j.jenvman.2007.07.025 and Resilient by Design. (2018). South Bay Sponge. Retrieved from http://www.resilientbayarea.org/south-bay-sponge

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Figure 58: Public Sediment. (n.d.). Unlock Alameda Creek. Retrieved from http://www.resilientbayarea.org/public-sediment

Figure 59: P+SET. (n.d.). Marin City. Retrieved from http://www.resilientbayarea.org/peoples-plan

Figure 60: Resilient by Design. (2018, May 18). Final Event. Retrieved from https://www.flickr.com/photos/149464388@N02/28757139758/in/album-72157697718501325/

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Figure 64: Own illustration, based on Haasnoot, Marjolijn, Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. Global Environmental Change, 23(2), 485–498. https://doi.org/10.1016/j.gloenvcha.2012.12.006

Figure 65: Own illustration.

Figure 66: Own illustration.

Figure 67: Own illustration, based on LISA data, EduGis.

Figure 68: Own illustration, based on LISA data, EduGis.

Figure 68: Own illustration.

Figure 69: Own illustration.

Figure 70: Own illustration.

Figure 72: Own illustration.

Figure 72: Illustration retrieved from Google Earth

Figure 74: Illustration retrieved from Open Street Map Landuse

Figure 74: Illustration retrieved from CBS

Figure 76: Illustration retrieved from EduGis

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Figure 102: Retrieved from Google Earth

APPENDIX

SELF REFLECTION

Jan Eggink

The planning tradition in my country, the Netherlands, is embedded in its national DNA. By using the concept of ''polderen'' we like to involve every stakeholder and actor in the project. In most of the situations Polderen results in meeting in the middle. The planning tradition formed this country and protected the spatial identity. By planning, we can manage multiple challenges at the same time.

However, planning for the far future also brings problems. Context and challenges can change over time. Because of this a development strategy should be adaptable to changing context. This is what we did in our project by implementing the Dynamic Adaptive Policy Pathways. These pathways together create a way to achieve the vision. If certain context or challenges change, a different pathway can be chosen to realise the vision. Because of deep uncertainty for the future of the Province of Zuid-Holland, related to the different scenario's on sea level rise, our vision on our development strategy was that it should adapt to changing context.

This, and other visions, become a sort of partner in the project with whom you can discuss about your proposal. The vision will behave like a mirror, constantly letting you reflect on your proposed design and how it relates to the vision. This is what happened in our project when we were debating on where we wanted our kick start projects to be located. Our vision stated that we looked into city edges and that we countered socio-spatial inequality. So it only made sense when we concluded that our kick start projects would be located in disadvantaged neighbourhoods in the city edges.

Stakeholder engagement is the key for the success of a project in my opinion. In our project we proposed to break the global food chain. This global food chain can be seen as a institution, which makes it hard to change. Because this break can be seen as a drastic change, all of the stakeholders needed to be engaged and needed to believe in the project. The stakeholder engagement is realised by creating and implementing a stakeholder engagement strategy which is based on creating a stakeholder network. This stakeholder network is aimed at activating and wide range of stakeholders to contribute to the Living Edges. By creating a collaboration between private and public partners, integrating local knowledge and technical expertise, the project Living Edges becomes socially and ecologically strong.

Concluding, the strengths of the project Is in the adaptability of the development strategy. Moreover, by creating and implementing the stakeholder engagement strategy the base for a socially and ecologically strong project is created. However, by proposing such a radical change to a institution all of the stakeholders needs to be engaged and must contribute to the project, which could possibly become a challenge. Because there are still some aspects needed to be further researched, this projects forms the base for a perspective change of the agri-food sector that will hopefully result in a new paradigm.

Jasmijn Ponssen

"How to be a good urbanist?" was a question raised by Roberto Rocco (2020) that has kept me thinking during the Q3 project Developing Spatial Strategies for the Global Metropolis. Rocco explained that a good urban plan can be broken down into three main elements: 1) fit for purpose; 2) beautiful/profitable/sustainable; 3) morally positive. This personal reflection will be structured according to these three themes.

