

THE FUTURE OF AGRICULTURE BY USING GREEN-BLUE INFRASTRUCTURE

A new frontier in Lelystad rural area

Pleun te Braake
MSc Landscape Architecture
Flowscapes 2023-2024
TU Delft



THE FUTURE OF AGRICULTURE BY USING GREEN-BLUE INFRASTRUCTURE

A new frontier in Lelystad rural area

First mentor:

Dr.ir. N.M.J.D. (Nico) Tillie

Second mentor:

Dr.ir. R.M. (Remon) Rooij

Author:

Pleun te Braake

4994558

Urban Ecology & Ecocities Studio
MSc Landscape Architecture
Faculty of Architecture
Delft University of Technology
Delft, The Netherlands

Abstract

The primary focus of this thesis is the agricultural sector and its sustainability in the rural region surrounding Lelystad, located in Oostelijk Flevoland. The research highlights the importance of maintaining healthy biodiversity in agricultural environments, which can help mitigate negative impacts from factors such as pests, climate change, and pollution. The specific area of interest faces numerous challenges such as climate change, groundwater salinization, drought, and a lack of agroecology and ecology. These challenges are a result of a landscape with distinct agricultural and natural areas. The objective of this research is to develop an integrated approach for a nature-inclusive and future-proof agricultural sector, based on the Farm of the Future area in Lelystad. The tools developed during this research can be implemented in other regions with a focus on connecting farmers and citizens for an integrated landscape.

The central research question of this thesis is: ***‘Which landscape architectural strategies could be used to increase the effectiveness of ecological infrastructure in rural areas to connect landscapes, promote functional agrobiodiversity, and restore biodiversity?’*** The research methods used include data collection, literature review, site visits, a design case study, and interviews. The thesis emphasizes three main themes: nature, water, and the connection between farmers and citizens. The proposed strategies include strengthening the green network, promoting nature-inclusive agriculture, and water retention. However, the specific challenges and opportunities of the Lelystad area require tailored solutions, and the proposed strategies are not directly transferable to other areas. Further feasibility studies and analysis are necessary, along with research into revenue models for farmers who switch to nature-inclusive agriculture.

By integrating these landscape architectural strategies, a rural landscape can be created that not only enhances agricultural biodiversity but also addresses climate issues and restores the relationship between farmers and citizens. This will result in a future-proof agricultural landscape that can sustainably support the needs of the community.

keywords:

transition, agricultural landscape, green-blue infrastructure, agroecology, connecting landscapes

Preface

I have a deep connection to the northeast region of Groningen where my roots are, and while I currently reside in the west of the Netherlands, I often yearn for the simple farming life. My passion for agriculture has driven my interest in this subject, and I hope to bring together my practical experience and my expertise in landscape architecture. It is disheartening to see the agricultural sector being criticized, but I believe that we can create a sustainable future perspective through policy and guidance by working together. The Netherlands has a crucial and beautiful agricultural landscape, and we must recognize that. Let's put the agricultural sector in a positive light again by being more nature-inclusive and creating a better future for all.

To follow my heart and create this vision, I would like to express my gratitude to my first mentor, Dr. Ir. Nico Tillie, and my second mentor, Dr. Ir. Remon Rooij, for their valuable guidance and support throughout this project. I would also like to extend my thanks to the Boerderij van de Toekomst organization for their cooperation, and especially to Maria-Franca Dekkers for her outstanding collaboration.

I hope you enjoy reading this report!

Pleun te Braake

Structure

table of contents

Part 1: Introduction

Glossary	8	Chapter 6: Designing	89
		Farm of the Future 2050	90
Chapter 1: Introducing	11	Green network	92
Biography	12	Agriculture & agroecology	96
Context	14	Water plan & agriculture	104
Fascination	20	Connection farmer & citizen	110
		Phasing	114
Chapter 2: Defining	23	Impressions	122
Problem statement	24		
Research definition	30	Chapter 7: Concluding	127
Research approach	32	Main findings	128
Methodology	40	Phasing Oostelijk Flevoland	130
		Vision Oostelijk Flevoland	132
		Recommendations for the provinces	136
Part 2: Research Design			
Chapter 3: Site Spatializing	43		
Low dynamic layers	44	Chapter 8: Reflecting	139
High dynamic layers	50		
Conclusions	52		
Chapter 4: Approaching	57	References	144
Threats & challenges	58	Appendix	149
Strenght and potentials	62		
Opportunities	64		
Stakeholder perspective	66		
Chapter 5: Exploring	73		
Design assignment	74		
Vision Oostelijk Flevoland	76		

Glossary

agroforestry: Agroforestry is a sustainable land management approach that integrates trees or shrubs with agricultural crops and/or livestock to enhance ecological resilience, biodiversity, and socioeconomic benefits on the same piece of land.

biodiversity: The variety of living organisms and ecosystems within a specific area, including genetic diversity, species diversity, and ecosystem diversity.

buffer strips: Grasses, herbs, flowers or other plants, planted alongside water bodies or between different land uses to attract biodiversity and to mitigate the impacts of runoff, erosion, and chemical leaching.

connectivity landscape: The spatial organization and connectivity of habitats and green networks, which influence the movement and gene flow of organisms in a landscape.

high dynamic: a situation or system characterized by rapid changes, variability, or complexity, often requiring adaptive responses or flexible strategies to navigate effectively.

land-sharing: An approach to conservation that integrates agricultural activities with biodiversity conservation by maintaining habitat heterogeneity across landscapes to support both agricultural production and wildlife.

land-sparing: An approach to conservation that involves separating areas for intensive agricultural production from areas designated for biodiversity conservation, aiming to maximize agricultural yield while minimizing habitat destruction and biodiversity loss.

low dynamic: A situation or system characterized by stability, predictability, or low variability, where changes occur at a slower pace and may require less immediate adaptation or response.

natural landscape elements: Natural elements in the landscape include features such as geological formations, water bodies, vegetation types, and other physical aspects shaped by natural processes. These elements play a crucial role in shaping ecosystems and providing habitats for various species.

paludiculture: A form of wetland agriculture in which crops or other biomass are grown in wetlands, such as peatlands or swamps, with the aim of sustainable land use, carbon sequestration and nature inclusivity.

salinization: The process by which salt accumulates in soil, typically due to irrigation practices or natural factors, leading to decreased soil fertility and reduced agricultural productivity.

strip cultivation: Different crops are grown in adjacent narrow strips of land, each 3 meters wide or a multiple thereof, such as 6, 12, or 24 meters, with only one crop per strip.

Part 1

Chapter 1

Introducing

Context
Fascination

Introducing

Phase 1 • Phase 2
Nature Dominated • Revolutionary Ideas

The Zuiderzee was nature dominated.

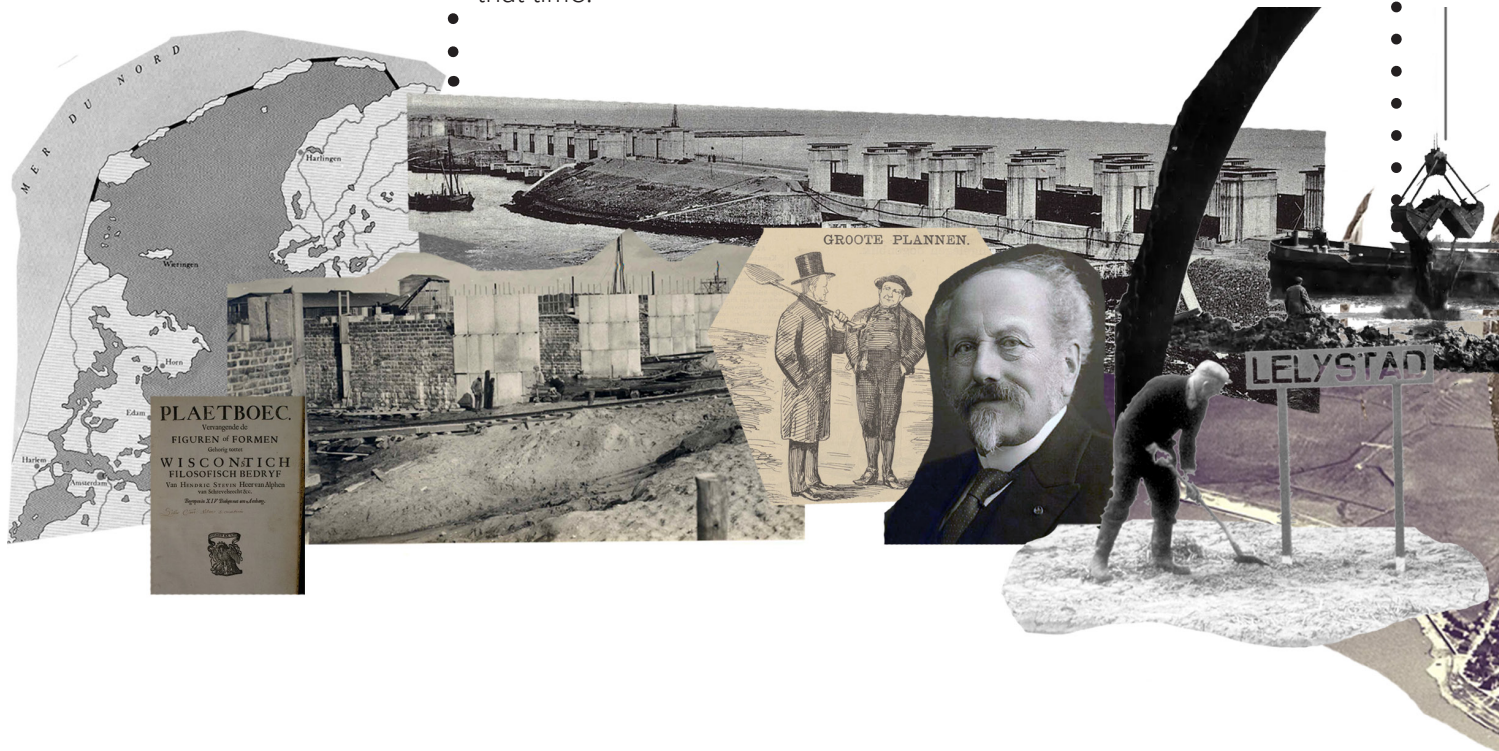
Hydraulic engineer Hendrik
Stevin had ideas on taming the
Zuiderzee

Phase 2 Revolutionary Ideas

The Zuiderzee Association played an important role in the reclamation ideas from Cornelis Lely and other engineers who devised plans to enclose and drain the Zuiderzee. However, there was no funding available for such a massive project at that time.

Phase3 Reclamation

During World War I, food shortage in the Netherlands and flooding around the Zuiderzee led to the Zuiderzee Act. The government decided to drain and close off the Zuiderzee for safety reasons.



- **Phase 4**
- **New Land**

- The province of Flevoland was to be created on 1 January 1988. According to the act of the Parliament from 27 June 1985.
- The orderliness of the landscape is attributed to the De Stijl art movement.

- **Phase 5**
- **Polder pioneers**

- A new society would be built with the motto 'new country, new spirit'. The government itself chose the people who wanted to move to the new polders.
- After the 1970s, this period was over. The idea that the government should determine where people could live was seen as old-fashioned and interfering.

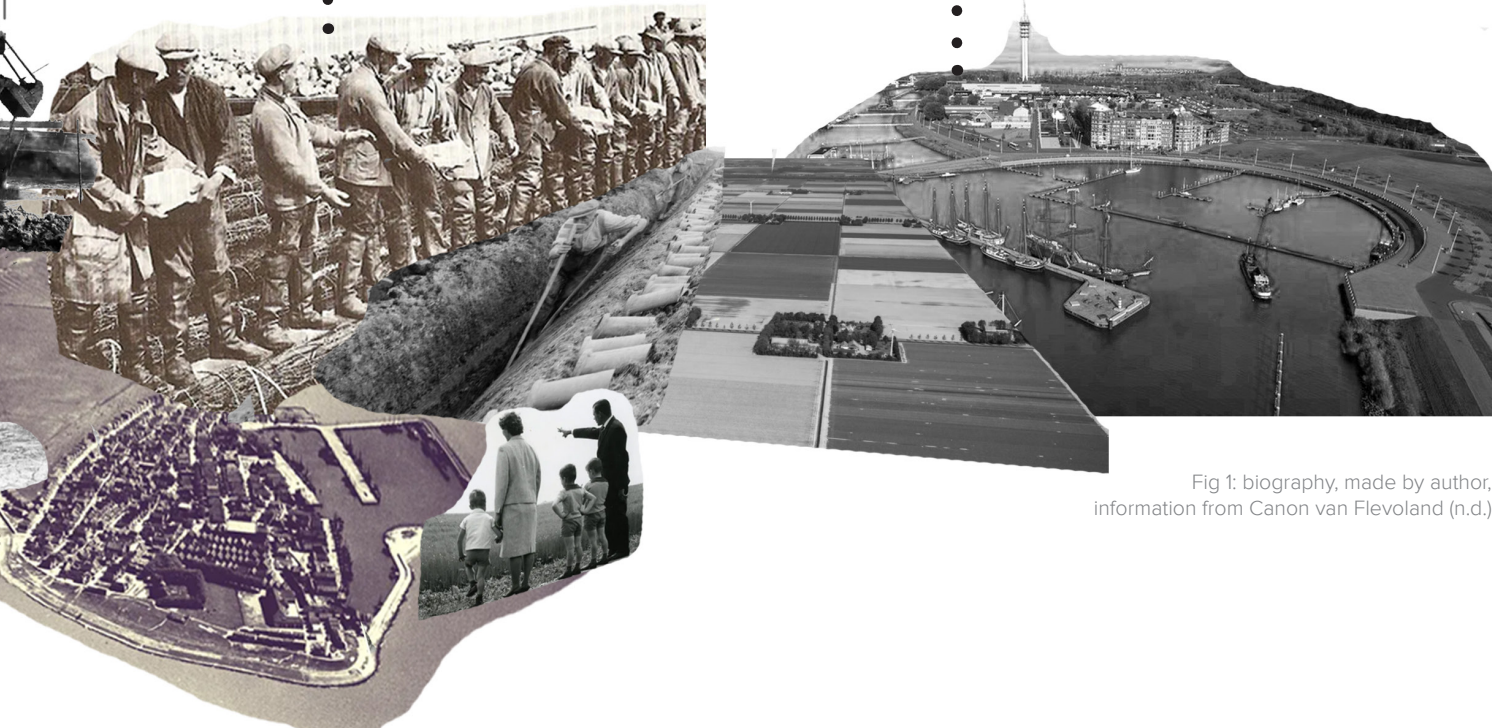


Fig 1: biography, made by author, information from Canon van Flevoland (n.d.)

Introducing context

Flevoland is the youngest and smallest province in the Netherlands. The province consists of the Noordoostpolder and the Flevopolder, both of which were created by the reclamation of parts of the former Zuiderzee. There are three polders, The Noordoostpolder in the North, followed by Oostelijk Flevoland, and in the south Zuidelijk Flevoland.

The Veluwe is located to the east of Flevoland and the west of Flevoland is bordered by the Markermeer with the IJsselmeer in the northwest of it.

The province consists of two parts: the Noordoostpolder, reclaimed to the mainland, and the Flevopolder, the largest artificial island in the world. The Flevopolder is connected to the mainland by bridges (including Stichtse Brug, Hollandse Brug

and Ketelbrug), a railway tunnel (Drontermeertunnel) and a dike (Houtribdijk). The province is on average about 5 meters below sea level.

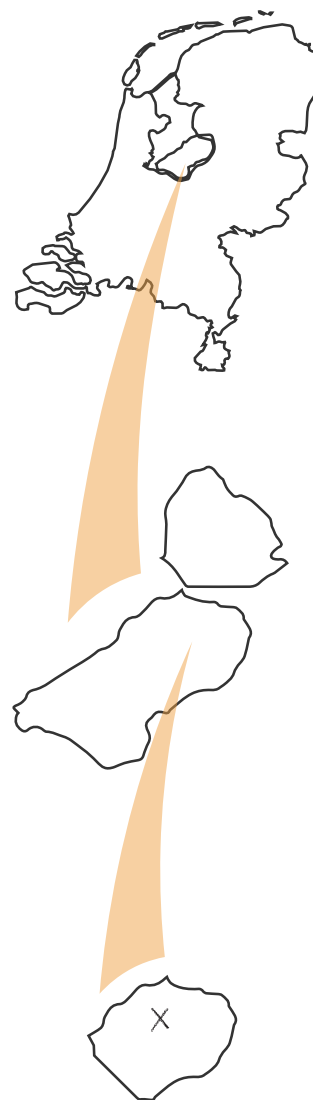
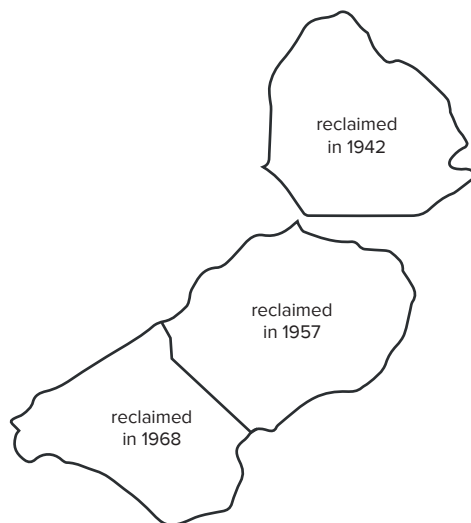


Fig 2: Flevoland, made by author

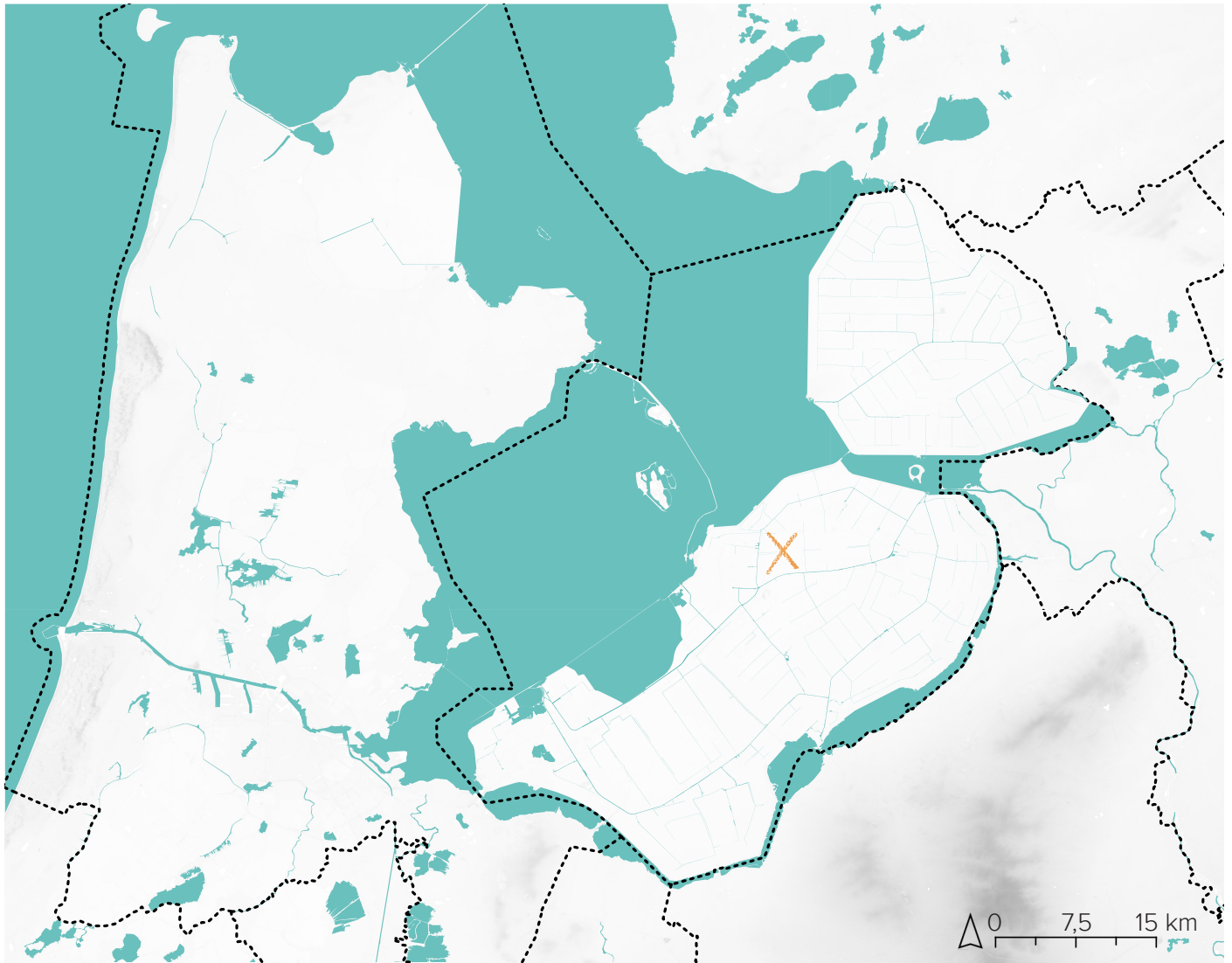


Fig 3: Flevoland. Made by author, data from QGIS

Introducing context

Flevoland is characterized by the open, structured rectangular layout. This division makes the landscape very functional, especially for agriculture.

During the creation of this man-made landscape, the separation of natural systems and agricultural systems was implemented to preserve land. This separation is referred to as the land-sparing principle. This principle was adopted because people were concerned about the impact of natural systems on agricultural production. As a result, a clear boundary was established between agriculture and nature.

One can find this separation in the Flevoland landscape: Flevoland boasts 22,302 hectares of forests, nature reserves, and landscapes, accounting for roughly 9% of

the province's total area, as reported by the Central Bureau for Statistics (2017). The larger nature reserves in Flevoland are typically situated on the outskirts of the province, while the land in between is

predominantly devoted to agriculture. The nature that occupies the spaces between these reserves is characterized by farmyard plants and orderly rows of trees lining the main thoroughfares.



Fig 4: Land sparing principle, made by author



Fig 5: Oostelijk Flevoland, photo by Han Reindsen

Introducing context



Farm of the Future (BvdT)

Farm of the Future is an organisation which does a lot of research about the future of farming, for example research about mechanisation, agro-biodiversity, circular agriculture, green energy, technology and much more.

This organization consists of Wageningen University, the province of Flevoland and the Ministry of Agriculture, Nature and Food Quality.

The Farm of the Future's central mission is to contribute to the transition to circular agriculture in the Netherlands, which will take shape along two lines:

1. Demonstrate how circular agriculture can address future

challenges in agriculture through innovative practices not yet implemented in the industry within the next 5-10 years.

2. Create a facility for effective development and testing of circular agriculture innovations.

The Farm of the Future company emphasises biodiversity, circularity, and ecosystems within their operations. However, it seems that there is a missing link between the company's efforts at the operational level and the bigger picture. This gap in the company's vision for the future of farming needs to be addressed.

Bridging the gap between the company and the larger scale is crucial to enhance the ecology and biodiversity of the entire environment.



Fig 6: Flevoland, location BvdT, made by author



Fig 7: Kavelkaart, by the Province of Flevoland



Ministerie van Landbouw,
Natuur en Voedselkwaliteit



WAGENINGEN
UNIVERSITY & RESEARCH



PROVINCIE
FLEVOLAND

Introducing

Fascination

Reclaimed

The province of Flevoland is unique because it was entirely reclaimed from the sea by the Dutch. Reclaiming the land was done by pumping out water. This is reflected in its rectangular structure. Flevoland's functionality, setting it apart from other Dutch provinces.

In 1891, Cornelis Lely proposed a plan to close and reclaim the Zuiderzee, but lack of funds prevented its implementation. Due to the First World War and the flood disaster of 1918, plans were reconsidered and funds became available for the project. In this way Flevoland ensures increased food production and protection against the sea (Canon van Flevoland, n.d.).



Fig 8: Pumping station De Voorst.
Photo by Directie van de Wieringermeer, 1947 via <https://www.hetflevolandsarchief.nl>

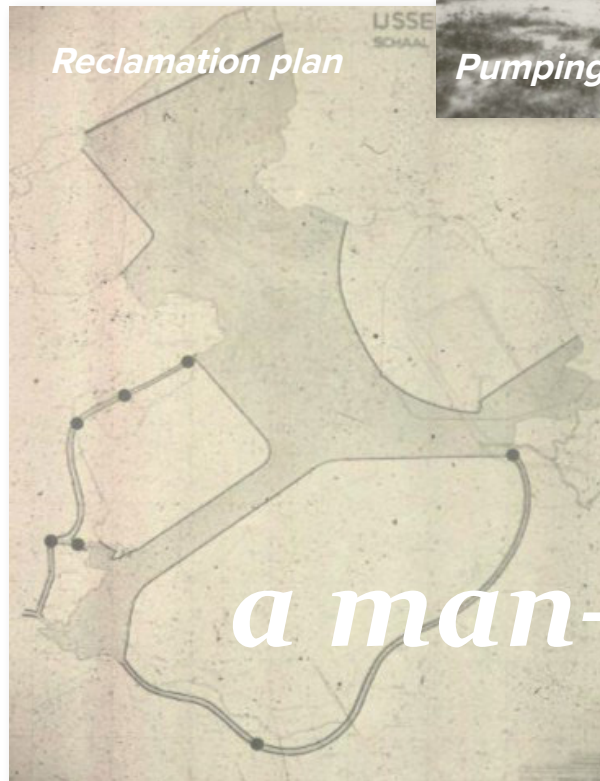


Fig 9: One of the reclamation plans for the Zuiderzee. Photo by Directie van de Wieringermeer, 1954, via <https://www.hetflevolandsarchief.nl>.

Agriculture

Due to the food shortages during the wars, the province of Flevoland mainly focused on agriculture. But also because of the soil. The soil consists of sea clay, which is very fertile, making it beneficial for Flevoland to produce food.

The landscape has been divided in a way that benefits farmers. Large-scale agricultural land with straight plots and few obstacles is the norm. When designing the landscape, nature is strictly separated from agriculture. This was done because people believed that nature was a major obstacle to agricultural production.

landscape

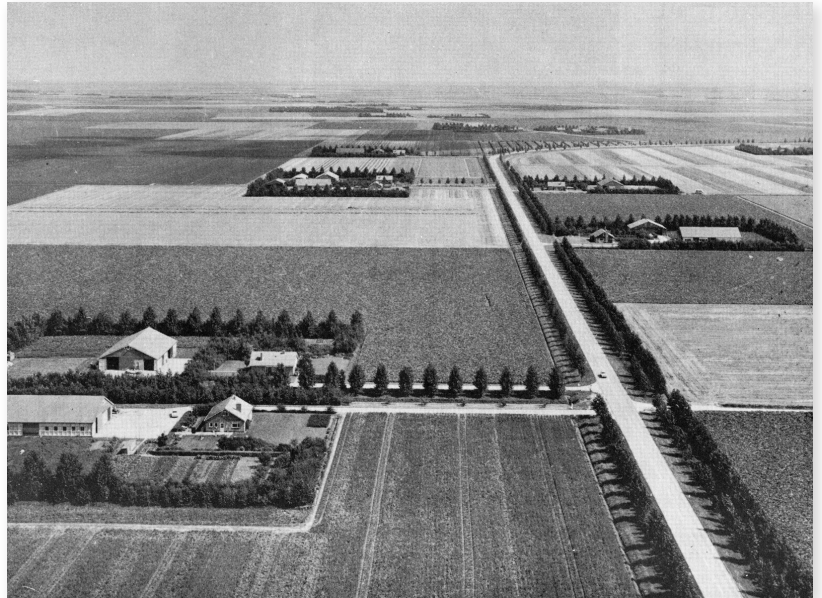


Fig 10: Farms in Flevoland from Stichting Polderpioniers (z.d.)
via www.stichtingpolderpioniers.nl/inpolderingshistorie/



Fig 11: The cultivation of man-made land by Stichting Polderpioniers (z.d.)
via www.stichtingpolderpioniers.nl/inpolderingshistorie/

Chapter 2

Defining

Problem statement
Research definition
Research approach
Methodology

Defining

problem statement

Biodiversity

Biodiversity is a term used to describe the variety of natural life. This includes everything from the genes and species of plants and animals to the complex ecosystems that exist above and below ground and in our oceans and rivers (Dawson & Norén, n.d.). Biodiversity encompasses all food webs, including flora and fauna, small animals, fungi, and microorganisms, as well as the diversity that exists in time and space. For farmers, maintaining a healthy ecosystem is essential for promoting healthy soil and ensuring the resilience of agroecosystems against climate extremes, diseases, and pests (Dawson & Norén, n.d.). Moreover, ecosystems provide vital social services such as clean air and water, climate regulation, and water, carbon, and nutrient cycle regulation (Dawson & Norén, n.d.).