"What do we want to bring to the Provincial debate?" was a question we tried to address in the project. Positioning ourselves as ethical Process Planners (Sehested, 2010), the Living Edges spatialise our collective values for achieving spatial justice through transitioning both large and small elements of the system (Fainstein, 2010). In translating Provincial ambitions to a vision and strategy, the concept of "Urbanism as Metagovernance" (Whitehead, 2003) both set the context and created for our Practise based Research. As the project progressed, it became increasingly important to structure our academic- and practise-based methods and understand the implications the different findings had on each other (Biggs & Buchler, 2008). In addition, structure and organisation became essential when collaborating digitally. In my opinion it has thought us to ask more concise questions, use clear visualisations and arguments and organise focussed discussions. As a result, we were able to focus our research more, and iterate within the niche of our project, which has created a better developed strategy and vision.

"How to synthesise the complexity of problems into an understandable project?" was a challenge we faced in synthesising our abstract ambitions to more concrete actions and visualisations. As our tutor Remon Rooij explained in a lecture about Regional Planning Methodology, it is easy to agree on abstract and long-term ambitions, but it becomes more difficult to agree when these ambitions become more concrete. Within our diverse team we all had slightly different perceptions of our vision elements, which only became visible when we started drawing and mapping. I understood that this is also embedded in strategy-making for inclusive and just processes (Johnson, 2005), and I am fascinated to discover more about the relationship between research and design.

"How to further develop ethical planning skills by learning from our team-work?" is the final question I would like to answer in this reflection. In my opinion, our project was a collaborative synthesis of the engineering side and soft side of regional planning. The tension field we discussed in the analysis is precisely what I think will challenge me throughout my professional career as well. This project has thought me that this technological and political aspects add layers of complexity, which a communicative and value-driven urbanist can translate to just projects that adapt our built and social environments to ensure public goods in the present and for generations to come.

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Lucas Di Gioia

This reflection is an attempt to position our vision proposal within the complexity of planetary urbanization (Brenner & Schmid, 2011) and the questions can we derive from it.

"This situation of planetary urbanization means, paradoxically, that even spaces that lie well beyond the traditional city cores and suburban peripheries—from transoceanic shipping lanes, transcontinental highway and railway networks, and worldwide communications infrastructure to alpine and coastal tourist enclaves, "nature" parks, offshore financial centres, agro-industrial catchment zones and erstwhile "natural" spaces such as the world's oceans, deserts, jungles, mountain ranges, tundra, and atmosphere—have become integral parts of the worldwide urban fabric." (Brenner & Schmid, 2011).

So the question here is: What is Zuid Holland's role on such global spatial dynamics and how does this revert to the provinces' spatial and social configuration?
Given that the agri food sector is highly dependent on the globalised production chain and economies of scale thematics, I begin by acknowledging that for inquiry to arise, our choice topic, related to the studios topics of research (Circularity, Urbanization and Social Spatial Justice), united people greatly interested in the planetary discussion. From the very beginning we have been interested in comprehending the global groundworks that have shaped the province, and from there, devise a strategy for implementing circularity focused on the agriculture economy and the future demands and challenges of the province. This was a fundamental aspect that guided our work process and proposal, allowing us to build a consistent interscalar narrative, but most importantly, position ourselves in the discussion by critically investigating the predominant economic and planning narratives.

Language is an important starting point of investigation. How one chooses his or her words to express concepts tells a great length on the epistemology of certain ideas. In the broader case of regional planning, the language being used in the case of regional planning (stakeholders, vision, SWOT, etc.) leaves the subject closer to the business and marketing jargon rather than that of the social sciences. What this means to say is: Whatever we are designing and proposing, it is more in tune to be heard by those that have an interest in buying or selling a model of life, of city, of urbanization, rather than by those that experience its reality, on the "outside edge of the render". Language has the power to exclude those of the discussion, and even when attempting to propose the most radical of societal changes as we have done, there is a limit to just how far designers can go when we still use the traditional language of business to express our visions.

Having said this: Is regional planning just not the attempt to manage the economic spatial byproduct of agglomeration (urbanization) and neoliberal driven models of development, in order to guarantee its maintenance?

If we briefly look back to the history of the subject, the concept of urban and mega regions have only really come into existence in the late 80ies when late-capitalism matured. Even today, with new paradigms for urbanization (circularity, sustainability, resilience), they still rely on givens linked to

economic principles of capitalism such as scarcity, for example, which relates to the principles of supply and demand and where the concept of circularity only proposes to change the system within the system itself. This leaves me to question: Can regional planning exist in other societal models, and on what scale is this best to do so?

Above all, we must begin by acknowledging the enormous importance of change in places that shape and drive the current development condition, and from here break free from the overarching model to kickstart alternative societal models.

We must figure new ways of expression to disseminate the new frameworks, rather than rely on communication methods that have put our society here in the first place. This language must be accessible, relatable and invigorating.

Building on the care-based common concept of Marina Chang (Vivero-Pol et al., 2018), we must listen with care to the individual and community collectiveness, challenging the approach of top-down models of management.

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Kong Tao

In this short period of two months, I think our group has made some reasonable and bold assumptions about the future of south Holland. Agri-food sector are our entry points. I'm sure most people would agree that a more circular food production and consumption is a worthy goal. Just as in the lecture, when voting for the most important value of the city, most people put sustainability in the first place. These goals are sometimes more of a slogan, and I wonder how planners can achieve them. After all, we are not experts in the field of food, nor do we have the power and capital to mobilize huge resources. Especially as we began to study the flow of food, energy, and waste, I found it increasingly difficult to control the situation. Because the problems we face are never isolated. If you are designing a site of several hectares, you can come up with any idea you want and justify it. Because it has a finite relationship to the outside world. But as the scale gets bigger, on a regional scale, any decision can touch a big chain. Assuming that food production will shift locally in the future, imports of food will fall and farmers in the countries from which it is exported will lose their jobs. Or they will export the goods to other countries, which means south holland will face new competition in the trading markets as big agricultural exporters. We cannot give a convincing answer to such a question in limited time.

We can only make a good assumption that south Holland will take the lead in breaking the linear system caused by globalization and moving to a more localized food production and consumption strategy. Assumptions are the bridge between research and design, and I think making reasonable assumptions is the role of planners. The vision is based on a survey of interdisciplinary knowledge, setting aside an infinite number of questions at the right moment, and then setting out a scenario that is most likely to happen in the future. It represents a decision about the values we recognize. Even if we can't answer all the questions, planners should seize the opportunity to improve the city rather than compromise with the reality.

Vision and strategy are almost synchronous in our work. If the vision is not linked to the change of urban space, it will always be a slogan. Mapping helped us find the urban space we needed to change. By introducing conditions such as climate change, flood risk, ecological conservation, and urbanization to help us identify areas with the potential for change that are the edges of cities. Vision has always served as a beacon for us to reflect on whether we are on the path to vision. Meanwhile, we introduced the Dynamic adaptive path way in the project to deal with the uncertainty in the future. We cannot act as stakeholders and make decisions for them. Planners have no right to do so. But we can work out ways to coordinate the interests of all parties. I think DAPP has advantages from both top-down and bottom-up approach. He made sure everyone was moving towards the same goal, while offering multiple paths to allow for discussion among different stakeholders.It has the flexibility to respond to changes in the future.

To conclude, I think we made a good work. It defines a framework for development, despite its long time span and the lack of proof in some areas. we recognized the shortcomings of the status and proposed a better alternative model, while remaining adaptable enough to cope with future uncertainties and constantly renew it.

Monique Vashti

"The problem is that we do not know how the future will unfold. Despite this uncertainty decisions need to be taken, because impacts may be significant and the implementation of policies takes time." (Haasnoot et al., 2013).

For the past two months, together with my colleague, I have dedicated my time and commitment in imagining the possible and desirable future and build the suitable vision and strategy planning for just and equitable Zuid-Holland. Now that it has come to an end, it just occurred to me how how crucial uncertainty is in the role of long-term regional planning.

This uncertainty leads to many puzzled questions that needs to be put together to get the bigger picture. Similar like working on a puzzle, what seems to be the "right piece (or answer)" might turn out to be the opposite. Just as such, the relationship process between research and design requires a challenging back and forth process. While it may look tiring, it certainly is one worth taking.

The deep thought of uncertainty has lead us in building a vision that is radical for Zuid-Holland, one would say. Though in moving towards the radical future, we propose multiple approach with robust and subtle options of choices and path in the strategy plan, which is the Dynamic Adaptive Policy Pathways (DAPP). Isn't it interesting... To achieve a strong vision or goal, one does not necessarily require a direct approach. This is the balance I would argue essential for urbanists when producing a strategy plan — not to mention in life, too.

I realized that working and understanding the DAPP strategy is intriguing, difficult and betimes challenging. Evaluating the DAPP, I believe that this is the just way that the region has to take in achieving our proposal, Living Edges. However, it is debatable because I would like to critically said that justice in planning is never definite (insert source). Therefore, in trying to mitigate the loss, we deep further into the governance aspect. Through the interscalar stakeholder engagement strategy and phasing, an inclusive build-up community planning is established.