Biodiversity loss

Agriculture is one of the primary causes of biodiversity decline, and it is becoming a more significant issue due to changing consumption patterns and an increasing population (Dudley & Alexander, 2017). Agriculture contributes to biodiversity destruction by converting natural habitats into intensive cultivation systems and releasing pollutants, such as greenhouse gases. The food industry's value chains exacerbate this impact by increasing energy consumption, transport, and waste (Dudley & Alexander, 2017).

In addition, in Flevoland, monoculture - the cultivation of a single crop, see figure 12 - has reduced biodiversity due to limited variation. The region's primary crops include potatoes, wheat, onions, sugar beets, and corn. The plot size in Eastern Flevoland, ranging from 30 to 45 hectares, creates a disconnect between larger habitat zones, which harms biodiversity following MacArthur and Wilson's (1963) Island Biogeography Theory.

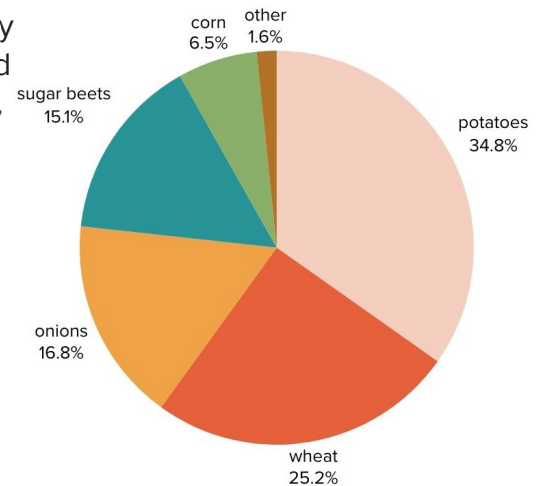


Fig 12: Crops variation Flevoland, by CBS.

Natural landscape elements

The intensification of agriculture in many Dutch provinces has led to a marked reduction in biodiversity, as natural elements have become scarcer in and around the fields (Dudley & Alexander, 2017). However, Flevoland stands out as an exception, as the agricultural system there was designed without consideration for nature, viewing it as a threat to production, following the land-sparing principle see figure 21. Consequently, the absence of features like hedgerows and hedges means that Flevoland still has ample opportunity to enhance biodiversity within its agricultural practices.

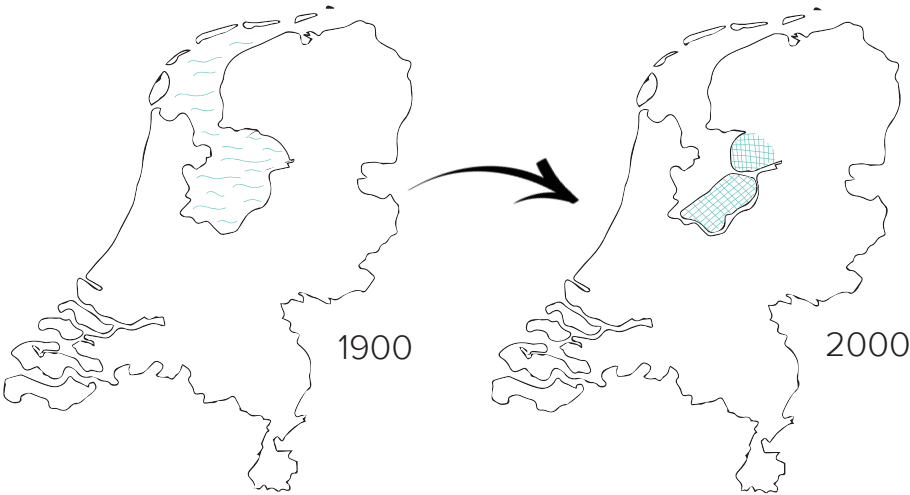


Fig 13: From sea to land, by author

Field flora

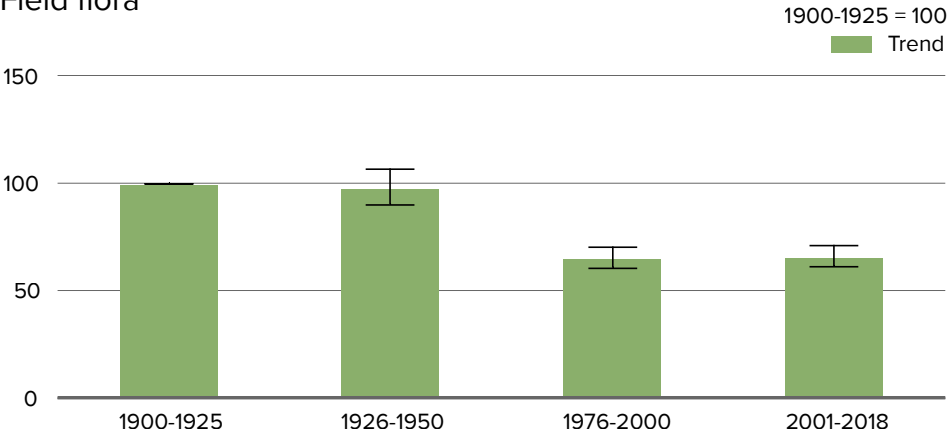


Fig 14: Decline Field flora in the Netherlands over time, by CBS.

Defining

problem statement

Salinization

In Flevoland, there is a varied distribution of groundwater. In Southern Flevoland, large freshwater reservoirs in the deep third aquifer are used for drinking water. There are also shallow freshwater reservoirs near the Randmeren.

The IJsselmeer and parts of Southern and Eastern Flevoland have predominantly brackish to moderately saline groundwater to a depth of approximately -40 meters N.A.P. At greater depths, between -40 and -60 meters N.A.P., the groundwater of the IJsselmeer is moderately saline to saline, especially around Almere (Oude Essink et al., 2008).

The distribution of chloride concentrations in the subsurface is strongly influenced by separating layers, especially in Southern

and Eastern Flevoland, which prevent salt intrusion into freshwater reservoirs. In addition, the historical absence of salinization in some areas is related to the presence of raised peat (Oude Essink et al., 2008).

Sea level rise

Due to climate change, Flevoland is facing the consequences of rising sea levels. The IJsselmeer area is a closed water system facing increased pressure due to

rising sea levels. This increase will impact the water discharge and reduce the possibility of draining to the Wadden Sea. As a result, extra pump capacity and water storage are needed. This also increases the risk of flooding as it becomes harder to pump away excess water. Furthermore, the availability of freshwater is impacted as the water from IJsselmeer is used to mitigate the increasing salt intrusion on the coast (Defacto Stedenbouw, 2021).

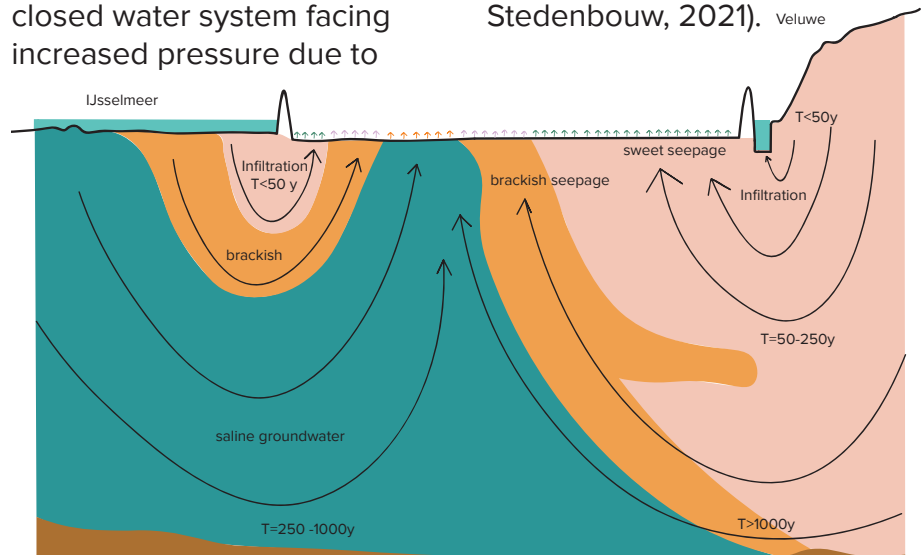


Fig 15: Seepage with saline and brackish groundwater. By author.

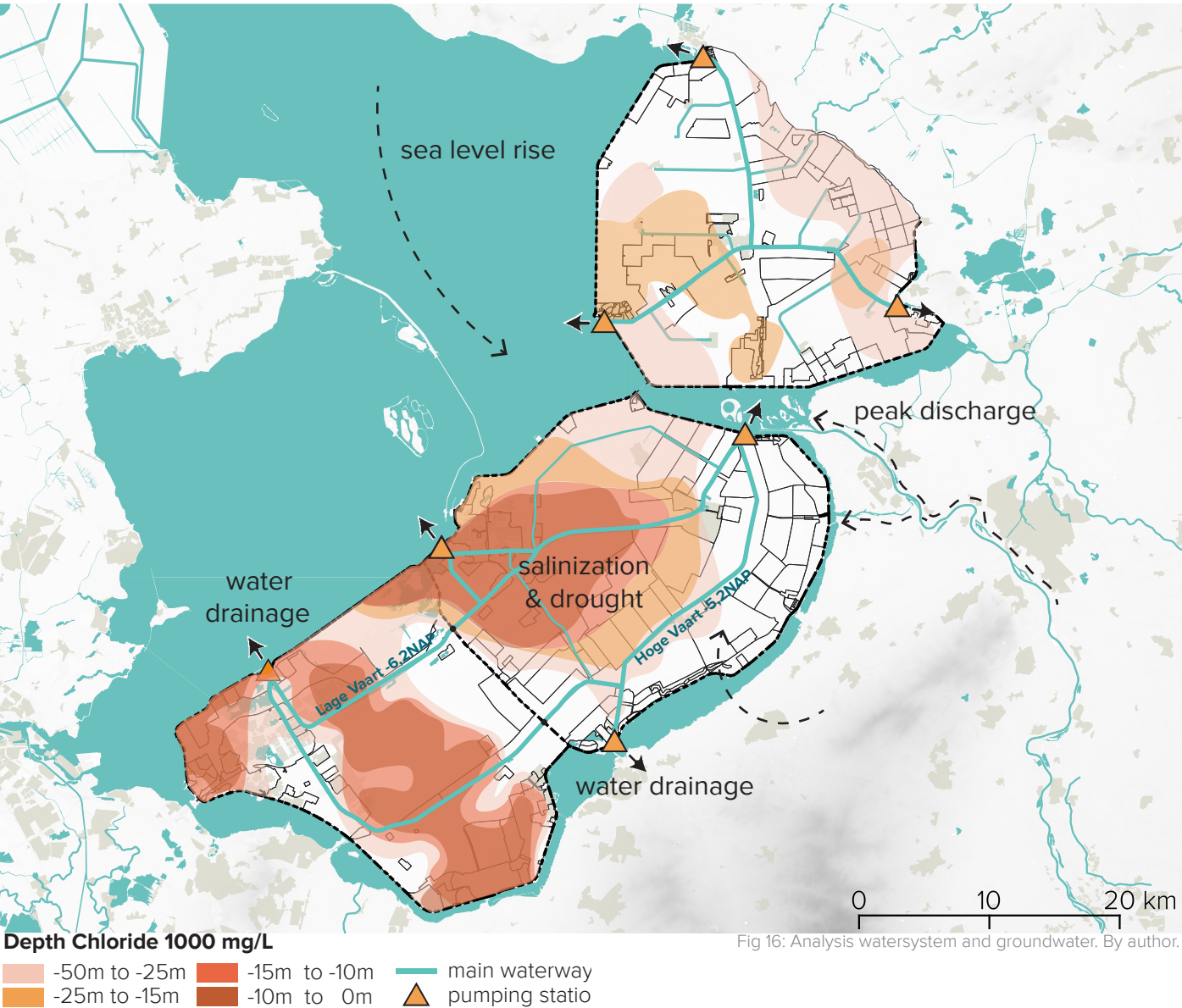


Fig 16: Analysis watersystem and groundwater. By author.

Defining

problem statement

Extreme drought

Due to climate change, Flevoland is experiencing more extreme weather, with increasing drought in the summer and heavy precipitation in the autumn and winter. Flevoland's water system pumps excess water into Randmeren or IJsselmeer.

The constant pumping of fresh water out in the winter and the use of the remaining fresh water for crops in the summer causes the saline groundwater to move upwards, this will increase the salinization.

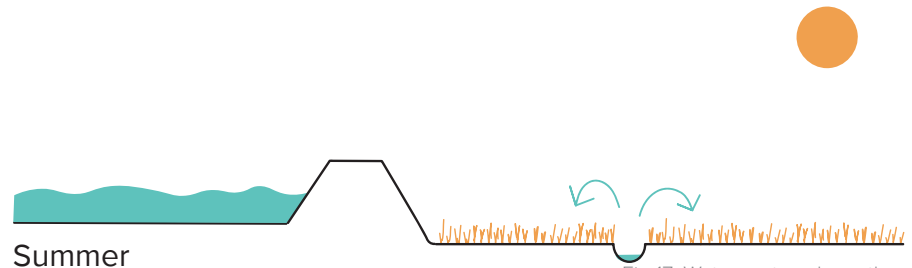
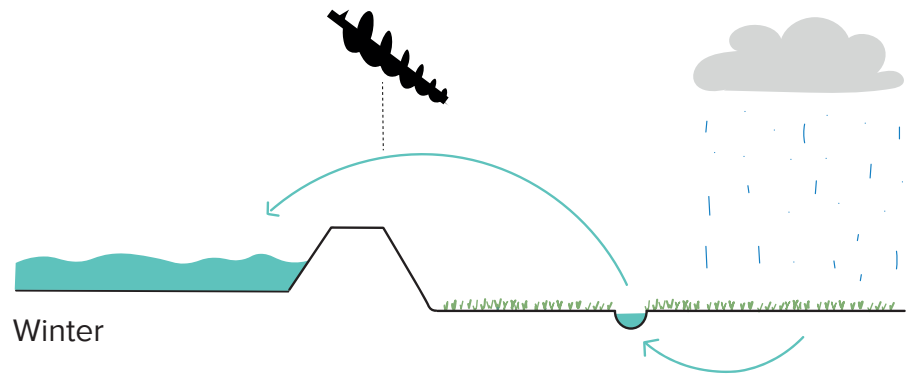


Fig 17: Water system, by author.

28

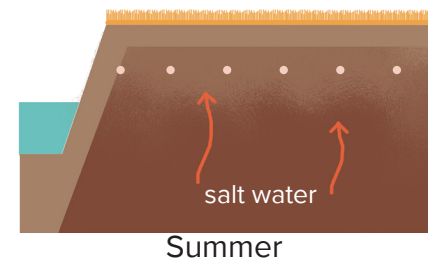
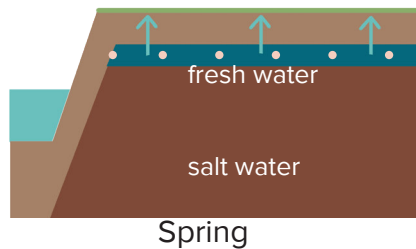
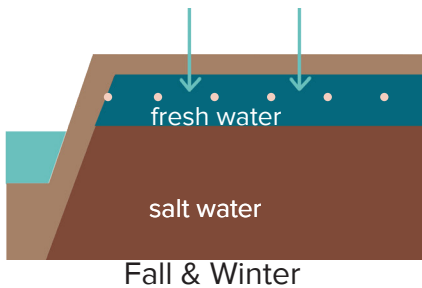


Fig 18: salinization, by author.

Waterlogging

Due to climate change, Flevoland also experiences more extreme wet periods. With the increasing frequency and intensity of extreme rainfall, water drainage becomes an increasing challenge, while at the same time retaining water for dry periods becomes more important. In addition, the limited space and soil subsidence make water distribution more difficult.

As a result of floods, farmlands are often submerged, leading to crop damage.



Fig 19: Submerged agricultural land, by author.

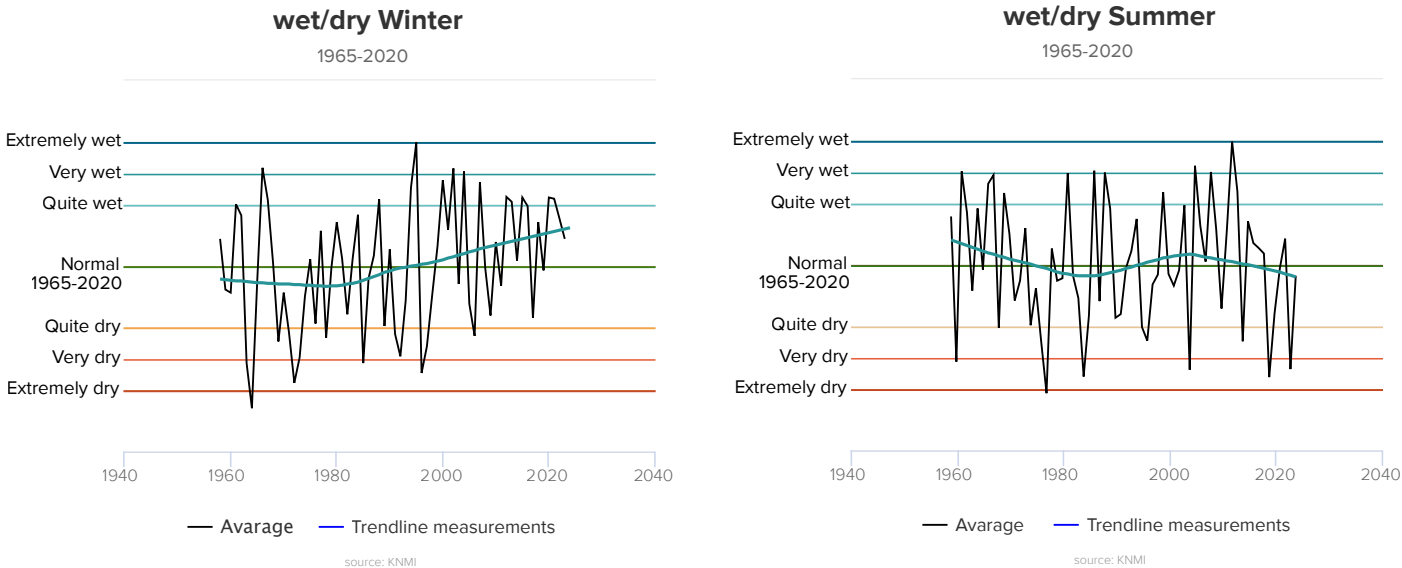


Fig 20: Climate diagrams, by author from KNMI

Defining

research definition

Research Objective and main Question

In agricultural settings, having a rich variety of plant and animal species plays a crucial role in mitigating the negative impacts caused by factors such as pests, climate change and pollution. By establishing a strong connection via the principles of land sharing or land sparing between agriculture and biodiversity, a more sustainable and productive outcome in agricultural practices can be achieved.

Which landscape architectural strategies could be used to increase the effectiveness of ecological infrastructure in rural areas to connect landscapes, promote functional agrobiodiversity, and restore biodiversity?

To adequately design this task, it is crucial to provide an objective and comprehensive view of the future of agriculture that is easily understood by everyone. Because it affects numerous stakeholders, a timeline is needed to highlight the necessary steps and their deadlines to achieve the ultimate goal of the vision.

Sub questions

1. What is the current low and high dynamic layer of the agricultural landscape in Flevoland and what are possible solutions, with a specific focus on the rural area surrounding the city of Lelystad?

1.1. What are the problems in the current landscape?

1.1.1. What are the problems in the low dynamic layer?

1.1.2. What are the problems in the high dynamic layer?

1.2. What are possible solutions for the low dynamic layer?

1.2.1. Land-sharing, land-sparing or a connectivity landscape?

1.2.2. What are possible solutions to increase the ecology and biodiversity?

1.2.3. What are possible solutions for the water problems?

1.3. What are possible solutions for the high dynamic layer?

1.3.1. What are possible solutions to improve the connection of city and country side?

1.3.2. What are possible outcomes to improve the connection between city dweller and farmer?

2. What is the vision of stakeholders of the future of agriculture in Flevoland?

2.1. What are possible design ideas according to the stakeholders?

3. What is suitable and sustainable design for the rural area around Lelystad?

3.1. What is the transition plan for this design?

Defining

theoretical background

Land-sharing/-sparing connectivity landscapes for ecosystem services and biodiversity conservation by Graß, et al. (2019)

There is an ongoing debate between land-sharing and land-sparing approaches in agriculture, focusing on the intersection of agricultural production and biodiversity conservation. The debate centers on whether low-yield, environmentally friendly agriculture over a larger land area (land-sharing) or high-yield, intensified agriculture over a smaller land area (land-sparing) is more effective in reconciling agricultural needs with biodiversity conservation (Graß, et al., 2019).

This article emphasizes that land-sharing supports species adapted to agriculture, which play a crucial role in providing

ecosystem services like pollination and pest control. On the other hand, land-sparing segregates biodiversity conservation from production, potentially limiting service provision due to disrupted species spillover.

Moreover the significance of connectivity in fragmented habitats for the survival of species is discussed. The need for both land-sharing and land-sparing strategies is emphasized to balance the management requirements of multifunctional agricultural landscapes. The authors suggest that both approaches are complementary, with land-sharing being effective for promoting ecosystem services and land-sparing being essential for conserving species that are incompatible with agriculture (Graß, et al., 2019).

The text advocates for the integration of both land-sharing and land-sparing approaches into a landscape connectivity matrix. This matrix aims to optimize spatial linkages between natural habitats and production areas to facilitate species movement.

The authors stress the importance of high connectivity for promoting spillover of ecosystem services, facilitating immigration, conserving response diversity, and ensuring resilience of ecosystem services in changing environments (Graß, et al., 2019).

Matrix:

Land-sharing

Continuum

Land-sparing

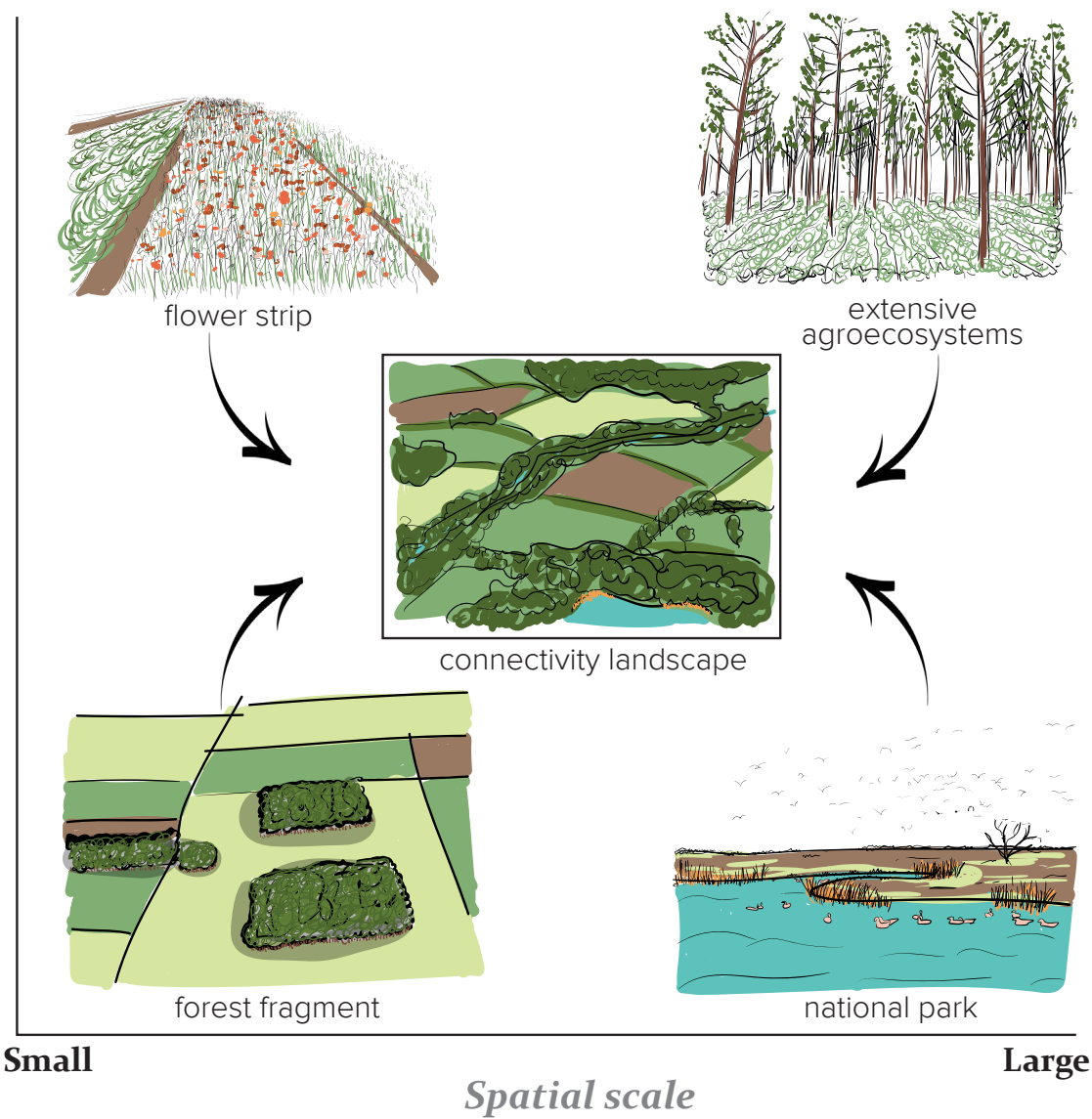


Fig 21: Land sparing & Land sharing matrix, by author from Graß, et al. (2019)

Defining

theoretical background

The Casco Concept by Kerkstra & Vrijlandt (1988)

The casco concept is a spatial strategy concept in the Netherlands that aims to design sustainable landscapes. It involves analyzing and examining areas to determine the compatibility of specific landscape qualities. The strategy focuses on balancing high and low dynamics, in other words: the rapidly changing elements such as infrastructure and the built environment, and the stable aspects such as nature and the environment (Kerkstra & Vrijlandt, 1988).

By integrating high and low dynamics, the concept attempts to create a symbiotic relationship that preserves and enriches the inherent diversity of the environment. This not only improves the overall aesthetic appeal of the

landscape but also contributes to its ecological sustainability (Kerkstra & Vrijlandt, 1988).

The casco concept balances agricultural productivity with environmental conservation in rural areas. It fosters adaptability and customization, respecting local traditions and ecological nuances. By promoting efficiency and sustainability, it envisions resilient rural landscapes that prepare for future challenges while addressing current needs (Kerkstra & Vrijlandt, 1988).

The casco concept fosters sustainable and efficient development while preserving natural elements to create vibrant landscapes through locally-aware development.