Considering the circular economy and spatial justice, I believe these two elements are strongly connected. In Living Edges, shifting toward circular economy through food sector means that it will disrupt the current ownership and profit, which will then affect not only spatial, but also social aspects. Therefore from this project, I understand that these two elements have a tight connection which is very important to consider for future of urban planning.

To conclude, I would like to reflect this project — Living Edges — to the beginning part of this reflection, which is the future uncertainty. Through Living Edges, we offer strategy and system that could be adapted when facing future's problem. However, as Innes and Booher (2010) state, the system of cities might take a new shape, but it remains living and evolving.

The Living Edges project made me realize that even though we could create a system that is resilient and ensuring, there will always be a bigger factor that any urban planner could overlook. Accordingly, the ability to be adaptive is very much needed, as our dynamic and unpredictable futures are constantly placed on the edge.

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APPENDIX

CALCULATION OF CITY EDGES CAPACITY

	Turn-over	Initial costs	Yearly costs		
		V			
	(€/ha/year)	(€/ha)	(€/ha/year)	what	(€
Open Land Farming (mono-culture)					
Potatoes	€ 7.300	€ -	€ 3.415	Input, labor, mec	€
Strawberries	€ 38.285	€ -	€ 35.562	Input, labor, mec	€
Maize	€ 4.200	€ -	€ 3.292	Input, labor, mec	€
Grassland - cow livestock	€ 7.969	€ -	€ 7.124	Lobor, input	€
Greenhouses					
Vegetables and fruits	€ 567.000		€ 494.000	Energy, labor, inp	€
Circular Farming Typologies					
Intercropping (=adapting by diversifying)	€ 9.125	no extra costs	€ 3.415	Input, labor, mec	€
Urban farming (big farm of 1 ha)	€ 81.900	unknown	€ 80.000	Labor	€
Community farm (herenboeren)	€ 7.800	€ 10.000	€ 3.000	Labor	€
Permaculture forest (mature after 20 yea	€ 15.794	€ 30.000	€ 9.480	Labor	€
Farming with Water					
Sea weed farming (long-lines)	€ 1.515	€ 25.000	€ 1.025	labor, transport,	€
Aquaculture (fish)	€ 30.000	unknown	€ 26.600	labor, transport,	€

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Profit			Pays-off after:	Netto Primary Production (tonnes)	Economic efficiency factor (compared to traditional agriculture)	Theoretical amount of people fed (if 1 person spends €25/week) € 1.300,00	(assume 5 people/tonne)
/ha/year)	(€/km2/year)		(years)	(tonnes/ha)		(people/km2)	(people/ha)
3.885	€	388.500		30	1,0	299	105
2.723	€	272.300			0,7	209	-
908	€	90.800			0,2	70	-
845	€	84.483		17	2,1	65	60
73.000	€	7.300.000		338	18,8	5.615	1.184
4.856	€	485.625	immediately	35	1,3	374	123
1.900	€	190.000	unfeasible	18	0,5	60	63
4.800	€	480.000	7 years	37	1,2	369	130
6.300	€	630.000	20 years	60	2,0	485	210
490	€	49.000	10 years	50	0,1	38	175
3.400	€	340.000	unknown	17	0,9	262	61

EXISTING

No	LANDUSE			PRODUCTIVITY			
				Residential		Agricultural	
	Land-use	Type	Total area (km2)	Productivity (people/km2)	Total production (people)	Productivity (€/km2)	Total production (€)
1	**Agriculture**	Openland farm	13,6			€ 388.500	€ 5.268.060
		Community farming				€ 480.000	€ -
		Agroforestry				€ 630.000	€ -
		Urban farming				€ 190.000	€ -
		Productive Wetlands				€ 340.000	€ -
2	**Urban**	all residential in spijk	12,6	5.744	72.545		
		-in the city center	8,9	6.605	58.788		
		-inside edges	2,2	4.710	10.268		
		-outside edges	1,6	2.251	3.489		
3	**Green**	Recreational (park, f	2,9	-	-		(b
		Agri-green					
4	**Industrial**		1,4	-	-		
	TOTAL		43,1		72.545		€ 5.268.060
	DIFFERENCE						

	Area (km2)	Productivity		Area (km2)	Productivity		
Agriculture	13,6	€	5.268.060	10,4	€	5.079.070	(€)
Urbanisation	12,6		72.545	12,7		88.804	(people)
Nature	2,9		low	12,3		high	(well connected and diverse)

LIVING EDGES

	Agriculture					Urbanisation			Nature
	Area (km2)		Productivity (€/km2)		Total production (€)	Area (km2)	Productivity (people/km2)	Total production (people)	Area
0	-	€	388.500	€	-				
	3,2	€	480.000	€	1.550.688				
	4,3	€	630.000	€	2.690.982				
	0,9	€	190.000	€	171.000				
	2,0	€	340.000	€	666.400				
						8,9	7.266	64.667	
						2,2	9.420	20.535	
						1,6	2.251	3.601	
ecomes productive wetland)									6,1
									6,2
(farming, residential mix)									
0	10,4			€	5.079.070	13		88.804	12
	-3,2			€	-188.990			16.259	9,5

	EXISTING LAND-USE							Type of Agriculture (CBS, 2016)														
	Total Area (CBS, 2017)		Residential (CBS, 2017)			Agriculture (LISA, 2020)		Glasshouses						Open land farming						Grass		
	Area (ha)	(%)	Inhabitants (people)	Household size (ppl/home)	Relative to total (%)	Employees (jobs)	Relative to total (%)	Space used (ha)	Relative to total area in PZH (%)	Turnover (€/year)	Costs (€/year)	Profits (€/year)	Space used (ha)	Relative to total area in PZH (%)	Turnover (€/year)	Costs (€/year)	Profits (€/year)	Space used (ha)	Relative to total area in PZH (%)	Turr (€/year)
Total Province Zuid-Holland	340.300	100%	3.682.680	2,2	100%	35.965	100%	4.800	1,4%	2.721.600.000	2.371.200.000	350.400.000	**49.400**	15%	€ 360.620.000	€ 168.701.000	**€ 191.919.000**	**73.200,0**	22%	€ 583.
Agricultural land (CBS, 2012)	163.344	48%	379.170	3,1	10%	28.635	80%	3.822	1,1%	2.166.912.721	1.887.927.485	278.985.236	39.332	12%	€ 287.122.305	€ 134.318.174	€ 152.804.131	58.281,2	17%	€ 464.
Urbanised area (CBS, 2011)	112.191	33%	3.303.510	2,1	90%	7.330	20%	978	0,3%	554.687.279	483.272.515	71.414.764	10.068	3%	€ 73.497.695	€ 34.382.826	€ 39.114.869	14.918,8	4%	€ 118.
- City Edges	59.318	53%	991.053	2,9	27%	6.964	19%	929	0,3%	526.952.915	459.108.889	67.844.026	9.565	3%	€ 69.822.810	€ 32.663.685	€ 37.159.126	14.172,9	4%	€ 112.
- Inner city	52.873	47%	2.074.366	1,8	63%	348	1%	49	0,0%	27.734.364	24.163.626	3.570.738	503	0%	€ 3.674.885	€ 1.719.141	€ 1.955.743	745,9	0%	€ 5.
Other	64.765	19%		*unknown*		*unknown*														

Productivity per Agricultural Production Type

Traditional Farming Typologies									
Open Land Farming (mono-culture)	49.400	€ 191.919.000	€ 3.885	-					
Grassland - cow livestock	73.200	€ 61.841.379	€ 845	-					
Greenhouses	4.800	€ 350.400.000	€ 73.000	4.800	€	350.400.000	€	73.000	(keeping the Westland)
Circular Farming Typologies									
Intercropping (=adapting by diversifying)	-		10%	7.320	€	35.547.750	€	4.856	(using 10% of grassland)
Urban farming (big farm of 1 ha)	-		8%	5.932	€	11.270.420	€	1.900	(using underused greenspaces in
Community farm (herenboeren)	-		10%	7.320	€	35.136.000	€	4.800	(using 10% of grassland)
Permaculture forest (mature after 20 years)	-		43%	30.650	€	193.095.000	€	6.300	(using 25% of existing grassland a
Sea weed farming (long-lines)	-		4%	3000	€	1.470.000	€	490	(in salt water bodies along the co
Aquaculture (fish)	-		17%	12.350	€	6.051.500	€	490	(using 25% of existing open land
TOTAL TRADITIONAL	**127.400**	**€ 604.160.379**	€ 4.742						
TOTAL CIRCULAR				**71.372**	**€**	**632.970.670**	€	8.869	*Nota bene: based on rough estimate*