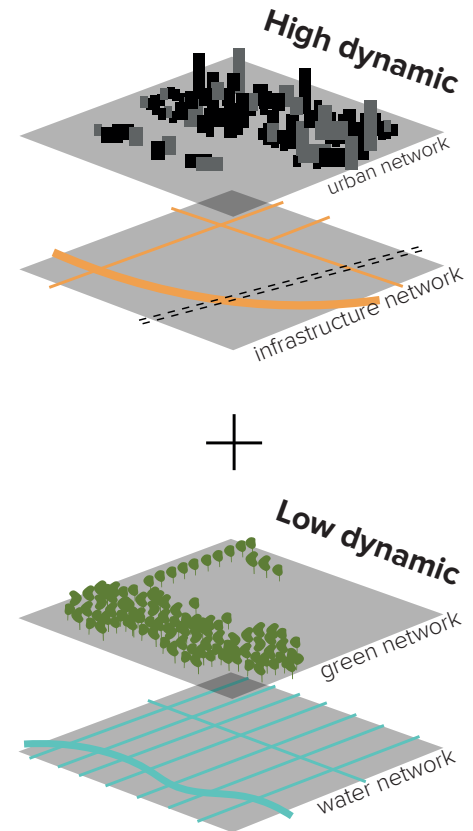


Fig 22: Low and high dynamic layers, by author from Kerkstra & Vrijlandt (1988)

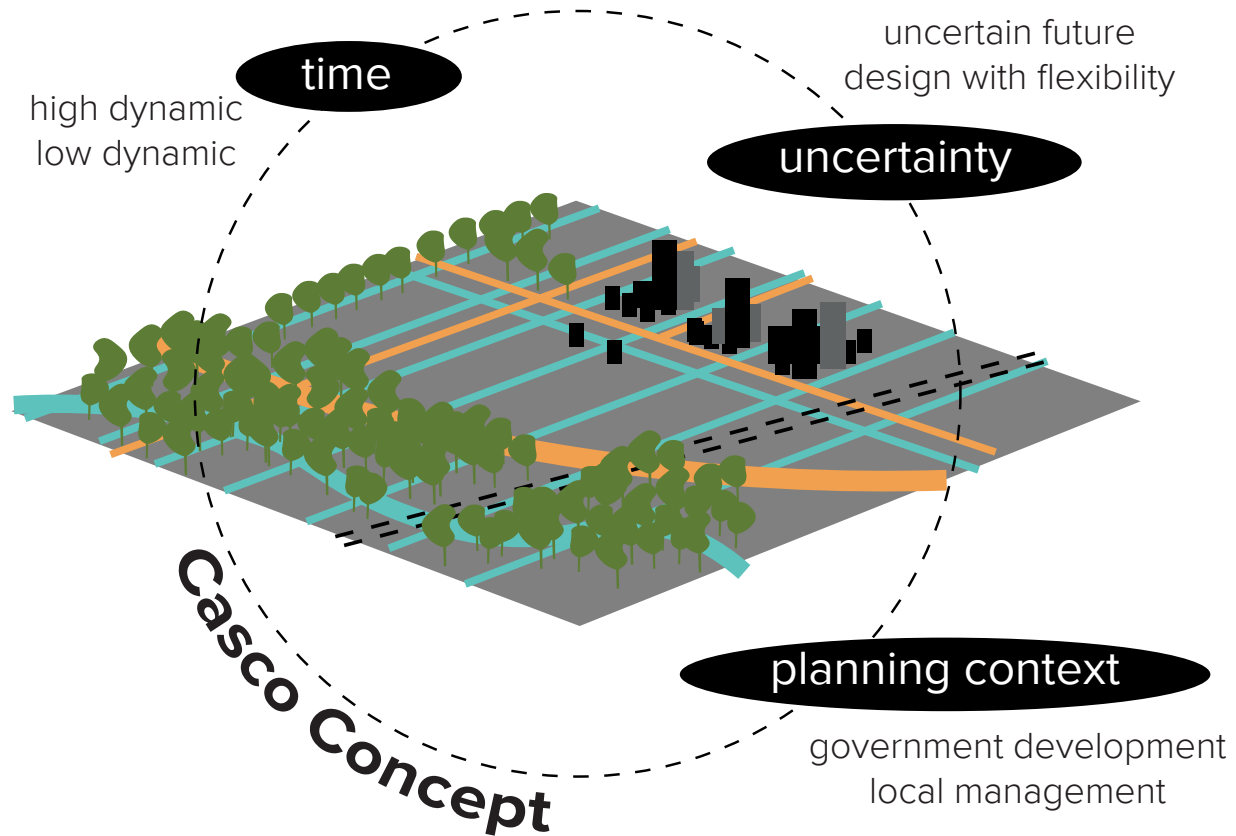


Fig 23: Casco concept,
by author from Kerkstra & Vrijlandt (1988)

Defining

theoretical background

The Transition Management Cycle from Derk Loorbach (2010) provides a comprehensive approach to guiding social transitions towards sustainability.

The cycle consists of four phases: strategic, tactical, operational, and reflective.

In the **strategic** phase, a team of leaders with diverse problem-solving skills work together to implement effective solutions. The team is selected based on their abilities, and they engage in an interactive process within a designated transition arena. This arena is designed to facilitate the navigation of societal transitions towards sustainability (Loorbach, 2010).

36

The **tactical** level involves addressing structural barriers to change. Self-formed coalitions

in an expanding transition network develop transition paths, negotiate investments, and refine individual plans and strategies. The innovative transition arena may encounter tensions with existing policy agendas, requiring strategic revisions (Loorbach, 2010).

Operational activities focus on carrying out experiments that align with the sustainability vision. Risky, iconic projects contribute to the transition in an innovative way. The experiments undergo continuous monitoring, possible repetition and scaling up over a longer period (Loorbach, 2010).

Reflective monitoring and evaluation are crucial aspects of the transition process. Continuous monitoring involves tracking physical changes, macro developments, and actor movements, promoting

collective reflection, and informing the next steps. The approach is reflexive, adaptive, and normative, guided by long-term perspectives and allows for innovation (Loorbach, 2010).

The framework emphasizes recognizing and addressing uncertainties, providing ample opportunity for innovation, and implementing a 'shadow trail' methodology to establish informal networks within policy processes. However, its potential remains to be validated empirically, and its application to diverse sociopolitical contexts and cultures presents persistent challenges. The framework must be tailored to specific contexts and cultures to ensure effective implementation (Loorbach, 2010).

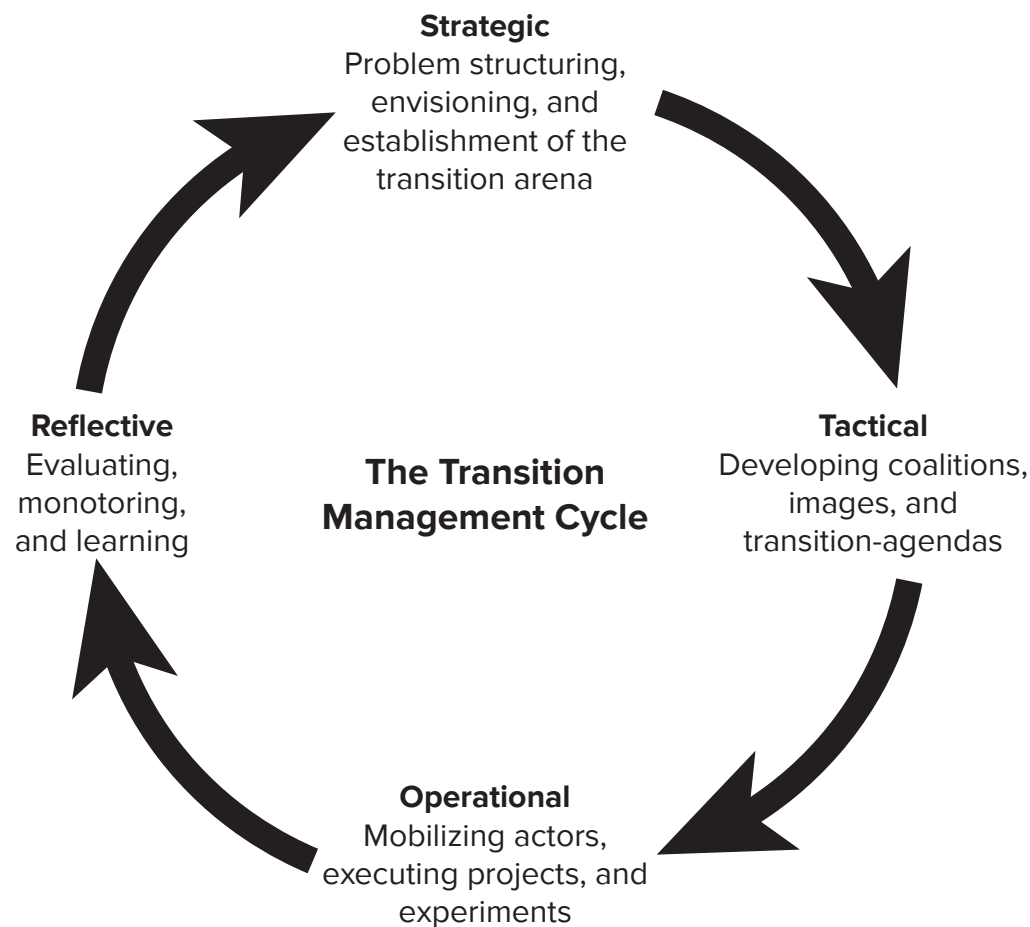


Fig 24: The Transition Management Cycle,
by author from Loorbach (2010)

Defining

theoretical framework

The previously discussed theories are summarized in a model for the design process.

Ecology

Land-sparing and land-sharing matrix by Graß, et al. (2019) assume that there are two ways to deal with the ecology of agriculture and nature. One way is based on the land-sharing principle, whereby agricultural land and nature go together and can benefit from each other. The other way is based on the land-saving principle, which is based on keeping agriculture and nature strictly separated, which is reflected in large nature reserves and open agriculture that do not get in each other's way. These two principles together form the connectivity landscape.

Vrijlandt (1988), the high and low dynamic layers are the most important. The strategy focuses on balancing high and low dynamics, in other words: the rapidly changing elements such as infrastructure and the built environment, and the stable aspects such as nature and the environment. By integrating these layers, the concept attempts to create a symbiotic relationship that preserves and enriches the inherent diversity of the environment.

Transition

Stakeholders are a crucial part of the design process because the outcome affects their future. According to Loorbach (2010), there are four phases in transition management: strategic, tactical, operative and reflective. Actors play an important role in each phase. Loorbach suggests

the formation of a transition arena, where a team of leaders with diverse problem-solving skills work together to implement effective solutions. The arena is designed to facilitate the navigation of societal transitions towards sustainability.

Overarching theoretical framework

These three theories together form the basis of this thesis. Figure 25 shows how these theories complement each other. The basis for a design is the low dynamic layer: nature, water, soil, air etc. In this case the basis starts with a dilemma of land-sparing and/ or land-sharing in the low dynamic layer. With the transition management plan from Loorbach (2010) in mind, stakeholders are early involved in the research.

The second part is to intergrate the land-sparing and land-sharing model into the low dynamic layer. And integrate on top of the high dynamic layer to create a sustainable and symbiotic design, als with the involvement of actors which are chosen by their abilities and engagement. Subsequently, developing a transition plan is of great importance to effectively oversee the different phases of the design process. The plan should be easy to understand for all parties involved and provide a concise overview of the how, what, when and why of the transition. It is essential to thoroughly evaluate the plan and the steps towards it and make any necessary improvements to ensure a smooth transition experience.

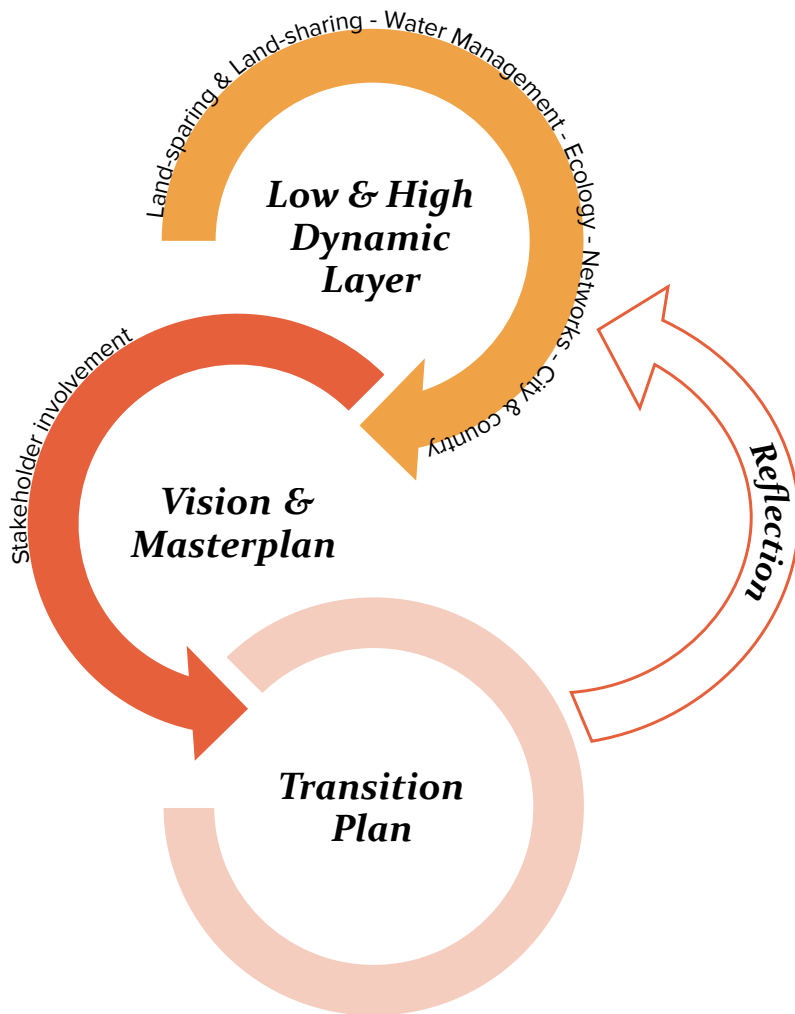
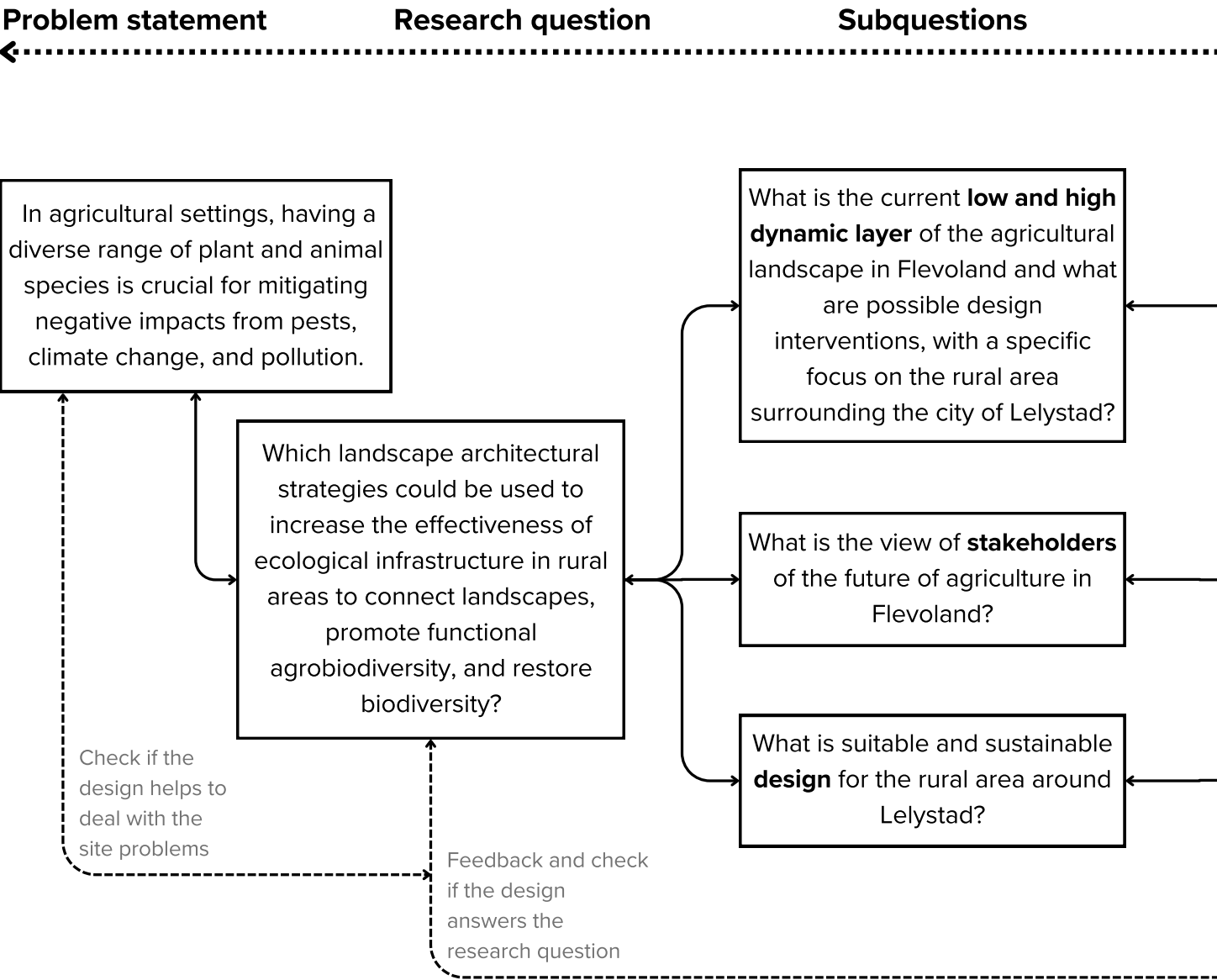


Fig 25: Theoretical framework, by author



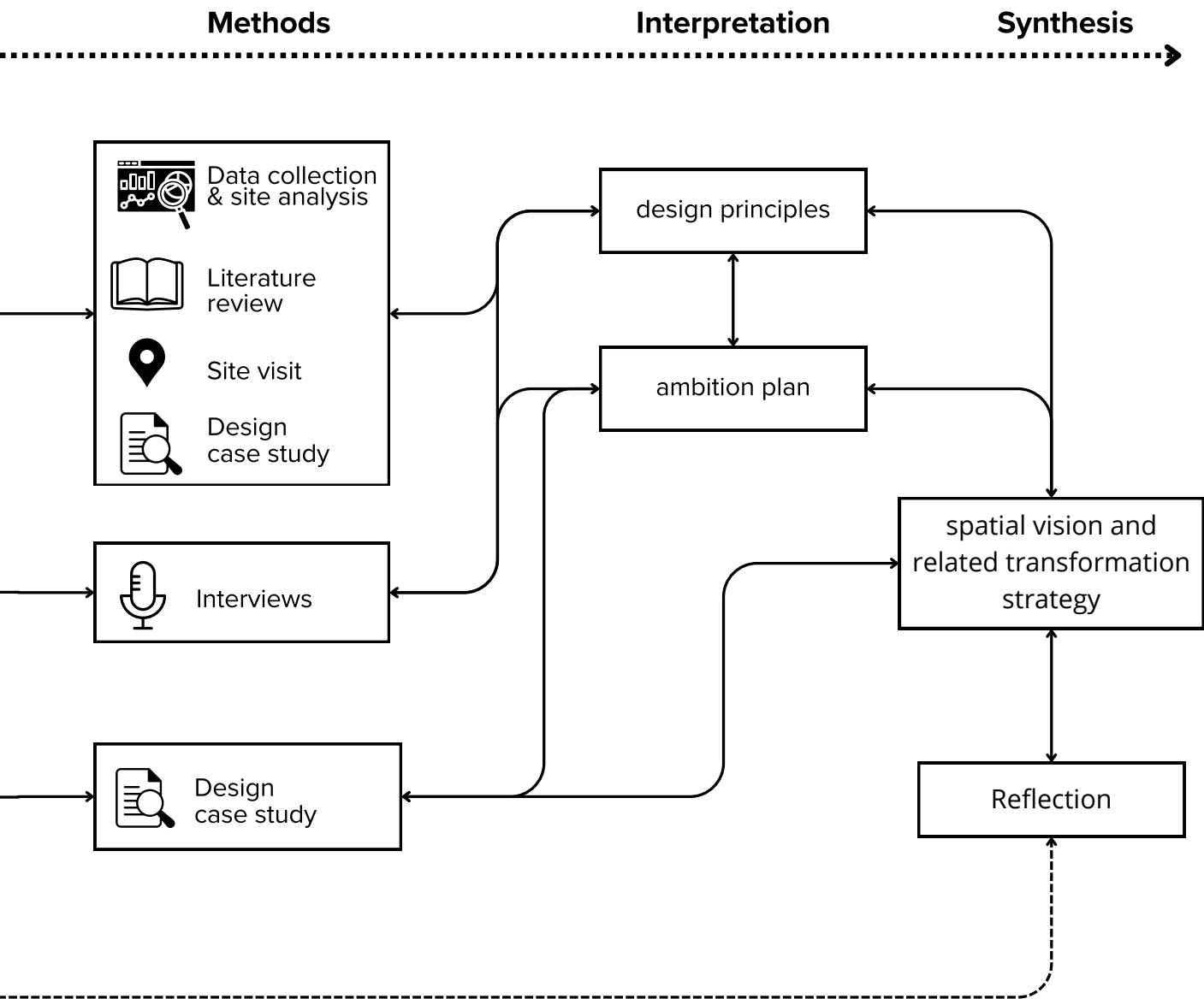


Fig 26: Methodology scheme, by author

Part 2

Chapter 3

Site Spatializing

Low dynamic layers
High dynamic layers
Conclusions & design principles

Zoom-in



Fig 29: Lage Vaart Bos, by Google Earth Pro

Fig 28: Green structure map, made by author. Data source: PDOK.

Site Spatialazing

low dynamic layers

Water structure

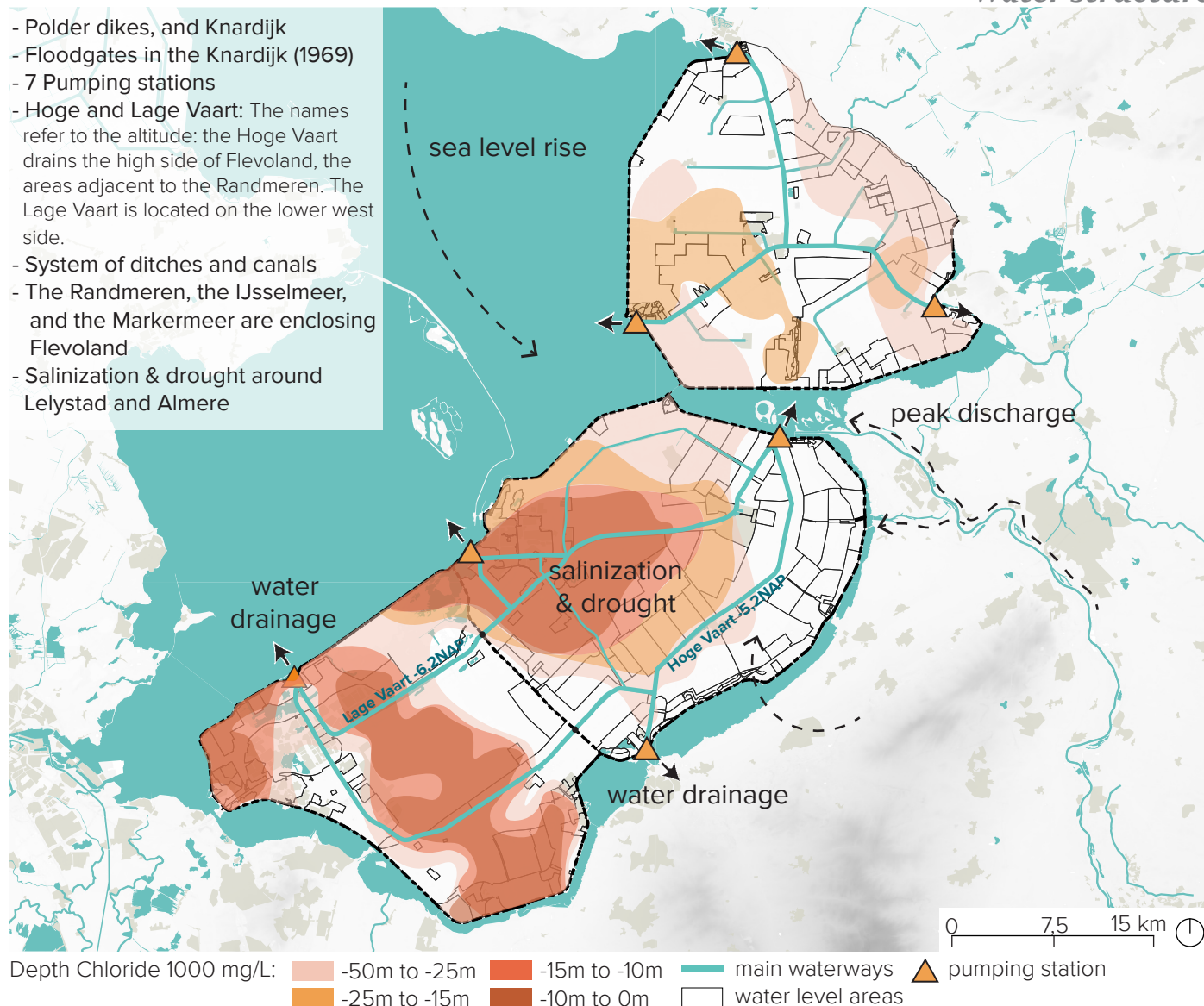


Fig 30: Water structure map, made by author.
Data source: Waterboard Zuiderzeeland

Zoom-in

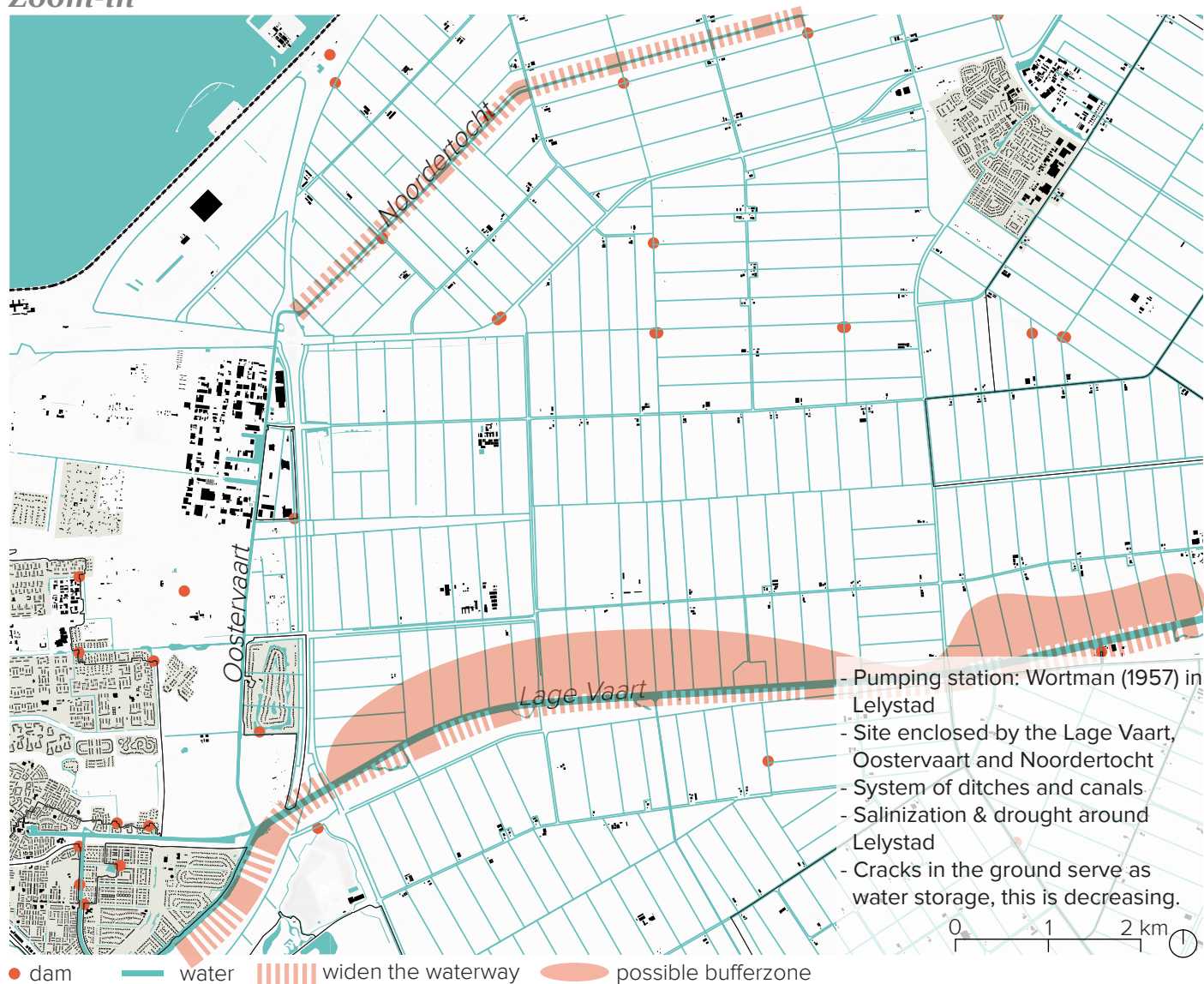


Fig 31: Water structure map, made by author.
Data source: Waterboard Zuiderzeeland

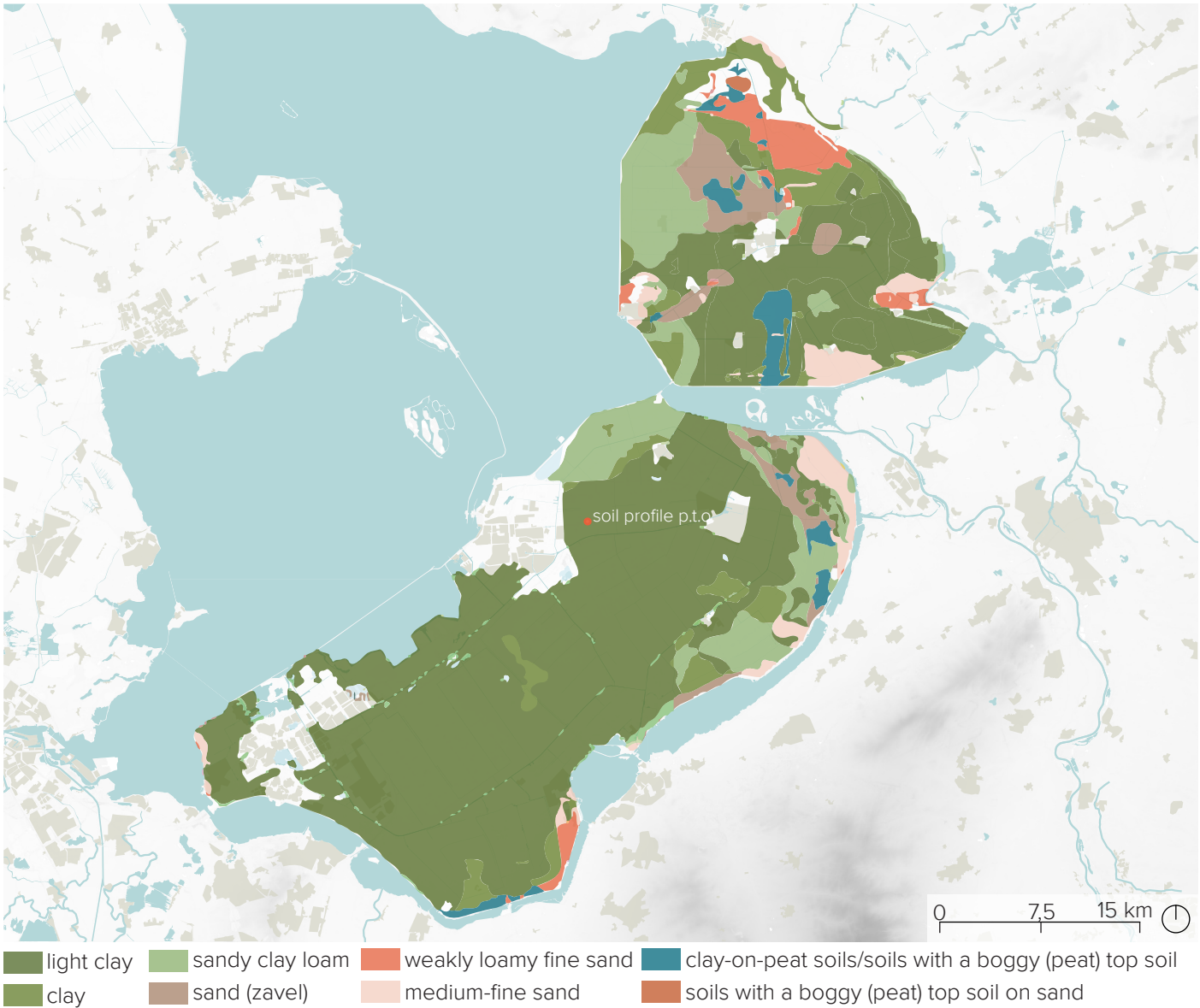


Fig 32: soil map, made by author. Data source: PDOK

Zoom-in

Flevoland consists of calcareous sand and clay soils with a relatively low organic matter content.

This soil ensures specific growth. The crops are relatively thin and the one-sided growth makes them difficult to mature.

The growth vigor is very high, this is visible in the forests. The ash trees, which belong here, show strong growth in height.

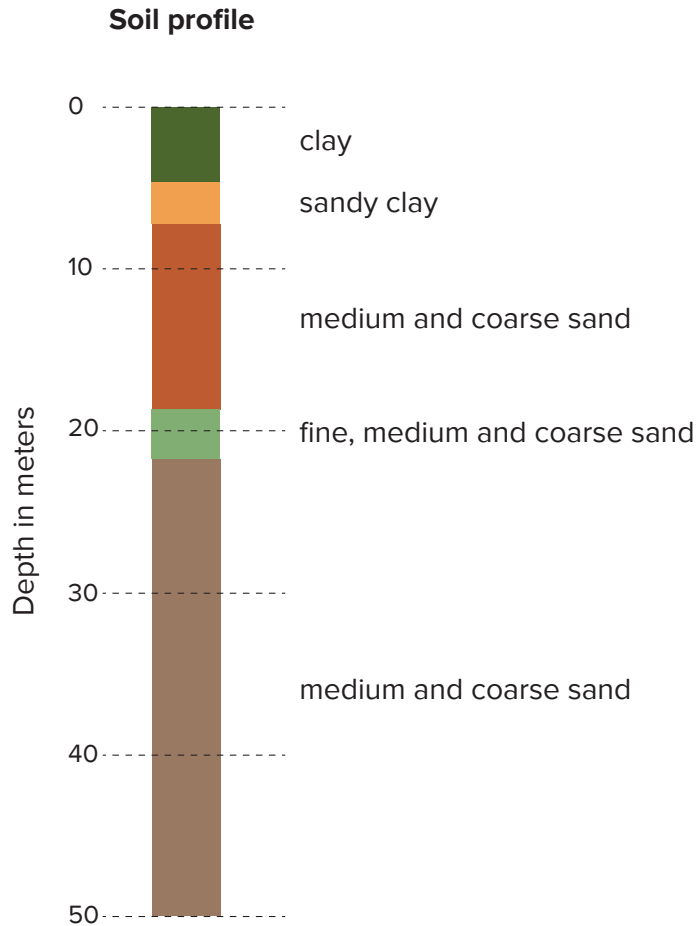


Fig 33: Soil profile, from DINOlaket, edited by author



Fig 34: Blue spot in the bottom due to lack of oxygen, by Bokhorst

Oostelijk Flevoland has a highly compacted soil structure. Due to the dense structure, the roots cannot penetrate the soil properly. Because of this compact structure more and more anaerobic blue spots develop in the soil. Roots don't grow there (Bokhorst, 2017).

Site Spatializing

high dynamic layers

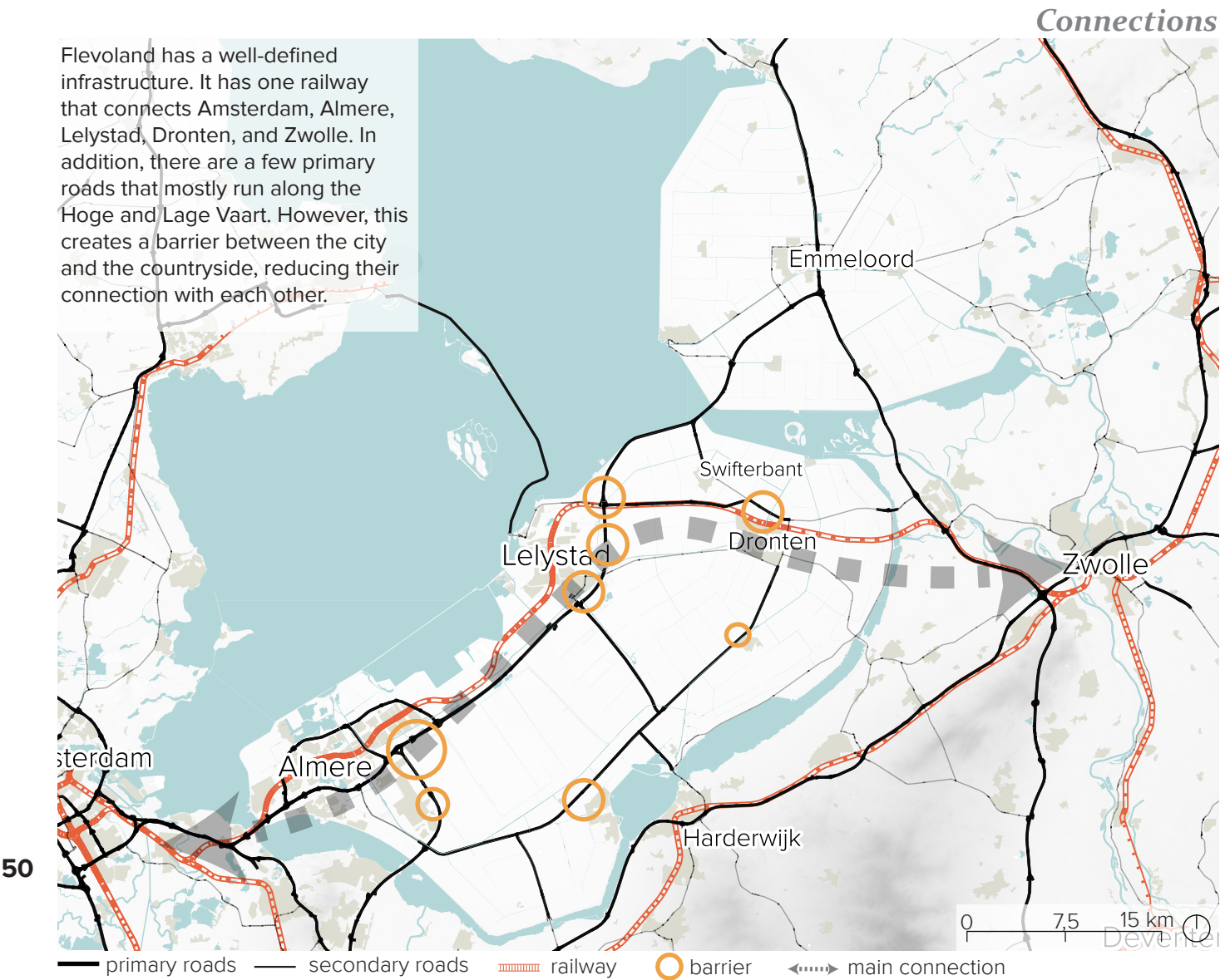


Fig 35: connections map, made by author. Data source: PDOK

Zoom-in



Fig 36: connections map, made by author. Data source: PDOK
MSc Landscape Architecture Thesis | Pleun te Braake

Site Spatializing

conclusions

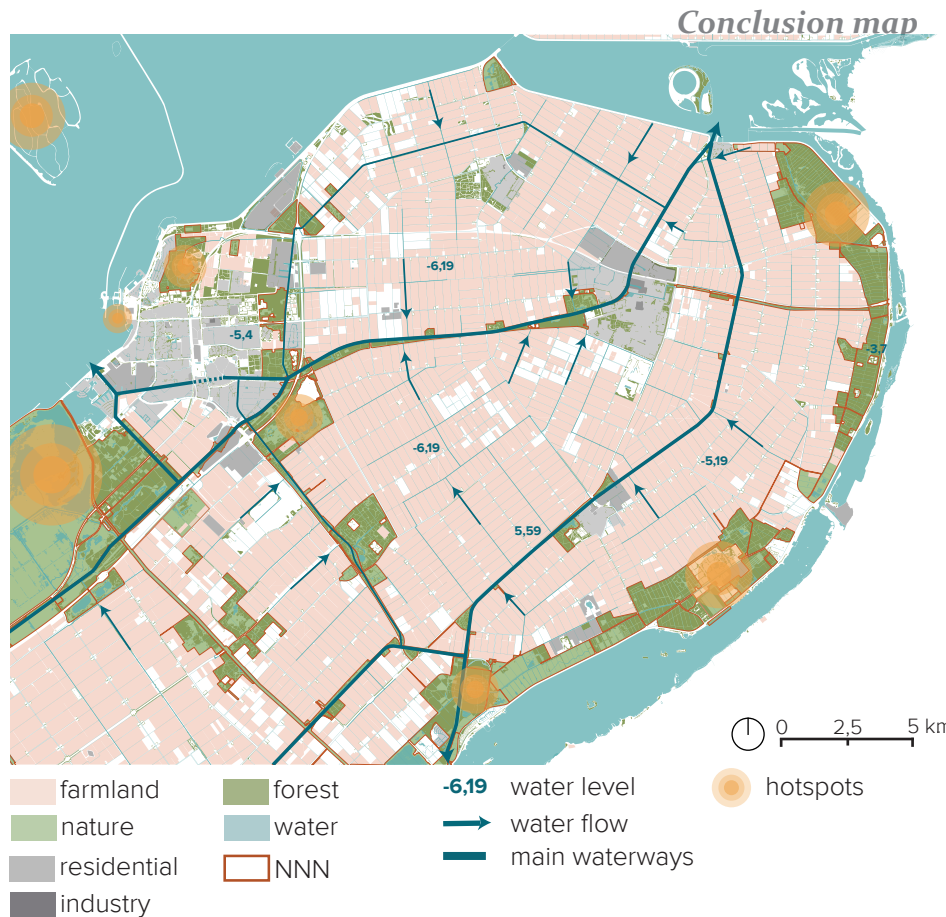


Fig 37: conclusions map, made by author. Data source: Zuiderzeeland, PDOK

Oostelijk Flevoland is divided into 4 main categories: the city: living and working, water, nature and agriculture. All categories are very separated from each other. In addition, there is a clear water structure that divides the land into plots. The main water flows of the Hoge and Lagevaart ensure that this water is collected and pumped away.

There are also several hotspots on the edges of Eastern Flevoland, such as Walibi, Lelystad Nature Park and the Marker Wadden.

Low dynamic layers

Within this context, the underlying dynamic layers are comprised of three distinct elements: nature, water, and soil. Through careful analysis, patterns can be identified and problematic areas can be pinpointed, allowing for the development of solutions, ideas, improvements and visions that build upon these foundations.

Nature & Agriculture

In Flevoland, agriculture and nature have traditionally been kept separate to maximize production (via the land sparing principle). Moreover, this high yield is mainly intended for export. This separation means there is limited interaction between nature, agriculture and the city. Nature in this case is mainly functional and often unattractive and monotonous. To increase biodiversity in

these places, it is important to increase the *variety of plant life in nature reserves and corridors*. In addition, the agricultural sector can also play a role in promoting biodiversity. For example, through nature-inclusive agriculture or by introducing different plants into the current agricultural ditch system. Which are examples of *the land-sharing principle*.

Water management

The region's waterways consist of two primary canals, the Hoge Vaart and the Lage Vaart, which serve as the main drainage system to the Randmeren, Markermeer, and IJsselmeer. However, this system is primarily designed for water drainage, leading to dry conditions for nature and agriculture during the summer months. As a result, salinization around Lelystad can be accelerated. In times of

heavy rainfall, it is essential to *collect water in specific areas* to prevent salt seepage and ensure there is sufficient water for the summer season.

High dynamic layers

High dynamic layers consist of infrastructure and connection between city and countryside. The analysis shows that there is a good infrastructure that connects Amsterdam with Zwolle and beyond, but there is no train to and from Emmeloord. The road network mainly runs along waterways, creating wider barriers between the city and the countryside. Lelystad in particular is surrounded by the railway, the A6 and several provincial roads. These barriers must be broken to *develop a good connection between city and countryside* and thus a better connection between city dweller and farmer.

conclusions

To conclude:

When looking the Oostelijk Flevoland's low dynamic layer, it is crucial to prioritize water, nature, and agriculture for the future. Agriculture is the primary industry in this region, but there is currently a dearth of biodiversity and natural resources. Additionally, the area is grappling with water-related challenges due to climate change and salty groundwater. Given these factors, it's essential to address these concerns if large-scale agriculture is to persist in the long run.

When looking to the high dynamic layer, it is crucial to prioritize the connection between farmers and citizens in Oostelijk Flevoland. This connection must be established on both a physical and mental level to secure a prosperous future for Dutch agriculture.

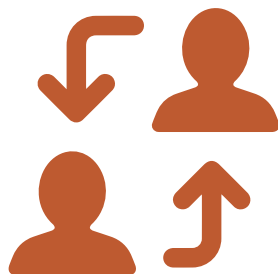
Main focus points



nature & agriculture



water



connection

Design principles

This conclusion leads to several design principles. These principles provide an integral picture of Eastern Flevoland and the surrounding regions of Lelystad. To create a more sustainable and future-proof landscape. It should be noted that these principles are not exclusive to any particular site. However, they are divided into the three main focus points: green network, water network and city-country side connection. In the next phase, these design principles are used to identify possible initiatives at specific locations.

Fig 38: Main focus points made by author

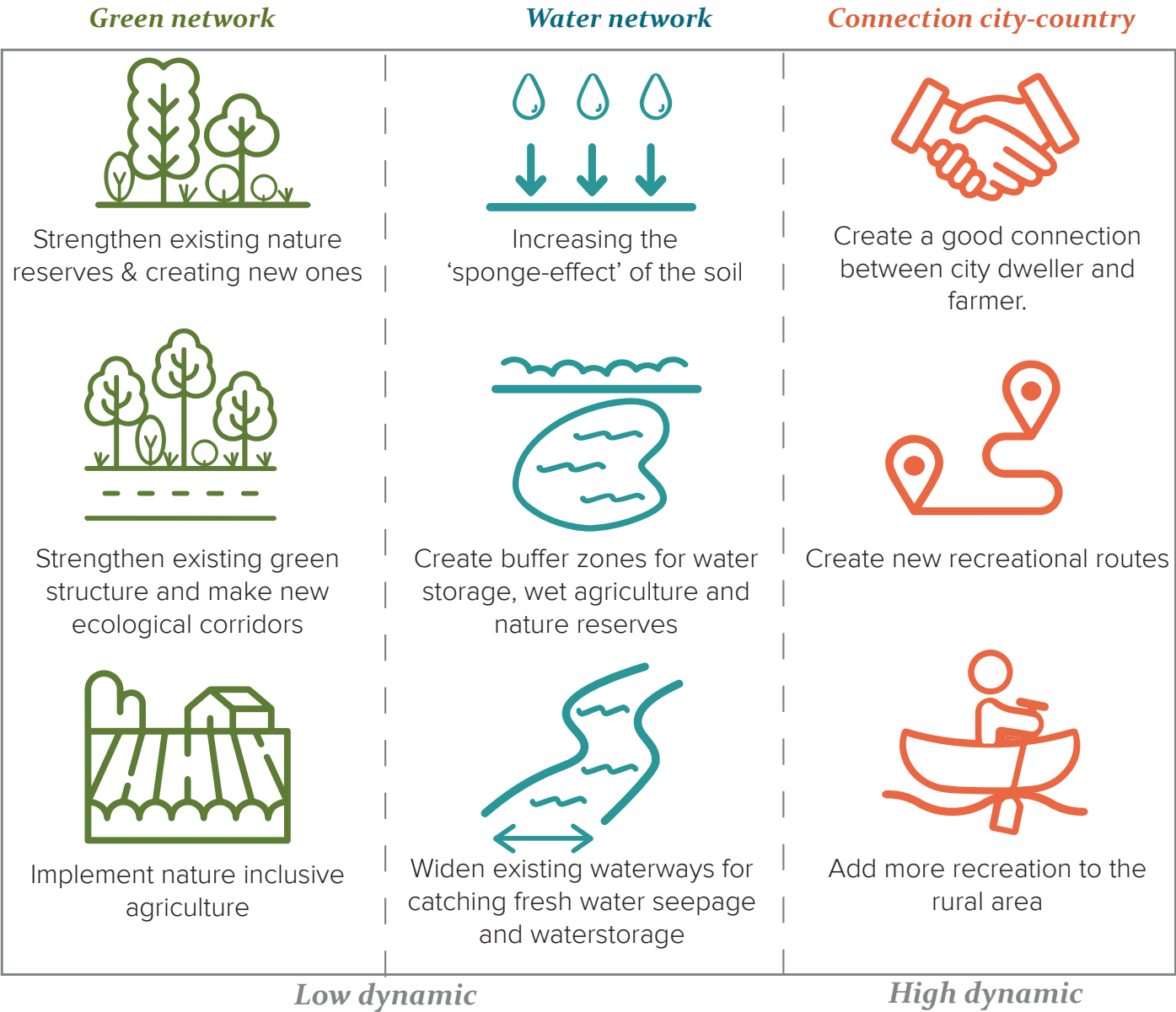


Fig 39: Design principles, made by author

Chapter 4

Approaching

Threats & challenges
Strength & potentials
Stakeholders view
Conclusions
Design assignment

Approaching

threats & challenges

Current agricultural system

The current agricultural system in Flevoland (fig 40) does not incentivize connecting agriculture and nature. This is because farmers are encouraged to produce as much food as possible, and if they were to give up land for nature, it would be at the expense of their food production and yield. At first, this may not seem viable from a financial perspective. However, food production legislation is becoming increasingly broad, putting pressure on the current system. These laws relate to the use of pesticides that can no longer be sprayed on crops, which increases the risk of more pests. According to the Common Agricultural Policy (CAP) of the European Union, they want to encourage the nature friendly and climate resistant agriculture, and to reduce greenhouse

gas emissions in the agricultural sector (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2023). In the future, these regulations will continue to increase, and the current agricultural system will no longer be a feasible option.

Future of the agriculture

The future of the agricultural sector is significantly influenced by global factors since Flevoland primarily produces for the international market (Provincie Flevoland, 2022). Consumer demand is subject to a wide range of social, political and economic factors, including Europe's policies that have a significant impact on the market. The outcome of the interplay of all these factors is challenging to predict. Therefore, the Flevoland agricultural sector's primary challenge is to prepare for all potential future scenarios.

The adaptability and diversity of the agricultural sector are crucial in this regard (Provincie Flevoland, 2022). Flevoland's agricultural companies, as the birthplace of the world's finest agricultural region, serve as a practical laboratory for the EU and the world.

To secure the future of agriculture in Flevoland, it is important to balance productivity with environmental sustainability. This requires collaboration between the government and farmers. The government should assist, while farmers should adopt sustainable practices. This was also highlighted in the interviews (p.64-69).

Green structure

Agriculture is enclosed by nature

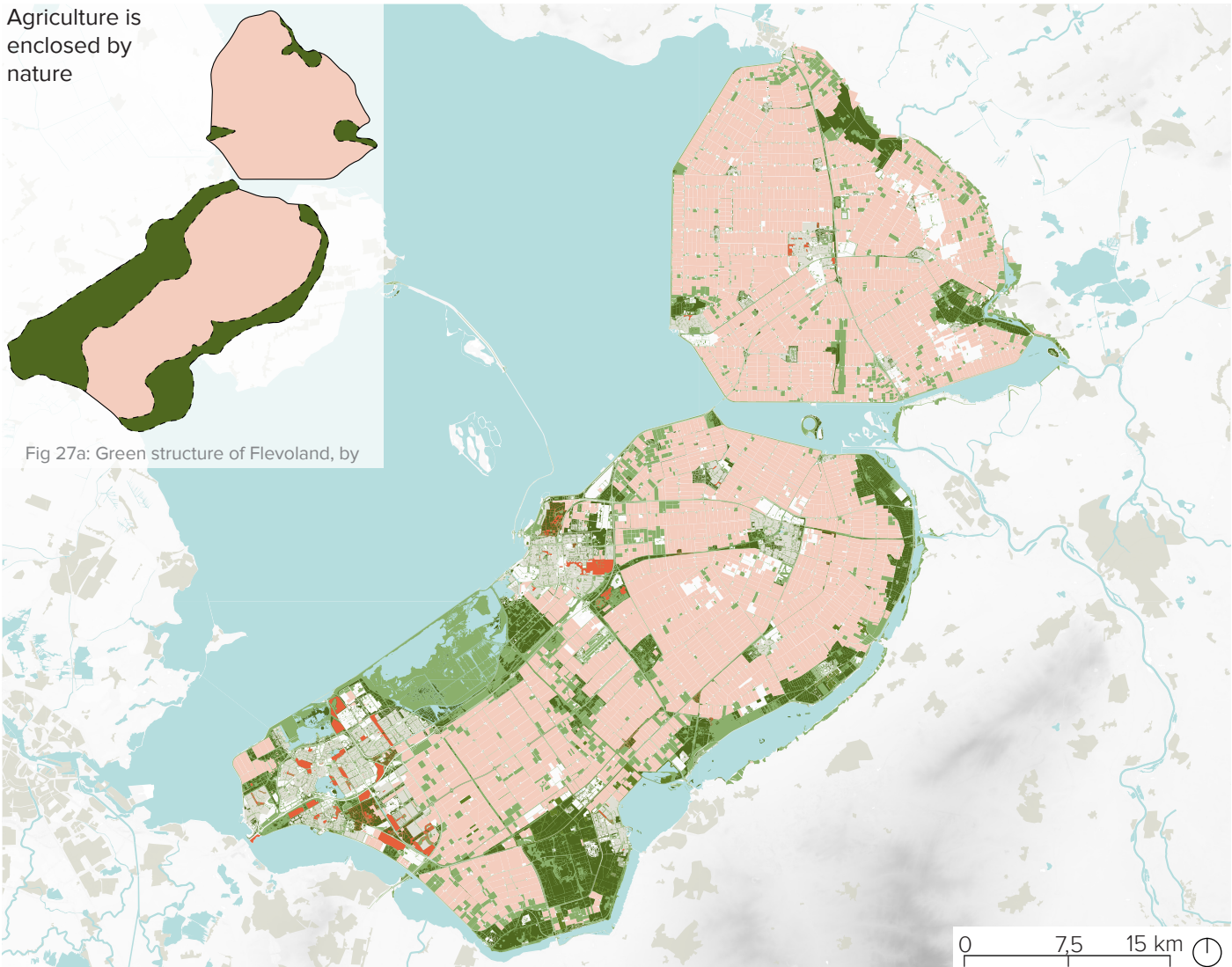


Fig 27a: Green structure of Flevoland, by

Fig 27: Green structure map, made by author. Data source: PDOK.

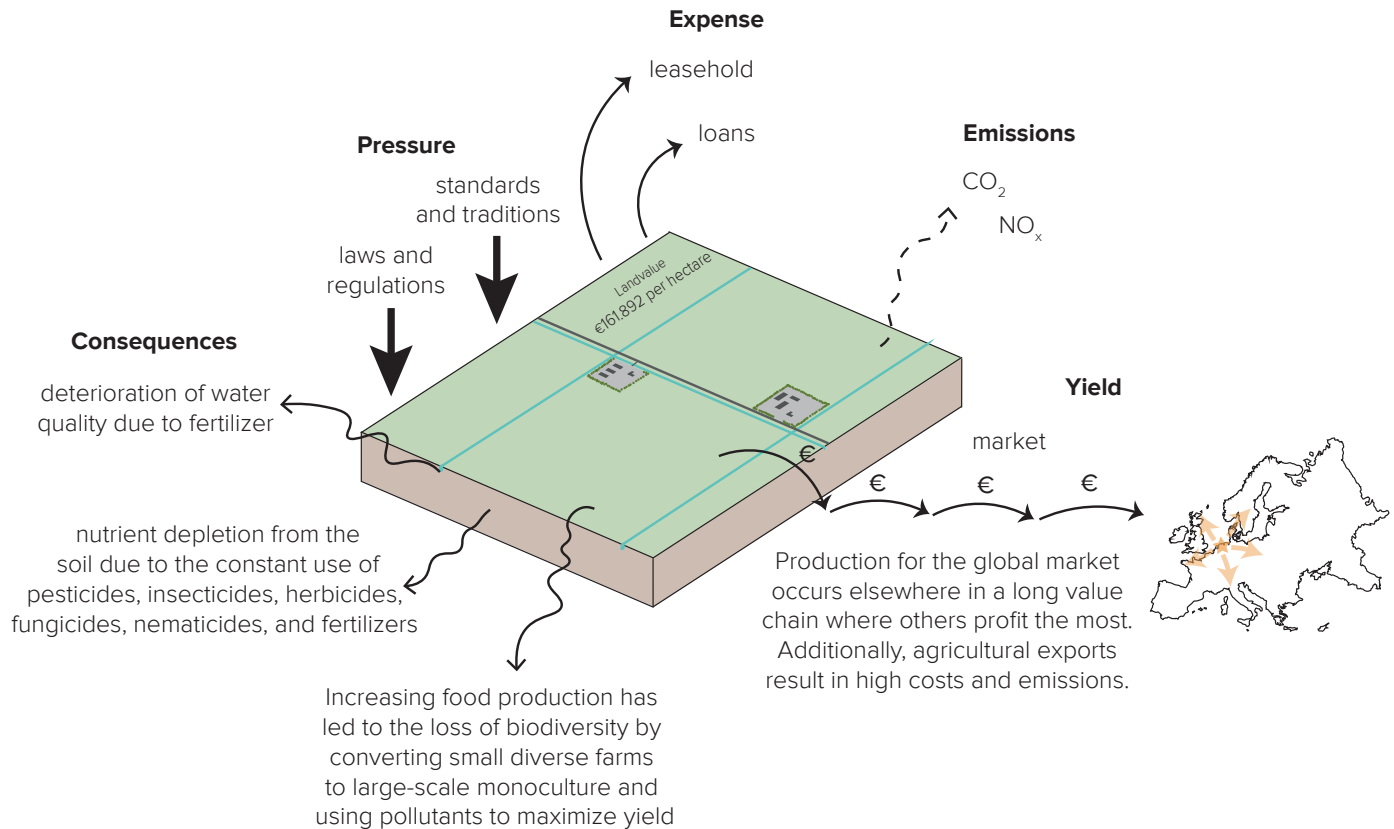


Fig 40: current agricultural system, by author

threats & challenges

Consequences farming

If farmers persist with the practice of growing only onions, potatoes, corn, wheat, and sugar beets, they may experience a decline in their production in the future. This is due to the salinization of the soil in the area around Lelystad. The high levels of salt in the soil cause crops to undergo salt stress, which results in stunted growth, discoloration, and a reduction in crop quality (Blom-Zandstra et al., 2014).

In addition to this, it is highly likely that there will be more regulations in the future regarding the use of insecticides and pesticides, among other things according to the CAP (Gemeenschappelijk Landbouwbeleid (GLB) 2023, 2024). As a result, crops will become more vulnerable to pests and diseases.