	% of existing agri land needed	% of edge area used for food production	increase in efficiency of farming	space (ha) available for spatial pressures
CONCLUSION	45%	10%	187%	73.902

	%
	der
CONCLUSION	

								Agricultural Productivity						Residential						
								EXISTING			FUTURE - LIVING EDGES			EXISTING		FUTURE - LIVING EDGES (van der Ploeg, 2018)				
land (livestock)			Other																	
nover	Costs (€/year)	Profits (€/year)	Space used (ha)	Relative to total area in PZH (%)	Turnover (€/year)	Costs (€/year)	Profits (€/year)	Area (ha)	Profits (€/year)	Average Agricultural Efficiency (€/ha)	future area (ha)	Profits (€/year)	Average Agricultural Efficiency (€/year)	Total homes (homes)	Average Housing Efficiency (homes/ha)	percentage vision (%)	Difference in amount of homes added (homes)	New Total Homes (homes)	New Average Housing Efficiency (homes/ha)	
328.276	€ 521.486.897	€ 61.841.379						127.400	€ 604.160.379	€ 1.775	71.372	€ 632.970.670	€ 1.860	1.673.945	4,9	109%	150.000	1.823.945	5,4	**Total Province Zuid-Holland**
440.572	€ 415.203.039	€ 49.237.534						101.435	€ 481.026.900	€ 2.945	45.892	€ 620.230.250	€ 3.797	123.458	0,8	100%	-	123.458	0,8	Agricultural land (CBS, 2012)
887.704	€ 106.283.858	€ 12.603.846						25.965	€ 123.133.479	€ 1.098	28.562	€ 12.740.420	€ 114	1.573.100	14,0	110%	150.000	1.723.100	15,4	Urbanised area (CBS, 2011)
943.318	€ 100.969.665	€ 11.973.653						24.667	€ 116.976.805	€ 1.972	27.134	€ 128.674.486	€ 2.169	341.742	5,8	192%	138.000	656.145	11,1	- City Edges
944.385	€ 5.314.193	€ 630.192						1.298	€ 6.156.674	€ 116	1.428	€ 6.772.341	€ 128	1.152.425	21,8	108%	11.040	1.244.619	23,5	- Inner city

Productivity per Agricultural Production Type

Traditional Farming Typologies								
Open Land Farming (mono-culture)	49.400	€ 191.919.000	€ 3.885	-			39%	
Grassland - cow livestock	73.200	€ 61.841.379	€ 845	-			57%	
Greenhouses	4.800	€ 350.400.000	€ 73.000	4.800	€ 350.400.000	€ 73.000	(keeping the Westland)	4%
Circular Farming Typologies								
Intercropping (=adapting by diversifying)	-		10%	7.320	€ 35.547.750	€ 4.856	(using 10% of grassland)	
Urban farming (big farm of 1 ha)	-		8%	5.932	€ 11.270.420	€ 1.900	(using underused greenspaces in city edges	
Community farm (herenboeren)	-		10%	7.320	€ 35.136.000	€ 4.800	(using 10% of grassland)	
Permaculture forest (mature after 20 years)	-		43%	30.650	€ 193.095.000	€ 6.300	(using 25% of existing grassland and 25% of existing open farmland)	
Sea weed farming (long-lines)	-		4%	3000	€ 1.470.000	€ 490	(in salt water bodies along the coastline)	
Aquaculture (fish)	-		17%	12.350	€ 6.051.500	€ 490	(using 25% of existing open land farms)	
TOTAL TRADITIONAL	**127.400**	**€ 604.160.379**	€ 4.742					
TOTAL CIRCULAR				**71.372**	**€ 632.970.670**	€ 8.869	*Nota bene: based on rough estimates*	

	% of existing agri land needed	% of edge area used for food production	increase in efficiency of farming	space (ha) available for spatial pressures
CONCLUSION	45%	10%	187%	73.902

	% of total homes needed for densification in edge	homes/ha needed in edge
CONCLUSION	92%	5

39%
57%
4%

city edges

and 25% of existing open farmland)
oastline)
farms)

es

% of total homes needed for densification in edge	homes/ha needed in edge
92%	5