Opportunities by salinization:

1. counter pressure from fresh water storages (Jorritsma, 2022)
 - retain water
2. other cultivation systems:
 - paludiculture
3. other types of crops, for example: salicornia

Opportunities by more laws and regulations:

1. attract natural enemies (Hatt et al., 2017):
 - nature inclusive agriculture
2. smaller plot sizes (McArthur and Wilson, 1963)
- 3: other cultivation systems:
 - strip cultivation
 - agroforestry
4. more crop species (McArthur and Wilson, 1963)

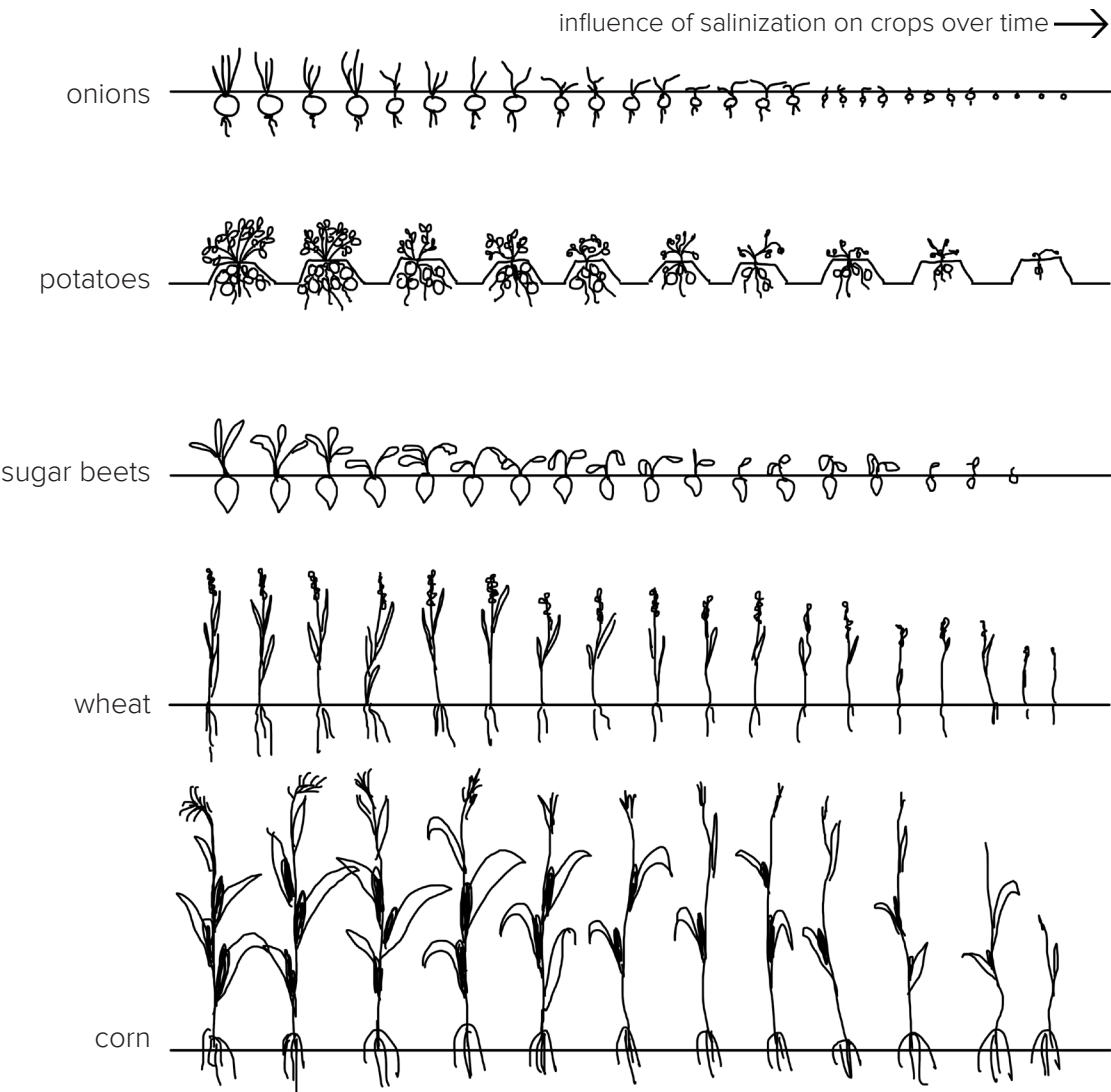


Fig 41: Impact of the salinization on crops, by author

Approaching

strength & potentials

Unused space

Flevoland has been designed specifically for agriculture, which means that there is a lot of unused open space in the landscape, such as wide bare roadsides, ditch banks, and headlands, see fig x. While these areas are currently empty, they offer great potential for introducing new landscape elements. For invertebrates and plant species richness, the most relevant nature elements are line-shaped elements such as hedgerows, ditches and water banks and small landscape elements such as farmyard vegetation according to Cormont et al. (2016). For maintaining and increasing biodiversity, these elements will play a significant role in the future of agriculture. If the use of pesticides reduces, we can then rely on natural enemies to control pests.



Fig 42: current empty roadsides at Edelhertweg, Lelystad, image by GoogleMaps, adjusted by autor

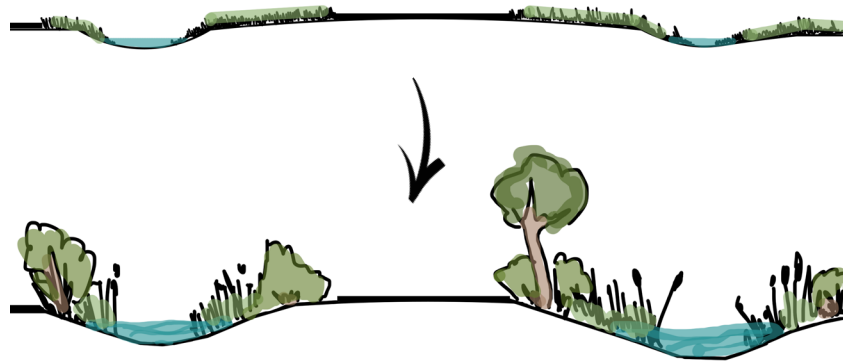


Fig 43: example current situation & future situation from the Edelhertweg, by autor

Pioneer spirit

Those who chose the hard life in the early days of the polders were pioneers. They had few facilities and relied on each other to build the new country. According to Willem Drees, who was a statesman of the province during that time, it was expected that the settlers who came to live in the newly created polders would break away from their old traditions (Canon van Flevoland, n.d.) They would start a new life in the new country and build a new society with the motto 'new country, new spirit'. This continued until the 1970s when the cities were established (Canon van Flevoland, n.d.). To bridge the past and the present, pioneers are necessary to ensure that Flevoland is sustainable and ready for the future.

Pioneering in the future: what is needed?

1. **Innovation in agriculture**, sustainability, nature including farmers, connection with nature, new agricultural techniques, nutrition, health, circular, short chains, country shop.
2. **Recreation**, residential recreation, catering, connecting Lelystad society and the region with nature and landscape, also through education.
3. On a large scale: **world food problems**, producing sufficient food of good quality in a sustainable manner.

Approaching opportunities

Part 2 | Chapter 4: *approaching*

To summarize the strengths and weaknesses, this chapter gives an overview of the opportunities for a more sustainable and futureproof agricultural landscape.

The current state of intensive agriculture in Oostelijk Flevoland is not sustainable, given the issues of soil exhaustion, water scarcity, and a disregard for natural processes. To ensure a brighter future, sustainable practices must be implemented.

The Common Agricultural Policy (CAP) is a partnership between, agriculture, society, Europe and European farmers. This policy aims to support farmers in improving their agricultural productivity and addressing climate change, as well as promoting the sustainable management of natural resources. It also

provides subsidies for nature-inclusive agriculture, allowing farmers to receive government support. (CAP at a Glance, 2024). The government will support the farmers in this way, but ***it is important that consumer demand also shifts towards more sustainable and diverse agriculture.*** Without such changes in demand, the economy may not be able to support this shift.

The incorporation of nature in agriculture has the potential to establish a sustainable agricultural sector in Flevoland. By ***creating a connectivity landscape*** that interconnects natural structures and integrates natural pest control mechanisms with agriculture, this approach promotes biodiversity and ecosystem services while enhancing agricultural productivity. The implementation of nature-

inclusive agriculture for long-term sustainability can be facilitated through partnerships between farmers, conservation organizations, and government agencies.

The start of this connectivity landscape could be in turning the unused space into a strong green network which connects the nature with the agriculture.

Approaching

stakeholder perspective

Farmer A

(personal communication, March 6th, 2024)

Farmer A is taking various initiatives to ensure that his farm is ready for the future. These steps include educating people, providing information to school children, maintaining an informative website, managing nature, and being part of several organizations that are working towards making agriculture in Flevoland more sustainable.

Farmer A is aware of the potential problems and opportunities that may arise in the future. In fact, Farmer A is already experiencing some salinization, which means he will have to come up with solutions to this issue.

When Farmer A thinks about the future, he envisions a more diverse agricultural landscape with appropriate earning models. He wants to create

an attractive environment where the green-blue veining connects the farmer and the citizen. Farmer A is open to new initiatives, provided that there is adequate information and support from the government and the province.

*I want a diverse
agricultural landscape
with appropriate earning
models*



Farmer B

(personal communication, March 18th, 2024)

Farmer B believes that efficiency is a crucial factor in modern agriculture. The sector has achieved great production levels for various products with high efficiency. In the Netherlands, we have the lowest carbon footprint in the agricultural sector worldwide. However, Farmer B is currently facing a challenge with the absence of a clear political course for the future. He believes that some of the short-term measures suggested by politics are controversial and not supported by science. Farmer B also highlights the impact of small groups that emotionally influence the public, leading to a growing polarization between farmers and citizens. This is a negative development for the future of agriculture and does not facilitate constructive discussions.

Moreover, Farmer B thinks that there is still a significant challenge in educating urban dwellers about the agricultural sector. He believes that they need to be informed objectively and without bias about the current situation.

Farmer B is not optimistic about the future and thinks that unity is essential to solving future challenges and achieving efficient and sustainable agriculture.

He suggests that there is still much to be gained from biodiversity in agriculture, such as managing field edges with herb and flower mixtures and herb-rich grassland. However, he emphasizes the importance of being well-informed about any potential interventions and having clear scientific evidence before making any decisions.

Farmer C

(personal communication, March 19th, 2024)

Farmer C believes that innovation and science-backed regulations are crucial for a sustainable food system. Challenges like climate taxation and ethical dilemmas need to be addressed. To bridge the knowledge gap and create understanding between farmers and urban dwellers, he suggests boosting local sales and fostering transparency, alongside initiatives like open farm days and informative presentations. To combat biodiversity loss, he advocates for practices like herb-rich grasslands and reducing pesticide usage. Regarding water-related challenges, he suggests solutions like irrigation, improved drainage systems, and embracing drought-resistant crops.

Farmer C stresses that government support and

economic incentives are vital for the farmer's willingness to embrace nature-inclusive practices. He envisions Oostelijk Flevoland transitioning towards a more circular and efficient agricultural model prioritizing economic viability alongside enhanced animal welfare standards.



Approaching

stakeholder perspective

Waterboard X

(personal communication, March 12th, 2024)

X, a representative of the water board, emphasized the significance of natural banks and presented the cycle of alternative mowing as a way to promote biodiversity. X advocates for crop diversity and urges farmers and civilians to be more aware, while also highlighting the need for collective efforts, investments, and subsidies.

X viewed crises as opportunities for change and suggested water buffering as a solution for dry summers and salinization. X acknowledges that there are issues related to water, but points out that the situation in Zeeland, where saltwater is a significant problem, is far more severe. Nonetheless, individuals, particularly farmers, must be aware of how to deal with such issues if they arise.

X sees a future where water, nature, agriculture, and urban areas work together for biodiversity and sustainability, with the government and province promoting this transition. According to X, Flevoland faces both challenges and opportunities to set an example in this transition.

Municipality Y

(personal communication, March 1st, 2024)

Y of the municipality not only emphasizes the attractiveness of the landscape but strives for a more robust and resilient character as the next step in the development of the polder. Climate challenges, the ageing of the polder (where trees mature and have to deal with decay) and significant spatial requirements in line with the sustainable energy transition make this necessary.

The goal is to create a sustainable, climate-adaptive and healthy green framework, which includes a multi-dimensional design of the water system. This results in a more robust ecosystem aimed at improving soil and water quality, benefiting both animals and people. The landscape is not only made more attractive but also has greater amenity and use value, creating

In the future water, nature agriculture and city working together for a sustainable landscape.



space for various attractive recreational developments. This in turn contributes to connecting the city and its surroundings.

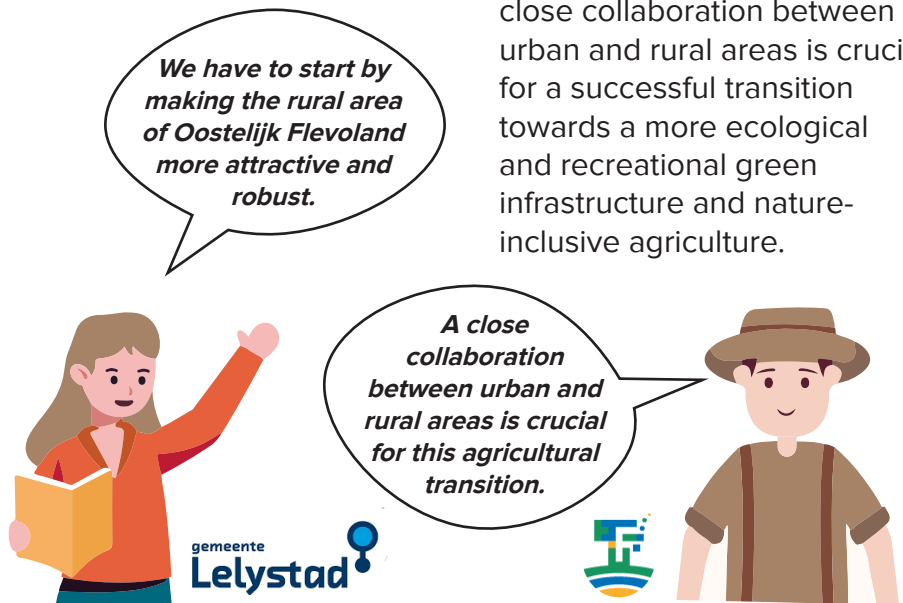
In the future 40,000 inhabitants are needed for the growth of Lelystad. This growth is crucial for the financial independence of the central government (especially in the management of public spaces). There is plenty of space in Lelystad for more houses to give it a city-like appearance. However, this space is currently dedicated to green space, which adds value to the city. To achieve this goal, construction could also take place on the east side of the A6 via a 'red for green' approach where landscape development is central. Through this principle, one could speak of inheritances and communities. Agroforestry and food forests are also included.

When we look to the future, Flevoland also focuses on the energy landscape. The energy landscape not only serves sustainable energy objectives but also includes natural and recreational objectives, which can potentially contribute to the water system and agroforestry

Farm of the Future Z

(personal communication, February 8th, 2024)

Z leads the Field Lab of the Farm of the Future organization. Z aims to promote ecological food production in Flevoland by utilizing unused spaces and diversifying crops in the future. Z stresses the importance of educating farmers and city dwellers to create awareness of food production and nature. A close collaboration between urban and rural areas is crucial for a successful transition towards a more ecological and recreational green infrastructure and nature-inclusive agriculture.



The current agricultural system in Flevoland is facing challenges because it prioritizes high food production at the expense of nature integration. New regulations, such as pesticide restrictions and EU policies, suggest a shift towards nature-friendly and climate-resistant agriculture. The future of Flevoland's agricultural sector is closely linked to global factors and the need for adaptability. This region has plenty of unused spaces that could be used to introduce landscape elements which is crucial for biodiversity.

Embracing a pioneering spirit, similar to the early settlers, is essential for sustainable development. To navigate the future successfully,

Flevoland must focus on innovation, sustainable practices, and holistic connections between

agriculture, nature, and society, ensuring it remains a global leader in agricultural solutions.

Farmers perspective

Farmers acknowledge that they can do more to support nature, but they feel that they lack sufficient information on how to do so effectively. Farmers often need to see evidence that an intervention works with a positive economic model before believing in its efficacy. Farmers feel there is increasing polarization between the city and the countryside due to a small but vocal group of extremists and politicians. Therefore, it is essential to raise citizens' awareness about the agricultural sector. According to Farmer B, "all people must be on the same page" to achieve this goal. One way to increase public awareness is to add more recreational activities

to the countryside, such as farmer education, B&Bs, farmers' restaurants, farmers' markets, etc. This will help to provide farmers with a more positive image and increase understanding and support for a transition in agriculture.

Furthermore, farmers are willing to become smaller-scale and more diverse, but the current economic model does not support this. After the World Wars, the Netherlands had to produce as much food as possible to prevent future famines, and this was also encouraged by the banks. To encourage farmers to change, the current economic model needs to be updated.

Other stakeholders

The organizations Waterboard X, Municipality Y, and Farm of the Future Z have a common goal to promote sustainability, biodiversity, and the integration of nature into human activities. They believe that it is important to work together and collaborate with different stakeholders, such as farmers, urban dwellers, government agencies, and environmental organizations. They also acknowledge the need to address climate change and promote resilient ecosystems while considering the social, economic, and environmental aspects of development. Overall, they advocate for a holistic approach that prioritizes the well-being of both people and the environment in Flevoland.

Future perspectives

A diagram has been created to summarize the stakeholders' vision of a sustainable future in Oostelijk Flevoland. The diagram highlights the most important topics that need to be addressed, which are nature, agriculture, water, and citizen connection. Each stakeholder has assigned a positive sign (+) to each topic they deem important. The topic with the highest number of positives is considered the most important according to that stakeholder and is placed at the top of their vision.

Stakeholders	Nature	Agriculture	Water	Connection farmer & citizen
Farmer A	+	+++	++	++
Farmer B	0	+++	+	+++
Farmer C	+	+++	+	++
Waterboard X	++	++	+++	+
Municipality Y	+++	++	++	++
Farm of the Future Z	++	+++	++	++

0 = no opinion + = important ++ = very important +++ = most important

Fig 44: Summary stakeholders view, scheme by author

Chapter 5

Exploring

Design assignment

Vision Oostelijk Felvoland & Farm of the Future area

Transitions:

- Nature Network & Agriculture
- Water Network
- Connection Farmer & Citizen

Exploring

design assignment

The information from analyses, research, and interviews is transformed into a design assignment that creates a vision. The design assignment comprises six different assignments that serve as the common thread of the design:



1. Generate an **ecological and green-blue infrastructure** which connects agriculture with nature.



2. Creating opportunities for a **sustainable and futureproof agriculture**.



3. Provide **recreation in the rural area** to connect city and country side.



4. Expand nature and recreational **opportunities for new community districts** in the rural area of Lelystad.



5. Use the **waterbuffer and paludiculture** to strengthen the existing ecological green-blue infrastructure and to provide counter-pressure to the saline groundwater.



6. Use the **stakeholders** for a bottom up approach and for keeping the local identity.

All the tasks in this project are interconnected, creating a unified vision. Figure 45 illustrates these connections along with the design principles that were previously explained. These principles are categorized into Water Network, Green Network, and Connection between Farmer and Citizen, and they support the six different design tasks, representing the whole integrated picture.

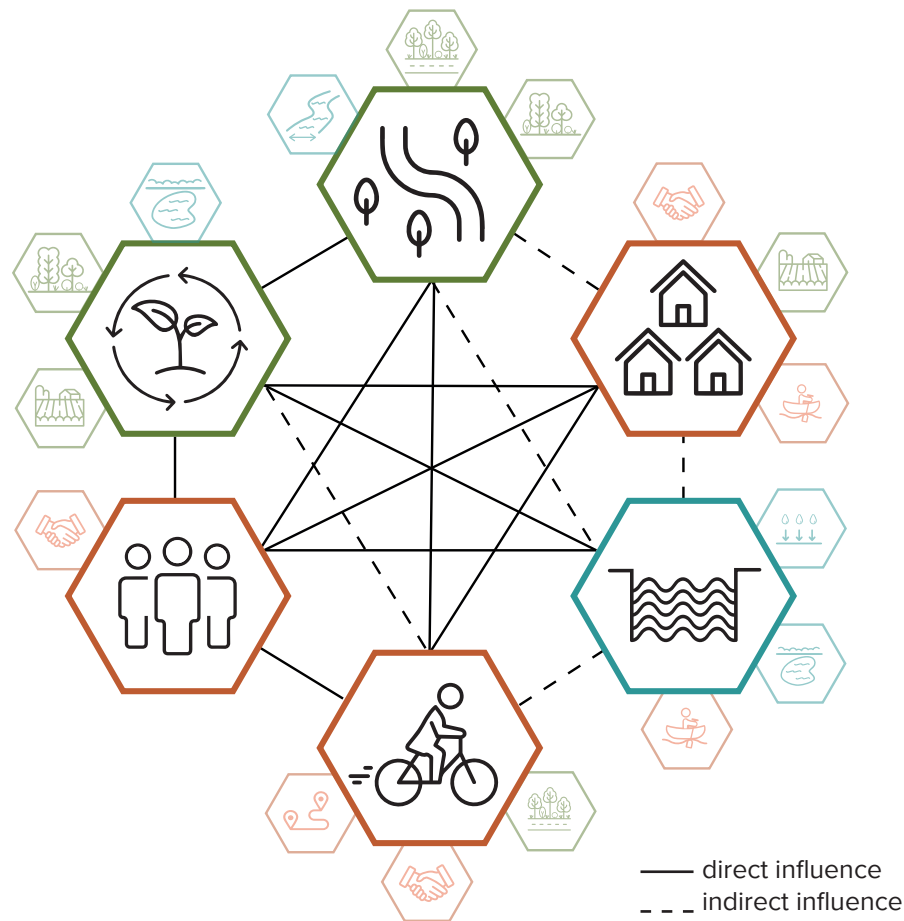


Fig 45: coherence of the vision, made by author

Low dynamic



Fig 46: Vision green network, by author



Strengthen existing nature reserves & creating new ones



Strengthen existing green structure and make new ecological corridors



Implement nature inclusive agriculture

The green network

On the left page, you can find the green structure vision for Oostelijk Flevoland. This vision emphasizes three important principles. Firstly, it aims to strengthen the existing green structures in the area, like the rows of trees and nature reserves, by introducing more plant diversity and creating layers of vegetation under the trees to promote biodiversity. Secondly, the unused spaces in the landscape, such as ditches, waterways, field edges, and roadsides, will be utilized as ecological veins. Lastly, the agricultural sector will shift towards a more nature-inclusive approach, which includes agroforestry, paludiculture, and strip cultivation. Additionally, sowing field edges and ditches will enhance agriculture with natural enemies.

The edges of Oostelijk Flevoland are marked in green. These areas are left to grow naturally and are used for catching fresh water seepage. New, larger green connections are created via roadsides to form a network of green spaces throughout the landscape. The smaller ditch structures are part of the secondary green structure which links the larger green areas with the agriculture.

The green network has a significant impact on the environment, affecting various aspects such as agriculture, water retention, and recreation. One of the most important roles of the green network is to enhance the landscape's beauty, which in turn attracts more people to the area for recreational activities.

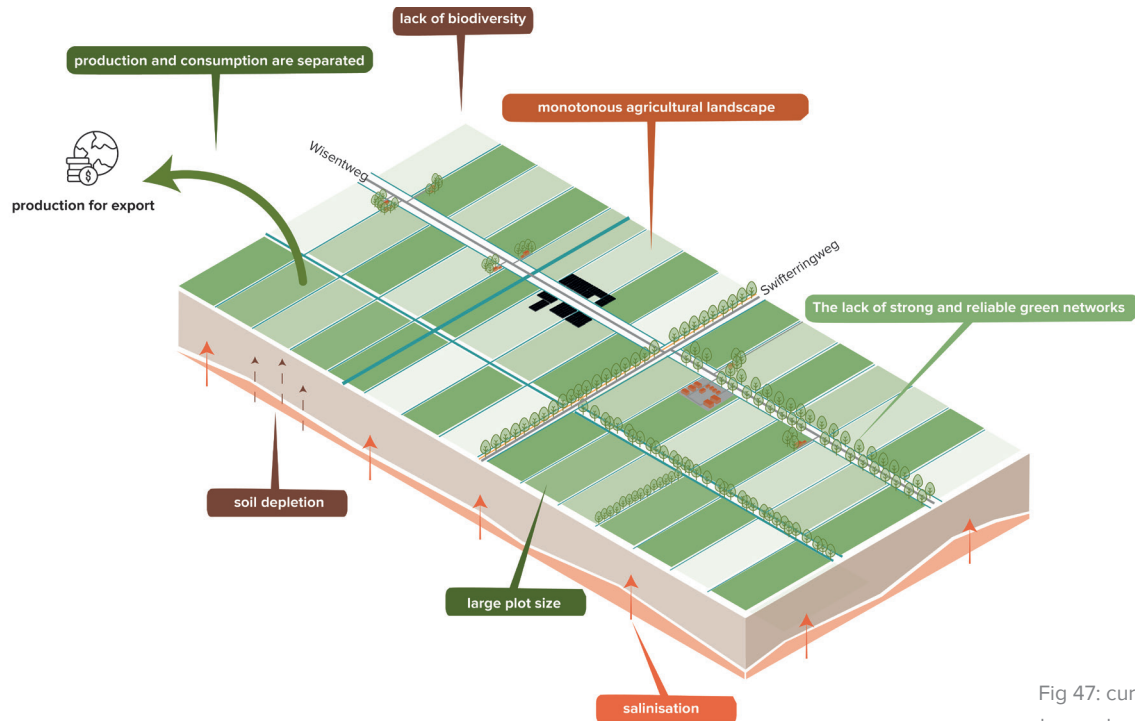


Fig 47: current situation
nature network, by author

Current situation

Biodiversity is vital for sustainable agriculture according to Dawson & Norén (z.d.), but it is not a top priority in Oostelijk Flevoland's current agricultural system. The land-sparing principle separates nature and agricultural systems, resulting in a lack of biodiversity (Graß, et al., 2019). This separation also leads to a monotonous green structure, monoculture, and larger plot sizes for maximum production. However, this production is not sustainable, and climate change exacerbates the problem. Despite its intensive production system, Flevoland sets an example for many other areas in the Netherlands and the world, and therefore its primary agricultural function must remain unchanged.

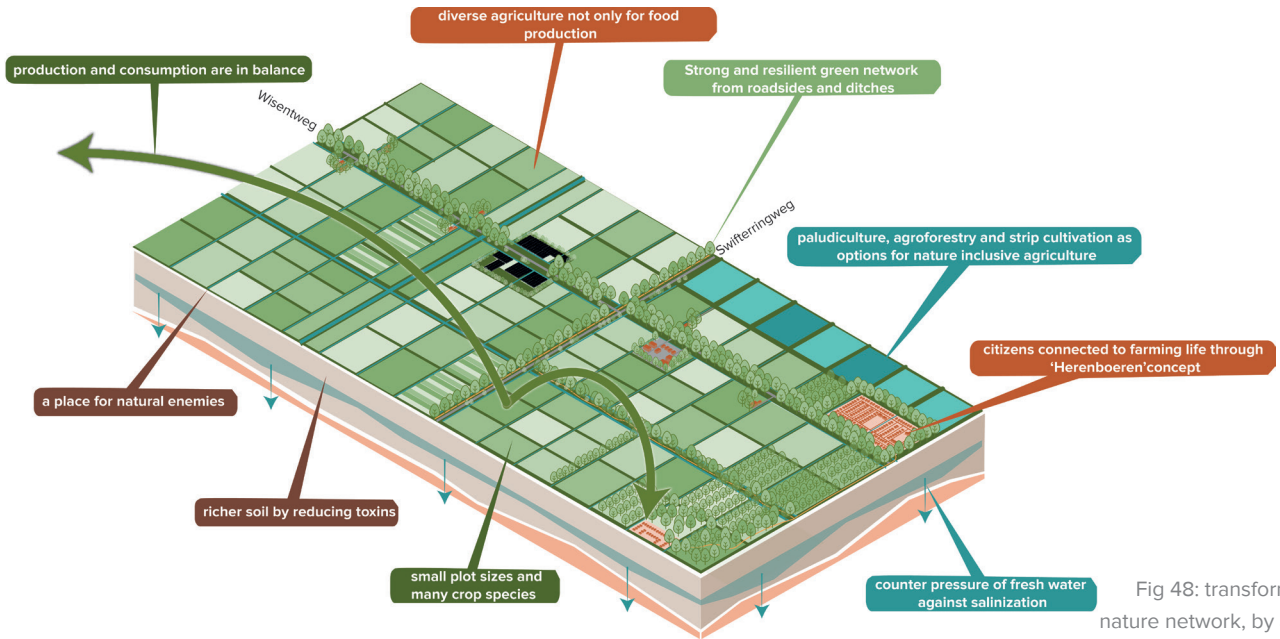


Fig 48: transformation nature network, by author

Transformation

To promote the diversity of Flevoland's ecosystem, it is crucial to prioritize agriculture that is more nature-inclusive. This can be achieved by implementing the principle of land sharing, which allows agriculture and nature to work together for mutual benefit (Graß, et al., 2019). By utilizing previously unused areas such as field ditches, headlands and roadsides and creating strong green corridors along roads and waterways to connect agriculture with the wider natural environment, a connectivity landscape is created where nature reserves, agriculture and nature-inclusive agriculture coexist (Graß, et al., 2019). In addition, fields could be more nature-inclusive through different production techniques, field size reduction, strip cultivation, paludiculture and agroforestry. Ultimately, this approach will create an attractive landscape that benefits animals, insects and city dwellers alike. A good connection with the city will help the agriculture to balance the production.

Low dynamic

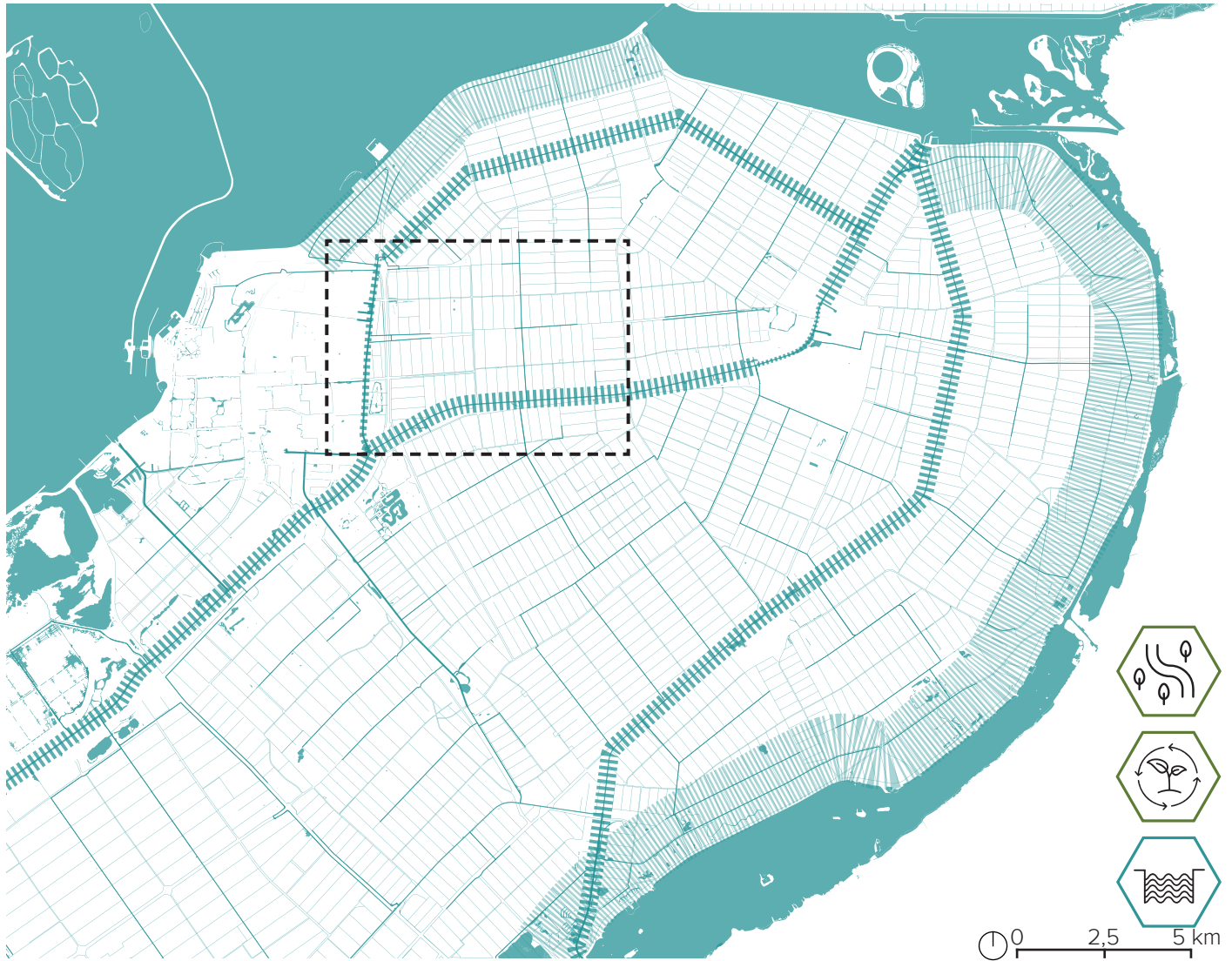
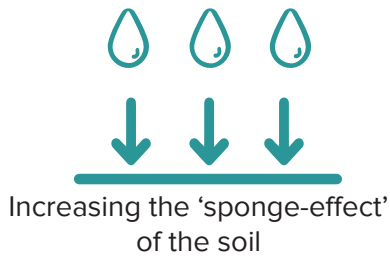


Fig 49: Vision blue network, by author



The water network

Flevoland is a polder that traditionally pumps out water as quickly as possible. However, in the context of the water network's vision, this approach is being reversed. By retaining water, it is possible to generate counter pressure to the saline groundwater that emerges in the region. This can be achieved in a variety of ways, such as water storage, wet agriculture (known as paludiculture), increasing the organic matter content of the soil, floodplains, and widening waterways. In addition, water retention also ensures a supply of water during dry periods, which are increasingly being affected by climate change.

The Hoge and Lage Vaart are the main drainage waterways of the Flevoland water system. By creating storage space for water around these canals,

the water is retained instead of being drained away. The Noordertocht in the northwest of the Flevopolder could be widened to allow more water into the system. Plot ditches also offer opportunities to provide arable farming with enough water and to provide counter pressure for the saline groundwater.

Moreover, the freshwater seepage from the Randmeren (Veluwe) and the IJsselmeer offers the opportunity to store more fresh water on the edges of Flevoland. This can be done in combination with agriculture such as paludiculture or recreation and nature, such as riparian forests. In these ways the water network impacts recreation, nature and agriculture.

transition: water network

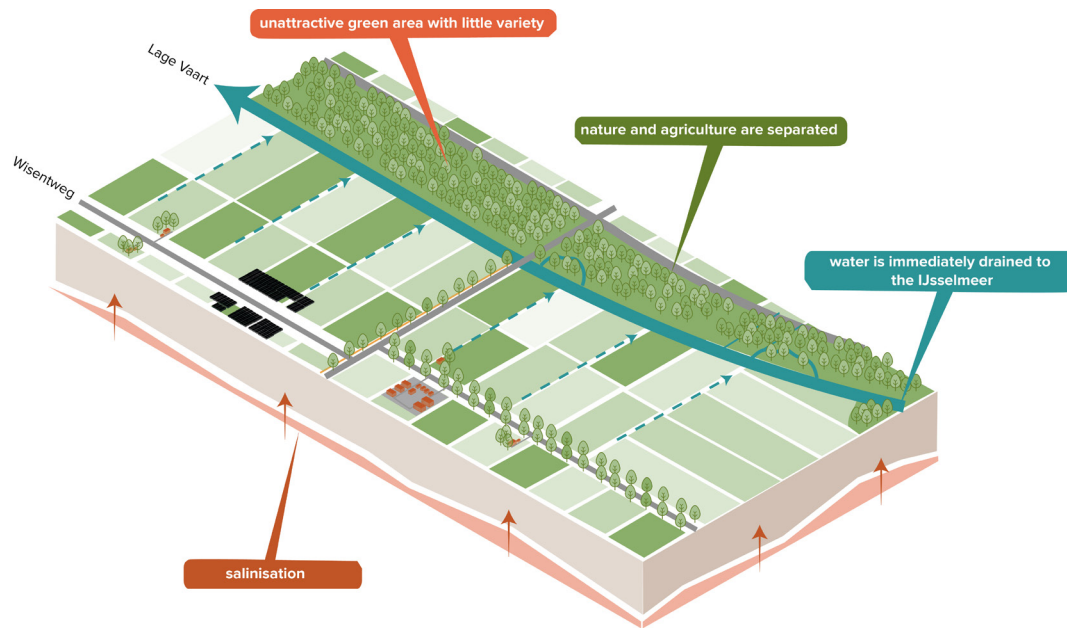


Fig 50: current situation water network, by author

Current situation

The existing water system in Flevoland efficiently directs surplus water to the IJsselmeer or the Randmeren, with no provision for retaining water during dry spells. This lack of water retention exacerbates soil salinization during droughts due to insufficient counter pressure against saline groundwater caused by constant drainage. Furthermore, the water system prioritizes functionality over aesthetics, making the surrounding areas less attractive for humans.

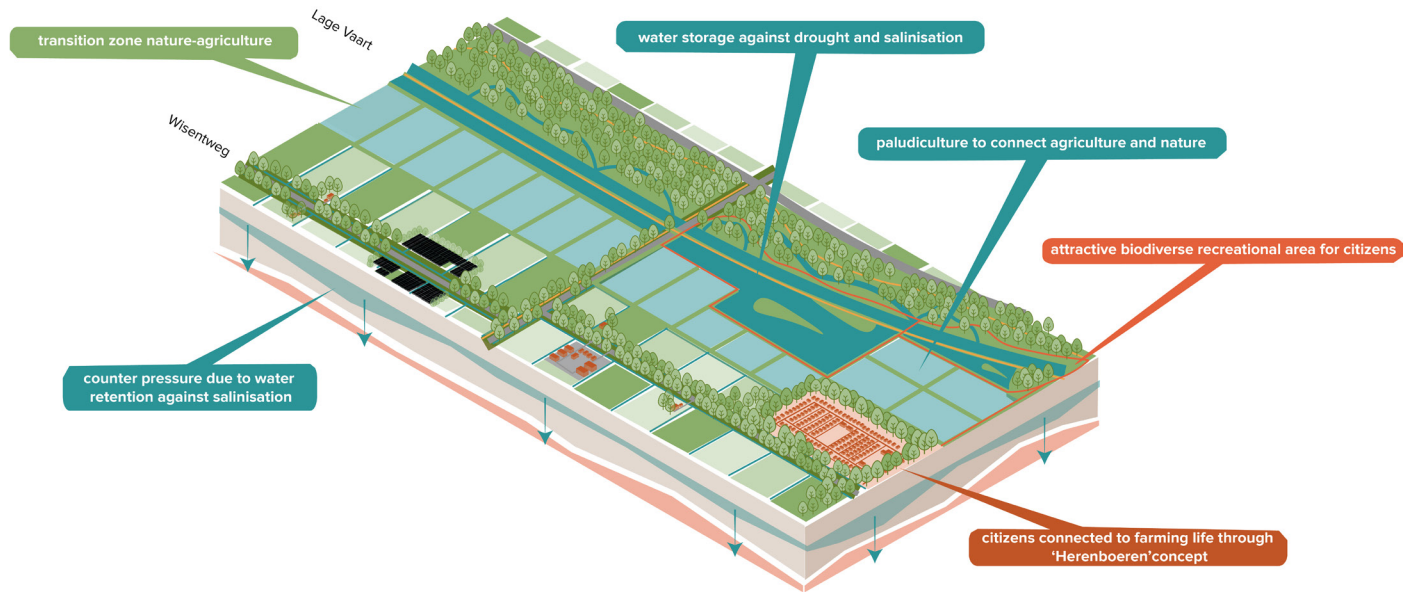


Fig 51: transformation water network, by author

Transformation

The future of the water system in Oostelijk Flevoland focuses on enhancing water retention. By implementing measures such as creating reservoirs, utilizing floodplains, engaging in paludiculture, and expanding waterways, there is potential to retain sufficient water to mitigate droughts and exert counter pressure on saline groundwater. This approach can be coupled with the development of a more visually appealing and recreational landscape, facilitating public understanding of landscape dynamics.

Exploring

Vision Oostelijk Flevoland

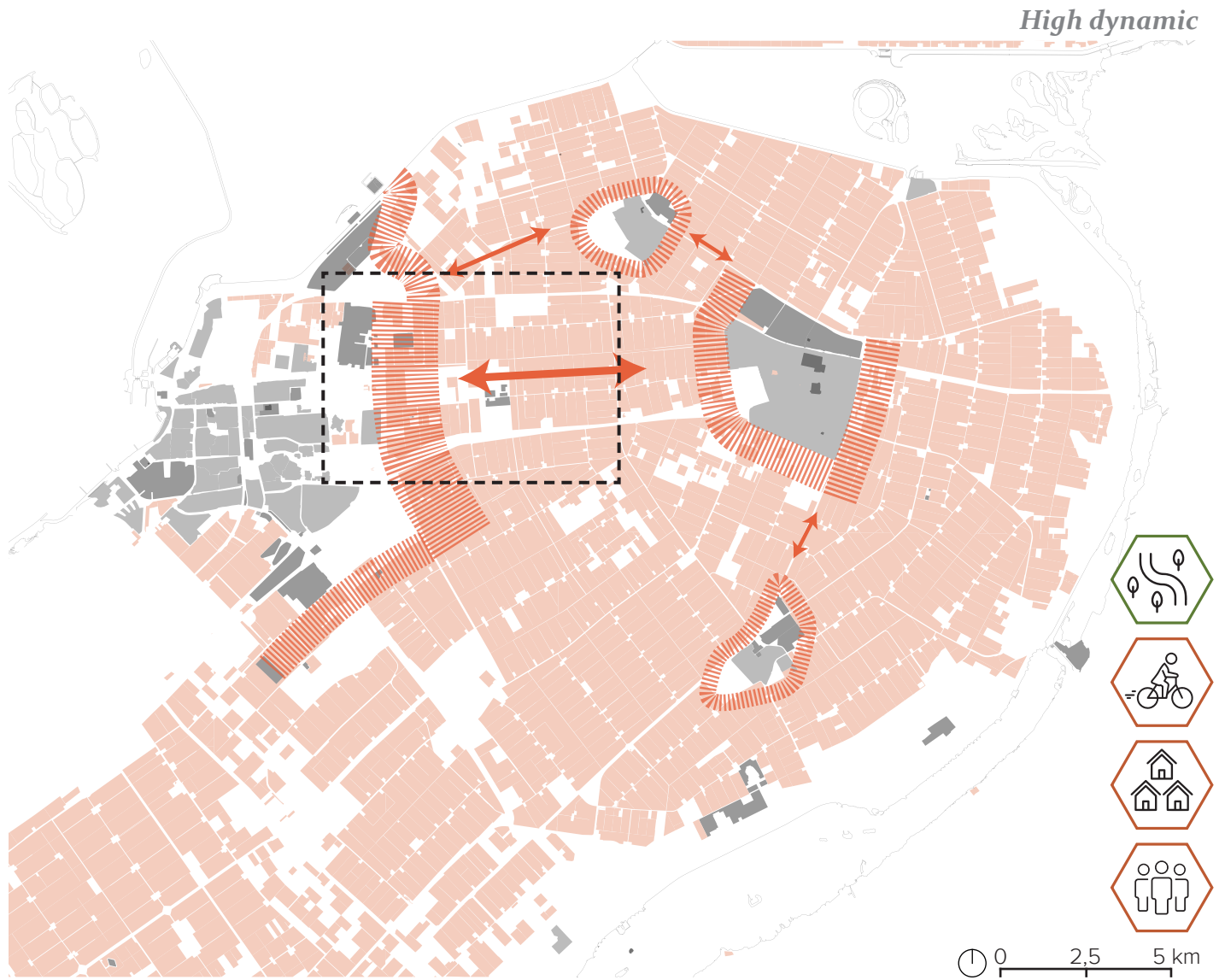


Fig 52: Vision connecting farmer & citizen, by author



Create a good connection
between city dweller and
farmer.



Create new recreational
routes



Add more recreation to
the area

Connection farmer & citizen

The high dynamic layer brings attention to the relationship between urban and rural areas, which is currently lacking in both physical and mental aspects. To overcome this challenge, it is essential to establish transition zones that bridge the gap between the two. Such zones will soften the physical barrier and create a more welcoming environment where citizens can engage in recreational activities in rural areas. These transition areas are identified in red, and they include recreational spaces, nature trails, and innovative housing options that blur the rigid line between city and countryside.

As previously mentioned, the green and water networks have a significant impact on enhancing the attractiveness of the landscape. This positive

impact contributes to the creation of the high dynamic layer. The combination of these layers results in a sustainable, productive, and recreational ecological landscape.

transition: connection farmer & citizen



Fig 53: current situation
connection farmer & citizen, by author

Current situation

Research into the existing dynamics between urban and rural areas reveals a clear physical and psychological divide. The clear physical separation between urban and rural areas prevents citizens from easily moving to rural areas, reinforcing the mental separation between the two. Furthermore, the separation of production and consumption further exacerbates this divide, which is especially evident in Oostelijk Flevoland, where agricultural production is primarily focused on export markets, resulting in limited interaction between farmers and citizens in the landscape. These deep-rooted divisions perpetuate a damaging cycle that hinders progress and makes the transition to a more sustainable and resilient landscape and agricultural model challenging.

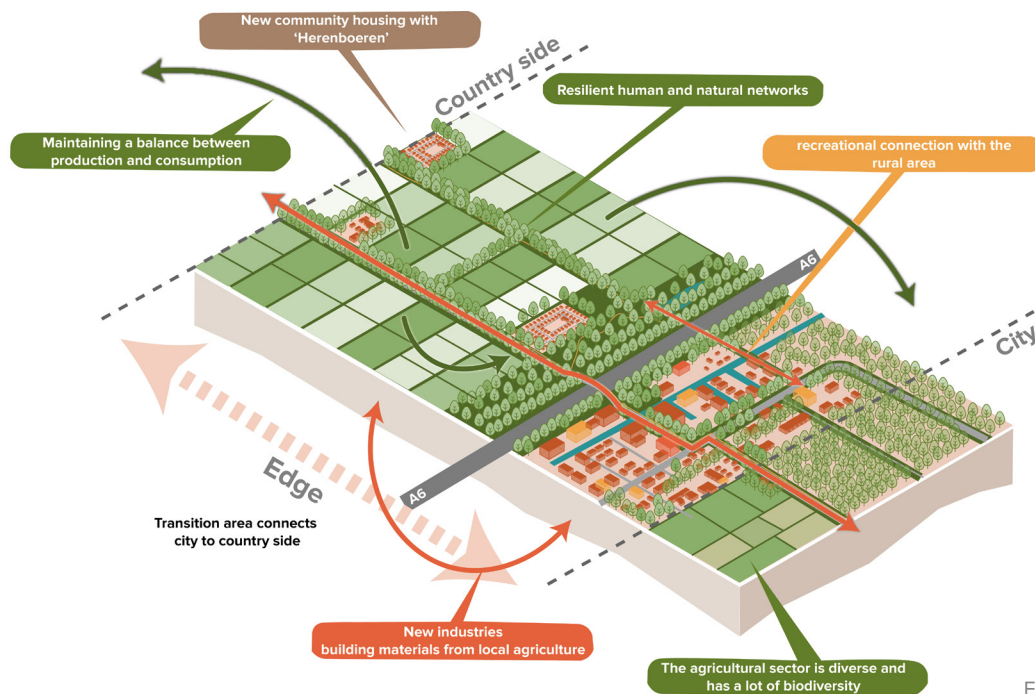


Fig 54: transformation
connection farmer & citizen, by author

Transformation

Increasing the attractiveness of the rural landscape and breaking down physical barriers would encourage citizens to become involved in rural areas, promoting a deeper understanding of farming life and fostering closer links between farmers and residents. Introducing greater agricultural diversity, establishing farmers' markets and cultivating new communities with a 'Herenboeren' concept would promote a more balanced relationship between production and consumption. Creating a transitional 'edge' where urban and rural environments intersect, allowing closer interaction between farmers and citizens, would facilitate the transition to a more sustainable landscape and agricultural model.

Chapter 6

Designing

Vision Farm of the Future 2050

Green network

Agroecology

Water Network

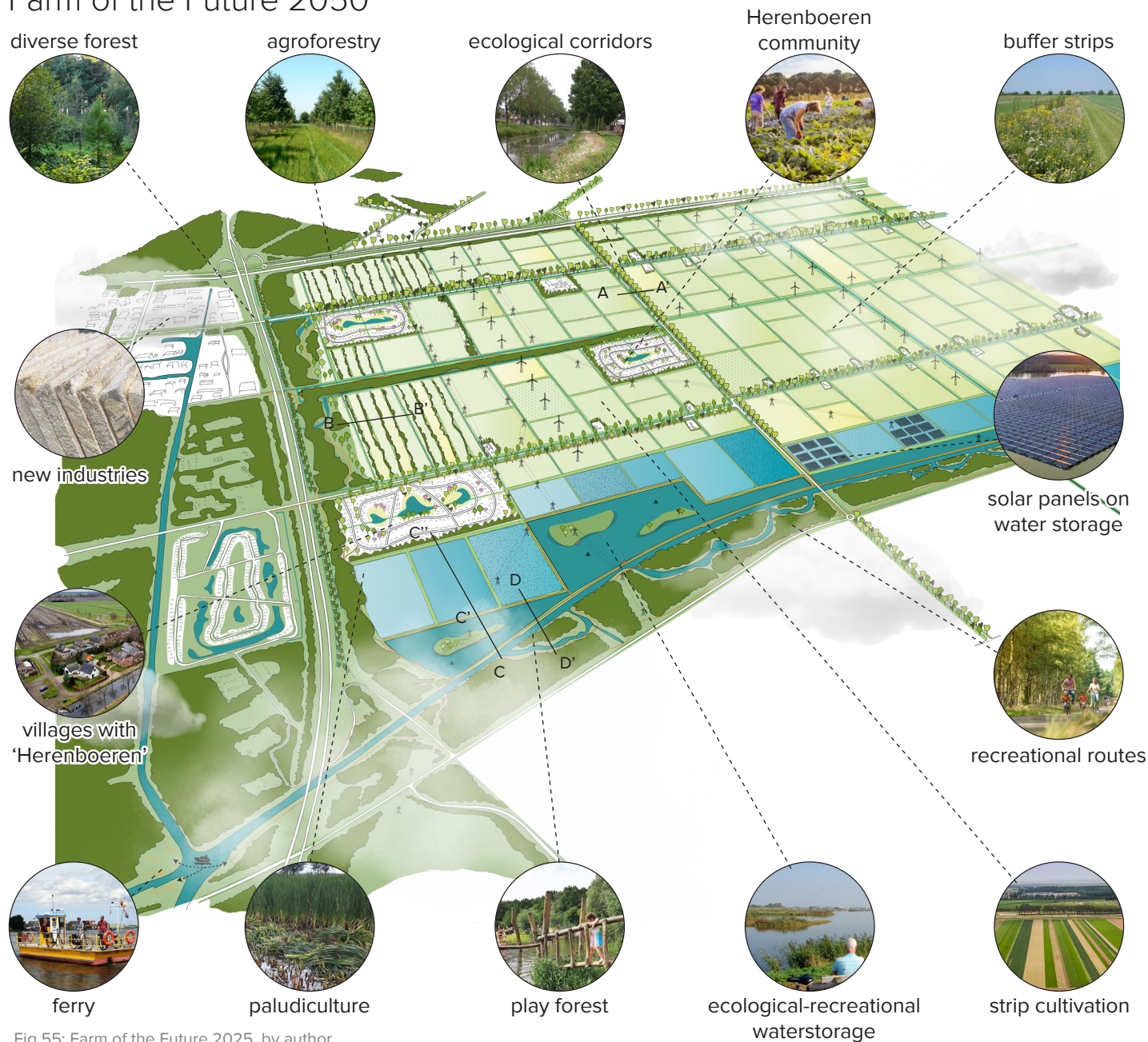
Connection Farmer & Citizen

Phasing

Expansion: Oostelijk Felvoland 2075

Designing

Farm of the Future 2050



Over the past 25 years, the Farm of the Future area has undergone a remarkable transformation. This once simple border between urban and rural spaces has now become a vibrant hub where farmers and citizens come together in their appreciation for sustainable agriculture and a breathtaking natural environment. Today, the area boasts expansive green spaces, ecological corridors, and nature-inclusive farming practices, which have culminated in a landscape that is robust, diverse, and healthy.

The Farm of the Future area now offers a plethora of recreational opportunities, inviting locals to explore cycling and walking routes, play forests, and food forests. There are also efforts to retain water in this area, which provide a sustainable future

for agriculture. An ecologically conscious recreational water area offers a tranquil escape, while the solar parks, designed with nature in mind, prevent evaporation and pave the way for a brighter, more sustainable future.

The rural area has become so appealing that even city dwellers feel more connected to it. As a result, community villages have emerged, providing a space for citizens to live in rural areas and interact with farmers. These communities invest in the Herenboeren concept, which promotes circular business operations. Moreover, the industry on the west side of the A6 is also transitioning towards greater sustainability by using eco-friendly building materials such as wood and cattail insulation. These materials are produced in the adjacent

agricultural area, allowing for shorter travel distances and contributing to a cleaner environment.

The transformation of the Farm of the Future area serves as an example of a new frontier in agriculture. The area is now a thriving ecosystem where farmers and citizens coexist in harmony, proving that it is indeed possible to create a sustainable future for our agricultural sector.

Designing green network

Green structures

The Future Blueprint for the Farm of the Future outlines *a series of green infrastructures, synergistically interwoven to create a resilient ecological network*. Central to this blueprint is the **primary** green structure, consisting of extensive nature reserves such as the Lagevaart forest and green edge along the A6. These primary structures serve not only as refuges for local flora and fauna, but also as recreational refuges for activities such as cycling and hiking. Importantly, this primary framework within the vision undergoes strengthening and expansion to serve as the foundation for subsequent green structures.

- 92 Complementing the primary structure, the **secondary** green infrastructure, existing

of green corridors along the roads, strategically promotes connectivity between primary and tertiary green areas. Comprised of a diverse collection of trees, shrubs and plants, these green verges not only increase biodiversity but also provide passageways for recreational activities and destination-oriented bicycle traffic. the secondary structure comprises approximately 1.6% of the entire agricultural area. This space is maintained by the municipality.

At the same time, the **tertiary** green infrastructure harmoniously interweaves agricultural landscapes with natural habitats, embodied by the integration of headlands, field ditches and field edges. These consists of about 21% of the entire agricultural area if an average width of 3m is assumed. These edges are

maintained by the farmer himself. Comprising an array of herbs, grasses and flowering flora, these borders serve as bastions against pests and diseases, while nurturing vital insect populations crucial to pollination and ecological balance. Consequently, the tertiary green structures seamlessly integrate agricultural commitments with ecological management, exemplifying a symbiotic relationship between cultivation and nature conservation.

1.6%

Ecological corridors
maintained by Municipality

21%

***Agricultural
green network***
maintained by farmers

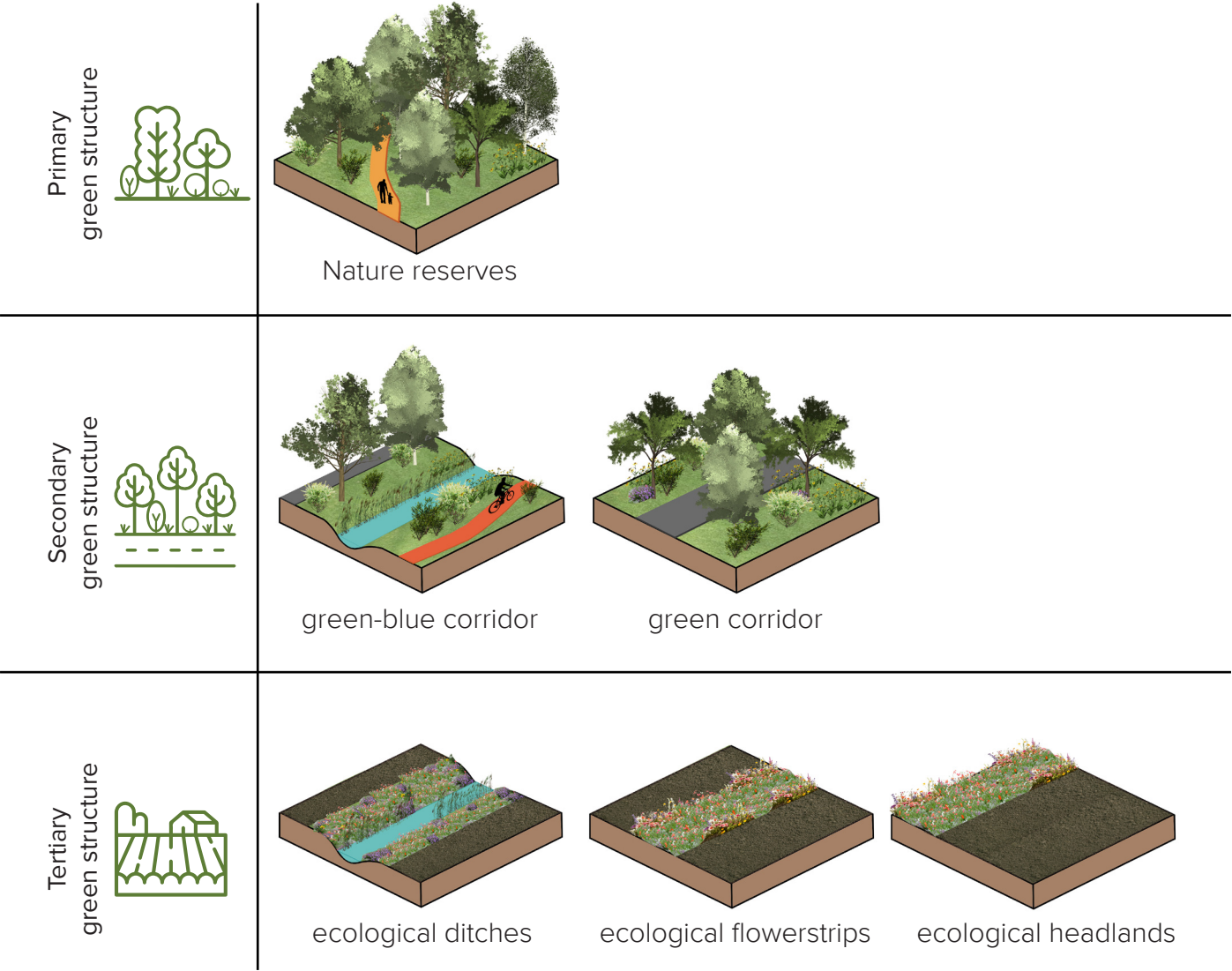


Fig 56: Tiles per design principle green network, by author

Designing green network

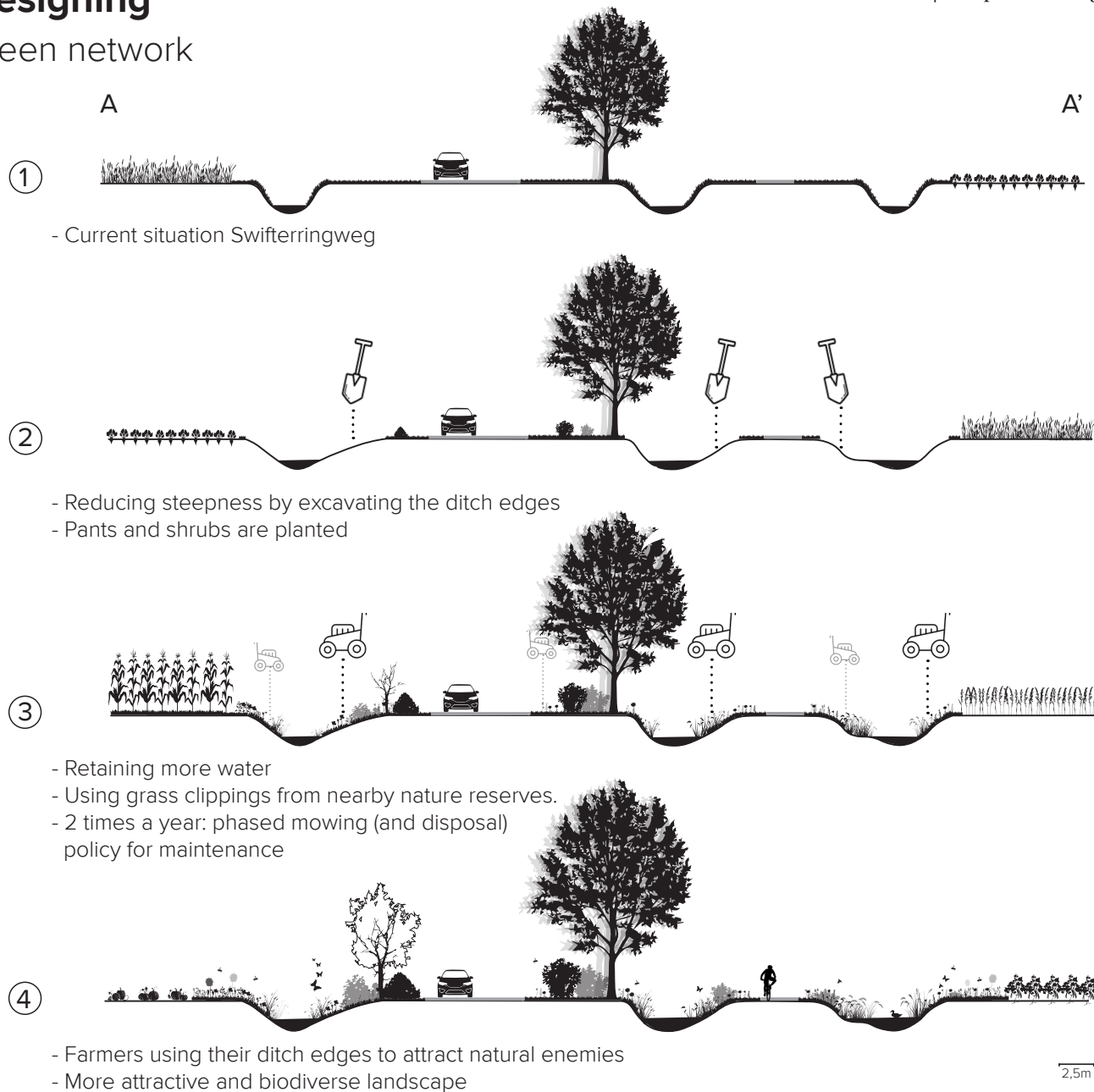


Fig 57: Section secondary green structure through time, by author

Impression secondary green structure - Swifterringweg, Lelystad



Fig 58: Impression roadside Swifterringweg after 25 years, by author



Designing

agriculture & agroecology

FAB

The concept of Functional Agrobiodiversity (FAB) primarily focuses on enhancing the natural capacity to manage diseases and pests in cultivated crops by promoting biodiversity. The objective here is to utilize natural predators of harmful insects, thus keeping pest populations at bay and promoting sustainable soil management. Ultimately, this approach can lead to a reduction in the usage of crop protection products, thus encouraging sustainable agricultural practices (Van Alebeek et al., 2011).

Field edges

Field edges, like ditch edges and headlands, are an excellent natural solution for pest control and pollination. These edges are situated close to the crop and have a greater impact on controlling diseases

and pests in cultivated crops by promoting biodiversity. Additionally, field edges act as a barrier between crops and surface water to prevent fertilizers and crop protection products from drifting (Van Rijn et al., 2011).

In Lelystad's rural area, field edges, as the tertiary greenstructure, play a vital role in creating a robust green network that stimulates functional biodiversity. A field edge that is 3 to 6 meters wide attracts insects and promotes natural pest control. It also provides enough space for various plant species that attract insects and offer a habitat for natural pest enemies. A wider field edge, ranging from 6 to 12 meters, provides shelter and a favourable environment for field birds (Van Rijn et al., 2011).

When utilizing strips designed for pollination, it is recommended to use narrow edges around the entire field rather than a single wide strip on one side of the field (Akkerranden en bloemstroken, 2021).

Annual & Perennial

There are two distinct categories of field edges: annual and perennial. The annual edge is designed to provide a blossoming edge during spring and attract honeybees and other natural predators in the summer. Meanwhile, the perennial edge serves as a living space that offers sustenance and winter shelter, particularly for ground-dwelling species like spiders and beetles. Although perennial borders may fall prey to overgrown grasses over time, they remain crucial to the survival of airborne predators.

As such, combining annual and perennial borders could prove highly beneficial for farming operations (Allema & Huiting, 2021)

Creation and Maintenance

For optimal results, it's crucial to sow in April/May on weed-free soil that has a firm soil structure to establish a field edge. Routine management tasks, as well as measures to prevent weed growth, like plowing and creating a false seedbed, are necessary for proper maintenance. To offset costs and potential yield loss, farmers may need to apply for subsidies from the Regional Association for Agricultural Nature (ANV). However, due to changes in the Common Agricultural Policy (CAP), the application process may vary in the future (Allema & Huiting, 2021).

Attract insects

Natural enemies in the agricultural sector, mainly for Aphids (Aphidoidea), are (1) Hoverflies (Syrphidae), (2) Lacewings (Chrysopidae), (3) Parasitic Wasps (Ichneumonidae), (4) Predatory Bugs (Reduviidae) and (5) Ladybugs (Coccinellidae). Also pollinators such as bees (Anthophila) and bumblebees (Bombus) are important in the field edges (Akkerranden en bloemstroken, 2021). Examples of plant species that attract these insects are**: Dill* (*Anethum graveolens*), Buckwheat (*Fagopyrum esculentum*), Parsnip* (*Pastinaca sativa*), Fennel* (*Foeniculum vulgare*), Sunflower (*Helianthus annuus*), Cornflower (*Centaurea cyanus*) and Corn marigold (*Glebionis segetum*) (Allema & Huiting, 2021).

Natural enemies



Fig 59: Natural enemies, by author information retrieved from Allema & Huiting (2021)

* = Lace-cap plants (Apiaceae) Not recommended next to carrots (Allema & Huiting, 2021)

** = Avoid species on the fringes of the same plant family as the crop used, as this increases the risk of pests (Allema & Huiting, 2021)

Plant species field edges

Fig 60: Plant species field edges, by author.
information retrieved from Allema & Hunting (2021) & Akkerranden en bloemstroken (2021)



- a. *Anethum graveolens*
- b. *Fagopyrum esculentum*
- c. *Glebionis segetum*
- d. *Cosmos bipinnatus*
- e. *Helianthus annuus*

- f. *Pastinaca sativa*
- g. *Papaver rhoeas*
- h. *Centaurea cyanus*
- i. *Trifolium pratense*
- j. *Leucanthemum vulgare*

- k. *Sanguisorba minor*
- l. *Foeniculum vulgare*
- m. *Medicago sativa*
- n. *Malva moschata*
- o. *Gypsophila paniculata*

a = annual plant
a = perennial plant

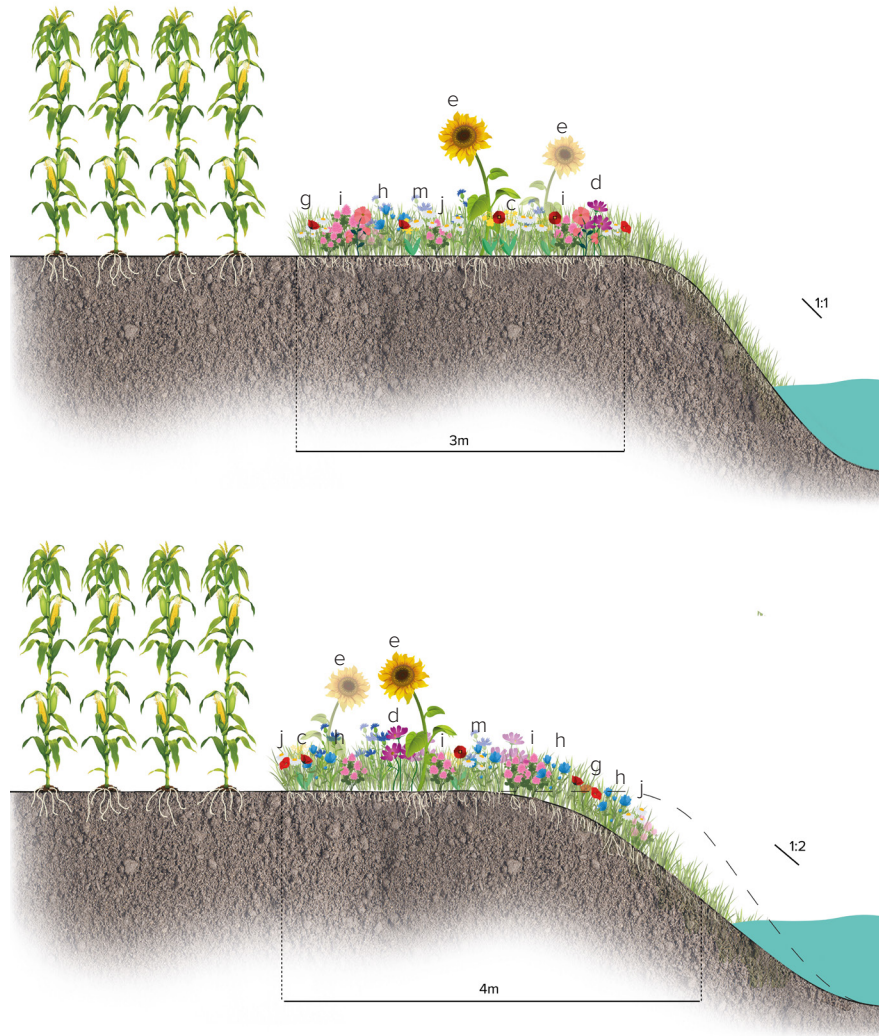


Fig 61: Section field edges, by author

Implementing field edges

Establishing field edges is a task that must be undertaken by the farmer:

1. Allow a minimum of 3 meters between the water's edge and the crop. By reducing the steepness of the ditch edge, additional sowing space can be created, maximizing the usage of the available land and adding extra water storage, see figure x.
2. Plant the field edges with annual and/or perennial plants. Avoid species of the same plant family as the crop being grown. Opt for varieties that provide shelter for meadow birds, flowers that attract pollinators, and plants that encourage natural enemies, see figure x.
3. It is recommended to outsource maintenance tasks, such as mowing, to contractors. Personal use of specialized waterfront mowers can be costly.

agriculture & agroecology

Nature inclusive agriculture

Nature-friendly agricultural practices can be adopted by utilizing unused spaces such as field edges as well as incorporating principles like strip cultivation, agroforestry, paludiculture, and more. These principles can be implemented to create a design that promotes nature inclusivity. While field margins are easier to adopt, farmers can also change their cultivation methods to achieve a more nature-inclusive approach.

To identify the best areas for these practices, a spatial analysis has been conducted. Generally, agricultural land closer to nature is more nature-inclusive, creating a seamless transition between nature and agriculture. In forested areas, food forests and agroforestry can be used for this purpose, while paludiculture and wet

cultivation can be implemented near water bodies and waterways. By reducing the plot size and adopting strip cultivation, the landscape can be diversified, benefitting biodiversity. Strip cultivation enables pest reduction and encourages biodiversity by combining different strips with various crops and flower strips.

Agroforestry

Agroforestry involves planting rows of trees on plots with a spacing of approximately 50 to 100 meters, as determined by the agroforestry researcher at Farm of the Future, see figure 63 for the layout of the concept. The distance is based on the length of the trees and their effective range, typically around 10 times the tree's height in meters. Hazelnut trees are a popular choice for this purpose, but various other species can also yield

different crops such as nuts, fruits, or wood. Agroforestry is a highly sustainable method of agriculture that has numerous environmental benefits. By integrating trees into farming practices, agroforestry helps to preserve biodiversity and promote carbon sequestration (Pantera et al., 2021). Additionally, agroforestry can be financially advantageous for farmers as they diversify their income by producing a range of tree-based products such as fruits, nuts, timber, and non-timber products (Pantera et al., 2021). The rows of trees create a natural barrier that protects crops from wind damage, provides a habitat for diverse wildlife, and reduces soil erosion, see appendix A (Kay et al., 2019). Given the increasing threat of extreme weather due to climate change, agroforestry will become even more vital (Pantera et al., 2021).

Paludiculture

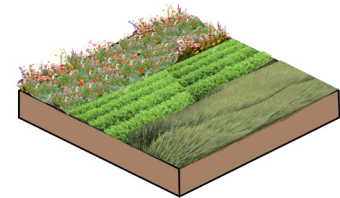
Paludiculture is a unique cultivation method that involves growing crops in water, with the water level varying depending on the crop. Its primary purpose is to preserve peat in shrinking peat soils, but in this case it serves as a water storage and nature-inclusive agricultural solution. Several crops, such as cattail, peat moss, and azolla, are cultivated through paludiculture, offering a range of market opportunities in the Netherlands. These crops have both short-term and long-term potential, as noted by Van Duursen and Nieuwenhuijs (2016). In figure X, the layout of the paludiculture system is depicted. Water is pumped onto the farmland using the pump between the water storage and the paludiculture area. The water level for cultivating cattails should be maintained between

5 to 20 cm above ground level. Cattails can be utilized as insulation, presenting a promising opportunity for the development of new building material industries in the region.

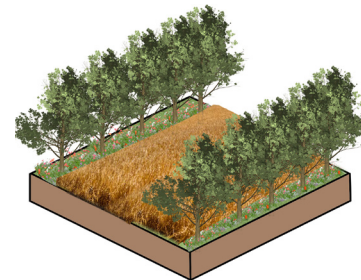
Strip cultivation

Strip cultivation involves the production of different crops in adjacent strips, typically 3 or 6 meters wide, depending on the equipment used. This approach offers several benefits, such as reduced exposure to pests and diseases, minimized use of crop protection agents, and a significant boost to biodiversity (Agriculture of the Future, n.d.). With a good understanding of crop management, strip cropping can be just as lucrative as traditional monoculture practices. For more information, please refer to appendix B (Matar, n.d.).

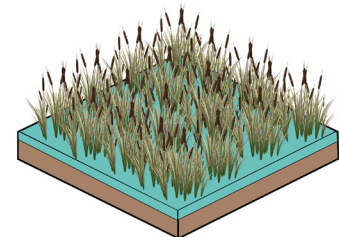
Nature inclusive agriculture



strip cultivation



agroforestry



paludiculture

Fig 62: Tiles per principle, nature-inclusive agriculture, by author

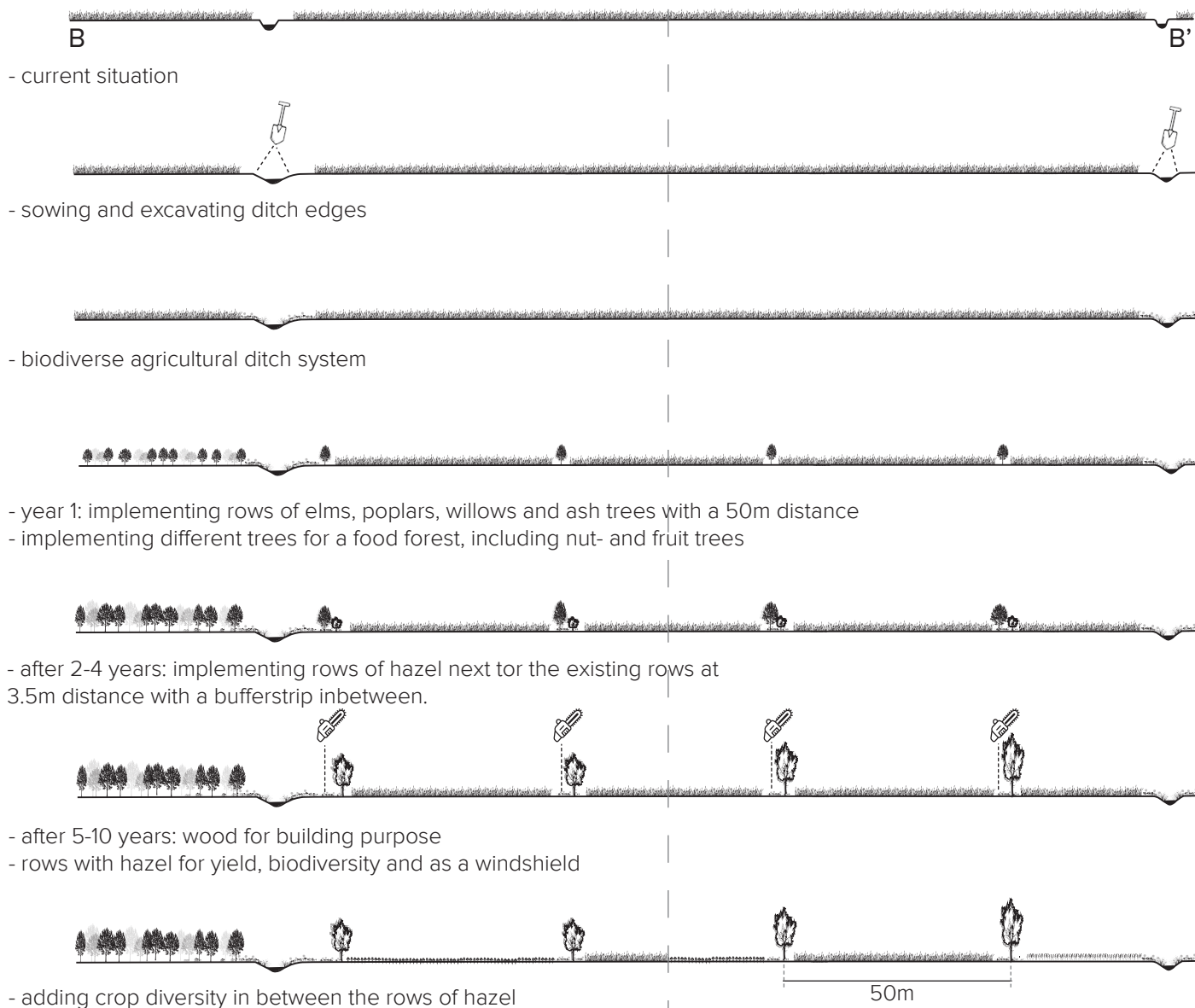


Fig 63: Agroforestry concept, made by author, from Farm of the Future

Paludiculture layout

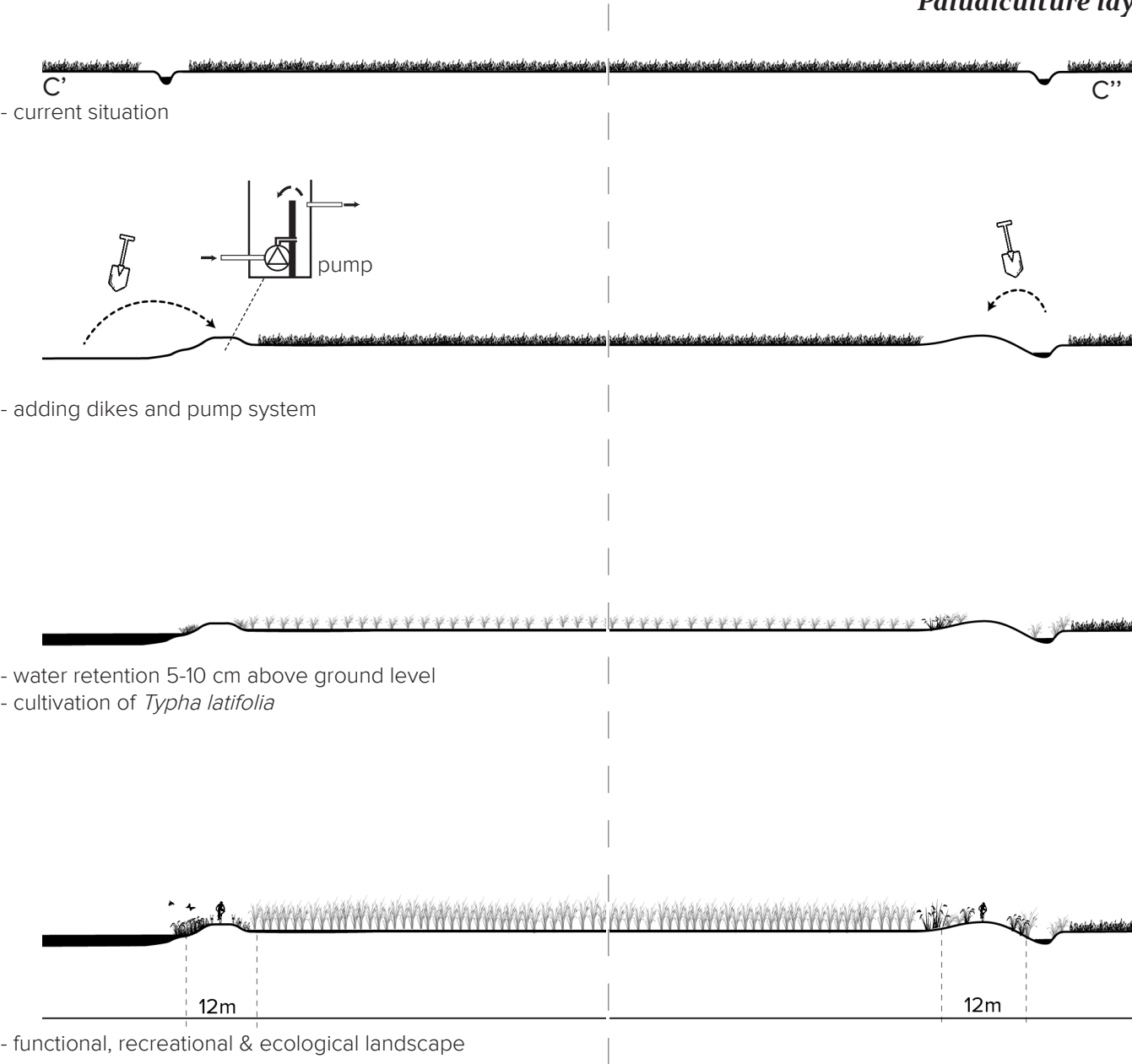


Fig 64: Paludiculture concept, made by author,

Designing

costs & benefits

Costs & revenues

When comparing the economic aspects of nature-inclusive agriculture with conventional agriculture, specific figures are not widely available. However, an assumption can be made based on the data from organic agriculture. Organic agriculture is a production system that prioritizes the health of the soil, ecosystems, and people. It relies on ecological processes, biodiversity, and local adaptations, rather than on potentially harmful resources. This aligns with nature-inclusive agriculture, which emphasizes natural pest control and strives for sustainable production practices.

Yield variation

Extensive research conducted in the USA and Europe has investigated potential yield variations between organic and conventional

agriculture. Meta-analyses of these studies, which have examined numerous comparisons between organic and conventional farming, have revealed significant yield disparities. Specifically, organic agriculture tends to yield around 20% lower compared to conventional methods (Van Loon, 2024). These variations are influenced by factors such as region and crop type, with the yield gap often widening at higher yield levels (Van Loon, 2024).

Consumer Prices

There exists a slight disparity in the quality of organically and conventionally grown products. For instance, organic food typically contains lower levels of pesticide residues and sometimes reduced nitrate, iodine, and selenium. Yet higher levels of antioxidants, omega-3 fatty acids, and iron.

Furthermore, a notable characteristic of organic products is their relatively higher cost in supermarkets. In the Netherlands, the difference in price compared to regular items is approximately 43%. Consuming organically grown food for a year in the Netherlands amounts to around €600 per person, which dissuades many from purchasing organic products. The elevated prices of organic food in supermarkets are partially due to the higher production costs, primarily resulting from lower yield levels, as well as the increased manual labour required for weed control and the expenses associated with certification inspections.

organic agriculture
39 % more costs
37% more revenue
than conventional agriculture

(Centraal Bureau voor de Statistiek, 2023)

A new earning model

An analysis conducted by the RIVM over 30 years (2025-2055) has evaluated the balance between the benefits and costs of field margins in the Hoeksewaard region. The study examined different aspects including crop production, pollination, pest management, water quality, climate, recreation, and biodiversity. The results indicate that the advantages of field edges for humans, nature, and the environment are roughly equivalent to the drawbacks. For example, a more attractive landscape and reduced costs for water purification outweigh a lower yield and the expenses associated with constructing the edges (Paulin et al., 2023). The ecological benefits of these field edges cannot be expressed in monetary terms, and while there may be additional health benefits due

to decreased crop protection products in surface water, these were not included in the analysis (Paulin et al., 2023).

The farmers bear the costs of these edges, but they provide a variety of ecosystem services, figure 65. Thus, the costs and

benefits are not distributed evenly. The RIVM suggests that in the future, all parties involved should share these expenses equally to promote the creation of nature-inclusive agriculture through the construction of ecological field edges (Paulin et al., 2023).

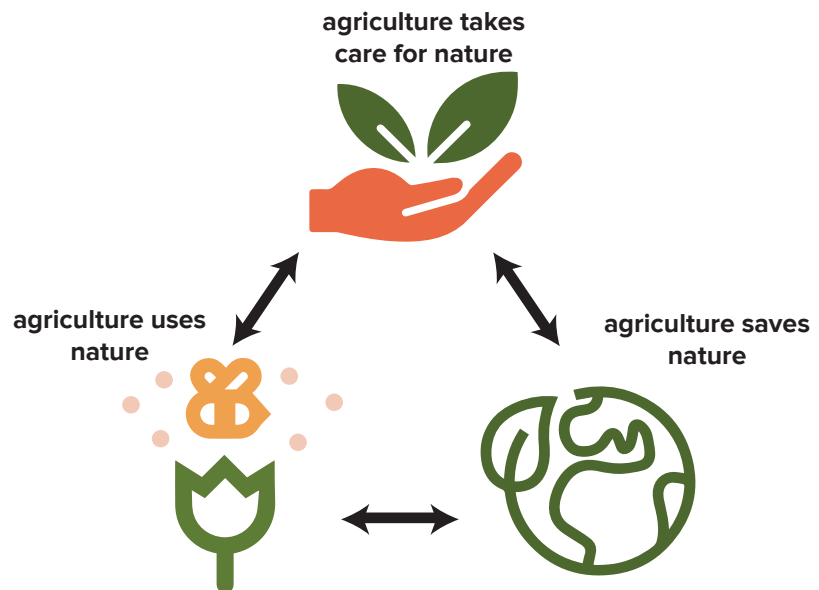


Fig 65: Nature-inclusive agriculture services, by author

Designing

water plan & agriculture

Water design

This design's water plan is divided into two parts. The first part entails a **water storage** facility adjacent to the Lage Vaart that taps and stores water for dry periods. Although this storage requires the sacrifice of 123 hectares of agricultural land, it is 2 meters deep and produces enough water to irrigate the entire area of approximately 2,300 hectares during dry periods, if it is assumed that there is a deficit of 100 mm of precipitation per year per hectare (Van Bakel et al., 2009). Furthermore, this water storage serves other purposes, such as recreation and contributes to biodiversity and nature in the area, making the agricultural region more appealing.

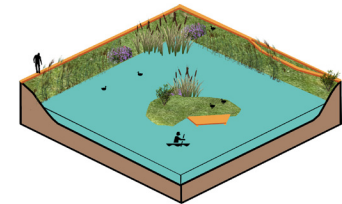
The second part, located next to the water storage, comprises **paludiculture**. Because the

water level for wet cultivation is relatively low, dikes are built around the fields in question to keep the water in the fields. These dikes also provide ecological habitats for various flora and fauna, as well as pleasant routes through the rural area, where citizens can learn more about the different types of cultivation systems.

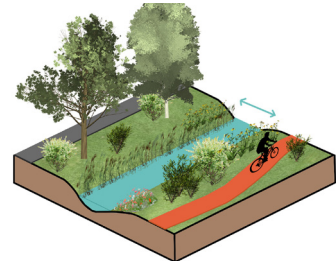
Widening waterways

The cross-section of the field edge shown in figure 57 demonstrates that ditches and waterways can be utilized to improve water retention. By excavating the edges of the ditch to create a gentler slope and widening the ditch itself, a greater amount of water can be held without altering the water level. This approach is typically most feasible for roadside ditches in Oostelijk Flevoland, where there is usually plenty of space for these modifications.

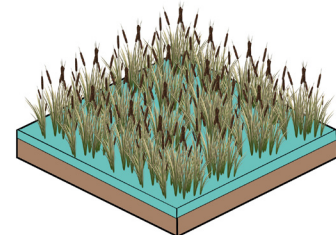
water retention



water storage



widening waterways



paludiculture

Fig 66: Tiles per principle, nature-inclusive agriculture, by author

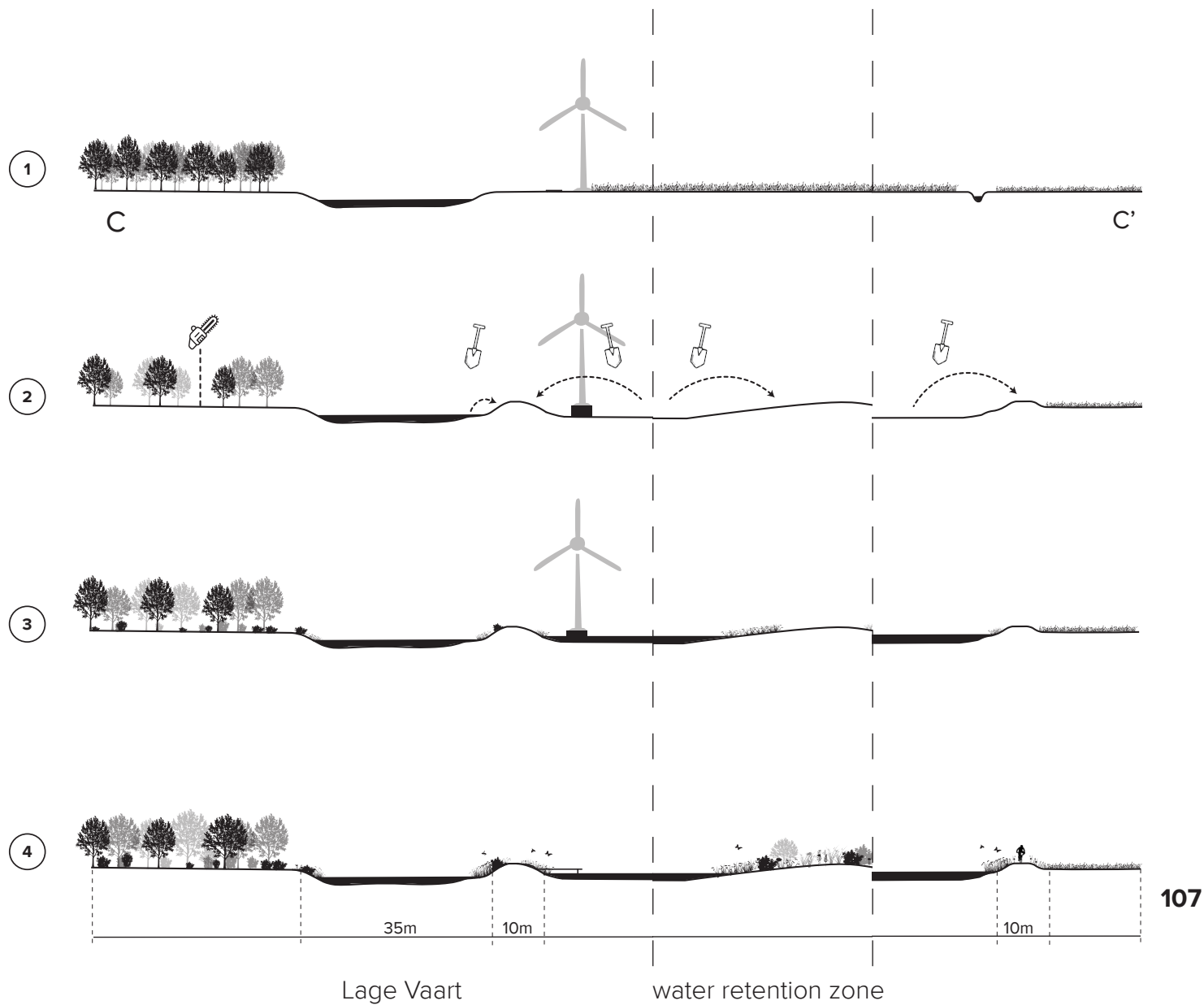


Fig 67: Section Lagevaart bos, Lage Vaart and waterstorage, by author

Designing water plan

An ecological, recreational and functional landscape

By integrating the Lagevaart bos and water storage with paludiculture, an transitional zone between natural and agricultural areas is established. This area offers plenty of room for biodiversity, recreational activities, and cultivation. It serves as a visible reminder of the rural area's intended use, which helps people better connect with the agricultural landscape and

develop an appreciation for it. These changes in the physical landscape layers also lead to a shift in the cultural and mental aspects of the area and its people.

Habitats

In this transitional zone between land and water, a variety of habitats support diverse flora and fauna. The Lagevaart forest provides a haven for larger mammals and birds, while figure 69

depicts the dike separating the paludiculture and water storage areas, which offer room for water bankside flora and fauna. Visitors are also welcome to explore and appreciate the natural surroundings.

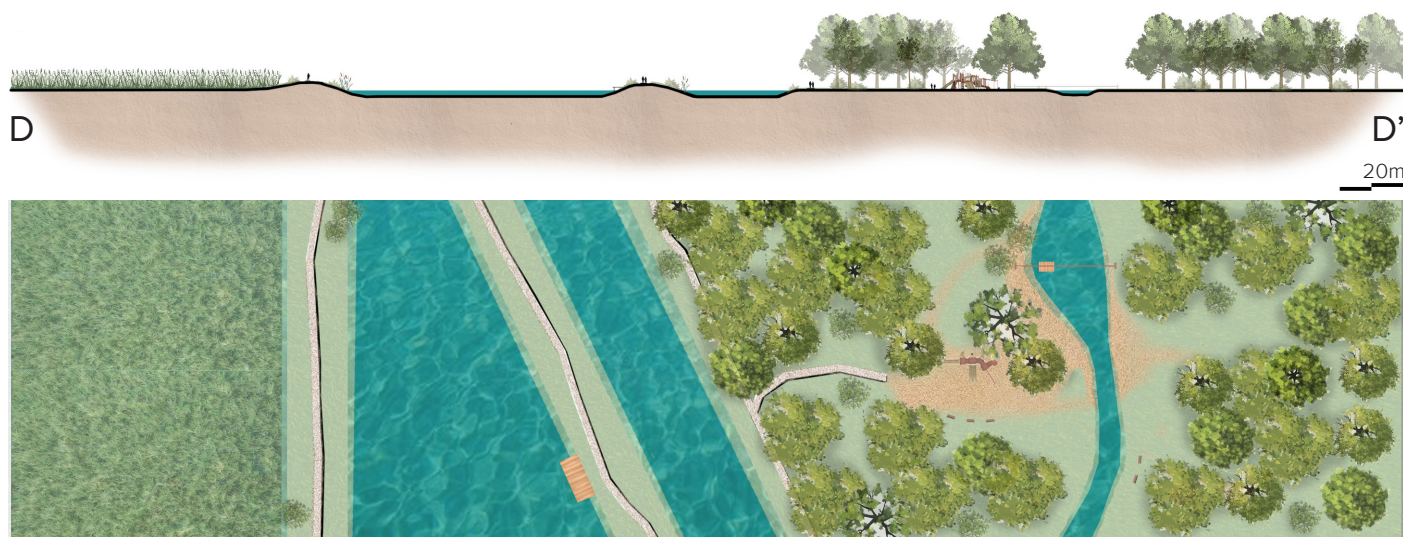


Fig 68: Section paludiculture, water storage, Lage Vaart and Lagevaart Bos, by author

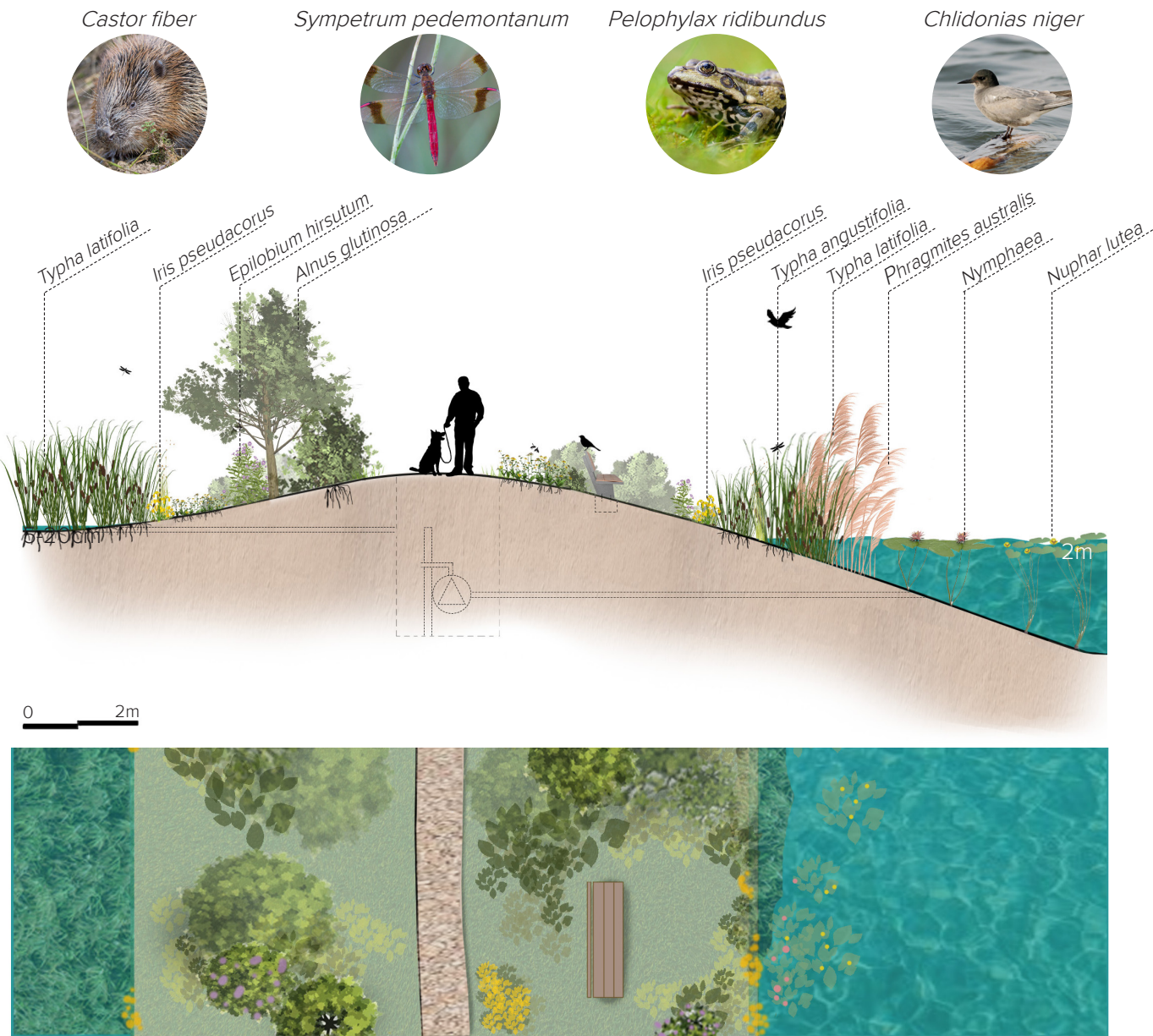


Fig 69: section ecological recreational dike inbetween waterretention zone and paludiculture, by author

Designing

connection farmer & citizen

To foster a stronger connection between farmers and citizens, it is essential to prioritize the development of rural areas. By implementing new green networks and expanding existing nature reserves, which may include water storage, forests, and food forests, the Lelystad area becomes more appealing to its residents. Moreover, new recreational routes specifically designed for cyclists and walkers will be created, connecting these citizens with the surrounding agricultural landscape.

As part of the efforts to promote this connection, various recreational amenities such as bed & breakfasts, eateries, and farmers' markets will be integrated. In addition, educational programming will also be included. For instance, the Farm of the Future pilot company in Lelystad offers

guided tours and explanations for visitors to learn about farming practices. Educational resources such as signs and visiting farmers who offer educational experiences will also be made available throughout the area.

Anticipating future population growth, the vision includes plans for new residential communities beyond the A6, within the agricultural area. These communities will operate according to the 'Herenboeren' concept, which has successfully connected farmers and citizens in other regions of the Netherlands.

Herenboeren

'Herenboeren' is an initiative that promotes a unique approach to food production. The core idea is to have farms owned collectively by communities of households

who share the harvests, see figure 70. Members of the collective have a say in the production processes, which prioritize ecological and sustainable practices without using harmful pesticides (Herenboeren, 2024). The ultimate objective is to achieve fully circular business operations. The 'Herenboeren' movement was established in 2016 and has expanded to include 21 operational collectives throughout the Netherlands (Herenboeren, 2024).

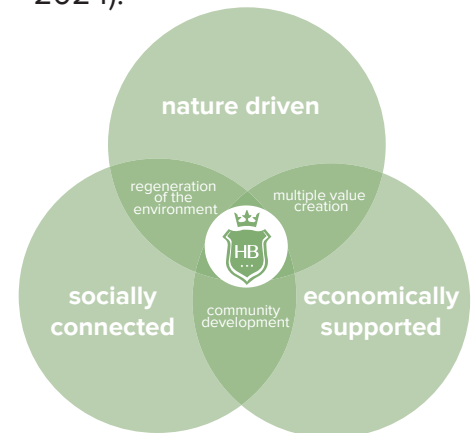


Fig 70: The 3 pillars of the Herenboeren Concept translated by author from Herenboeren (2024)

New routes

One of the most important things to improve the connection between the city and the countryside is to create attractive routes. This physical connection ensures that the physical disconnection will be bridged, and people will be more inclined to walk or cycle through the rural area.

This will improve the mental connection between farmer and citizen gradually and with that, the cultural layer is also shifting towards a strong bond between farmer and citizen.

In figure 73 a route sequence is depicted through this new landscape.

The route shows the variety of the landscape at eye level when walking from the new village through the new functional nature reserve. From a new diverse forest to paludiculture, to a water storage that also offers recreation and a beautiful view over the water back to the spacious green village.

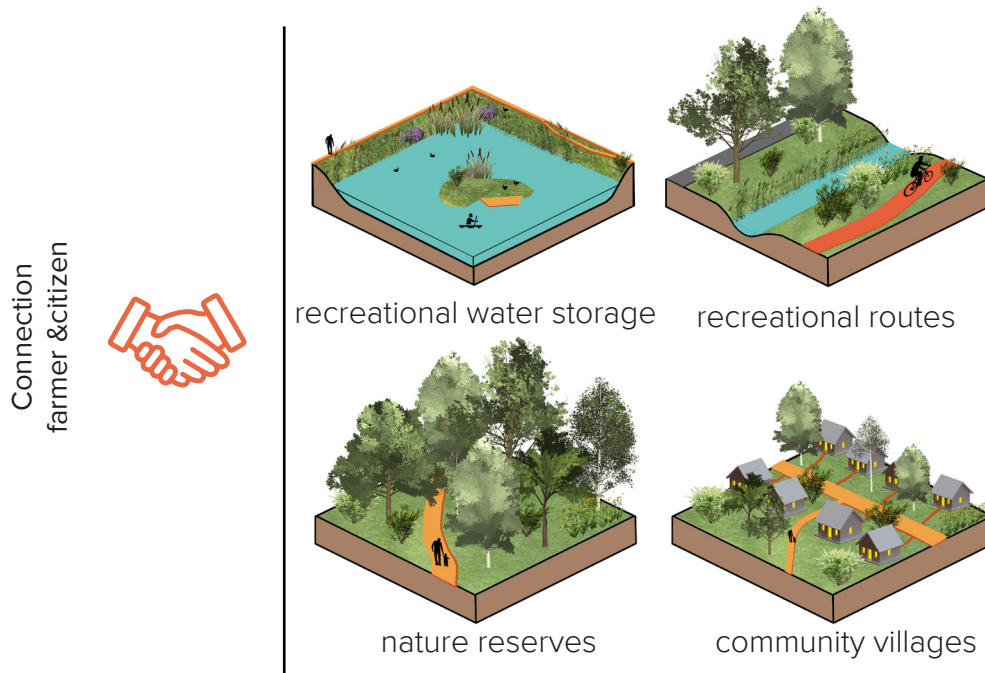


Fig 71: Tiles per design principle green network, by author

Designing

connection farmer & citizen

Part 2 | Chapter 6: *designing*



Fig 72: New villages with 'Herenboeren' concept, by author

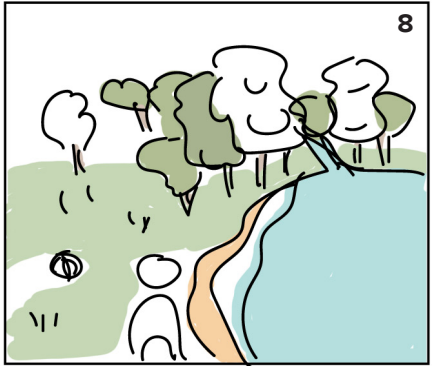
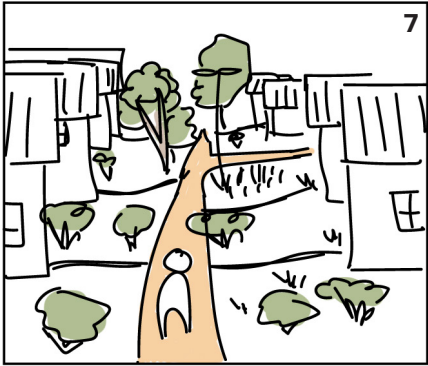
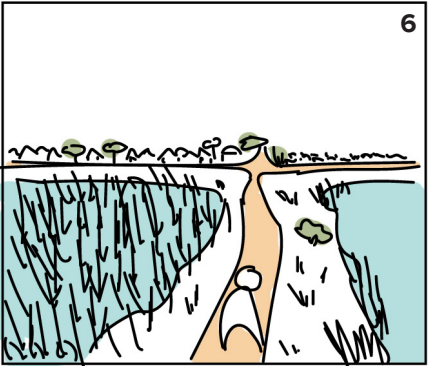
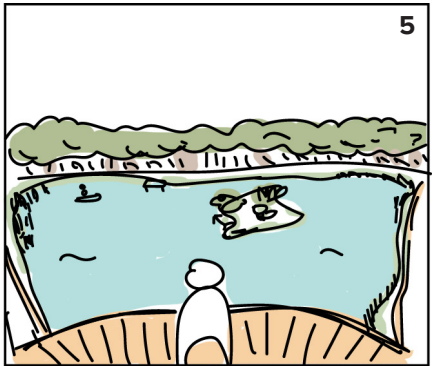
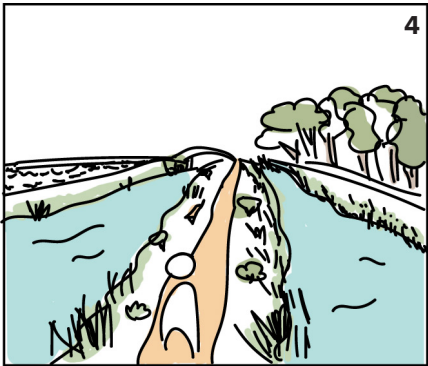
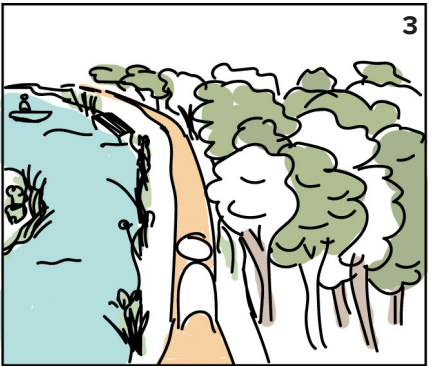
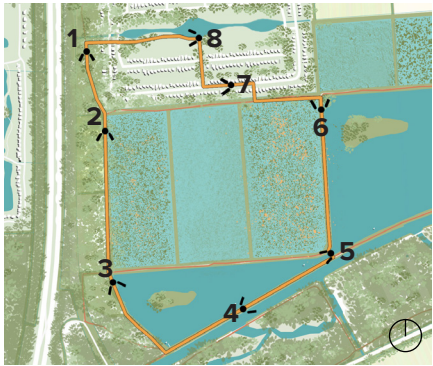
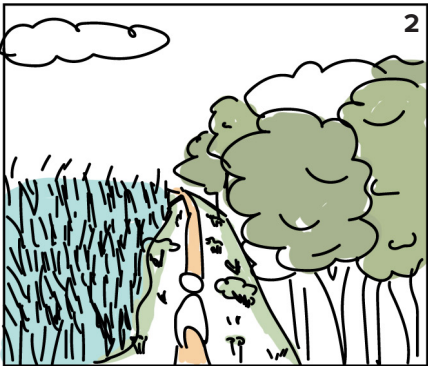
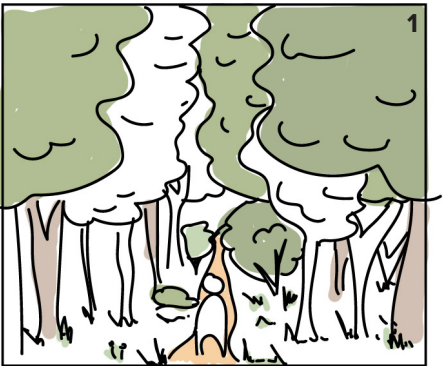


Fig 73: route sequence, by author

phasing Farm of the Future area

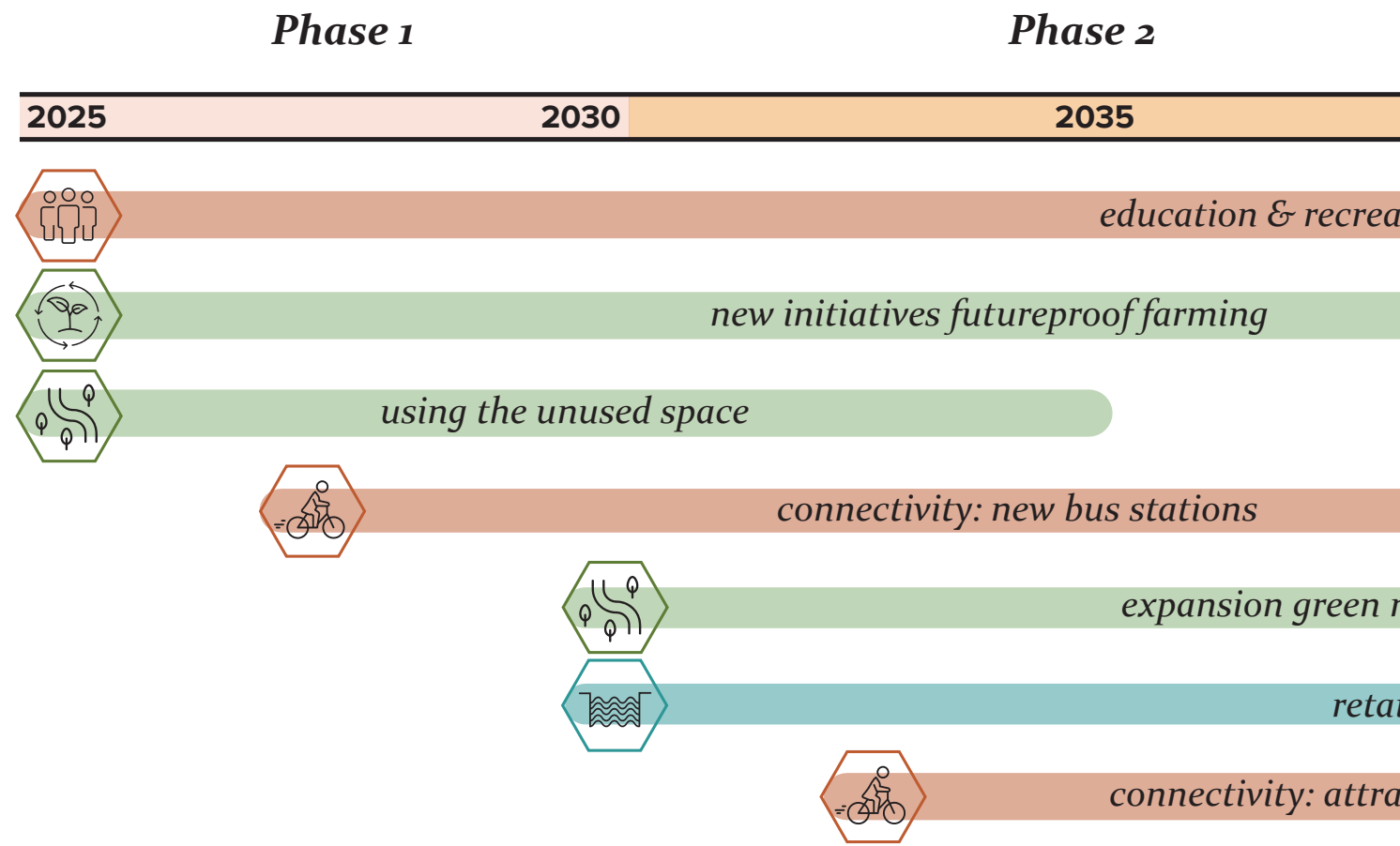


Fig 74: Phasing Farm of the Future area, by author

Phase 3

2040

2045

2050

creation

Urban network and nature reserves

Retaining water

tractive bike and walking pathways



new living communities: 'Herenboeren concept'

expansion of initiatives



Fig 75: phase 1, by author

explanation icons



Existing busstation



New busstation



Education



Cafe or restaurant



Park



Playground



B&B or camping



Farmers market

2025-2030

Depicted in figure 74, one can see the phasing plan towards a more sustainable and futureproof rural area starting with phase 1.

The initial stage of the 'Farm of the Future' plan (figure 75) is to make the most of the available space by using areas that are currently unused, such as verges, ditch edges, and headlands. This will be achieved by planting shrubs and trees in verges, sowing in field margins, and excavating ditches to enhance water retention capabilities and constructing natural banks.

Furthermore, farmers are taking the lead in promoting recreational activities such as hosting a farmers market featuring locally grown produce, offering

bed and breakfast services, and providing educational opportunities for visitors.

Subsequently, new bus stations and routes will be established to enhance the physical connectivity between the urban centre and the surrounding countryside.

In the field of agriculture, there are ongoing experiments with various forms of nature-inclusive cultivation, and this trend is expected to continue. To foster greater crop diversity, the size of fields will be decreased, and flowery buffer strips will be used to differentiate between plots, similar to the concept of field edges.

Designing

phase 2

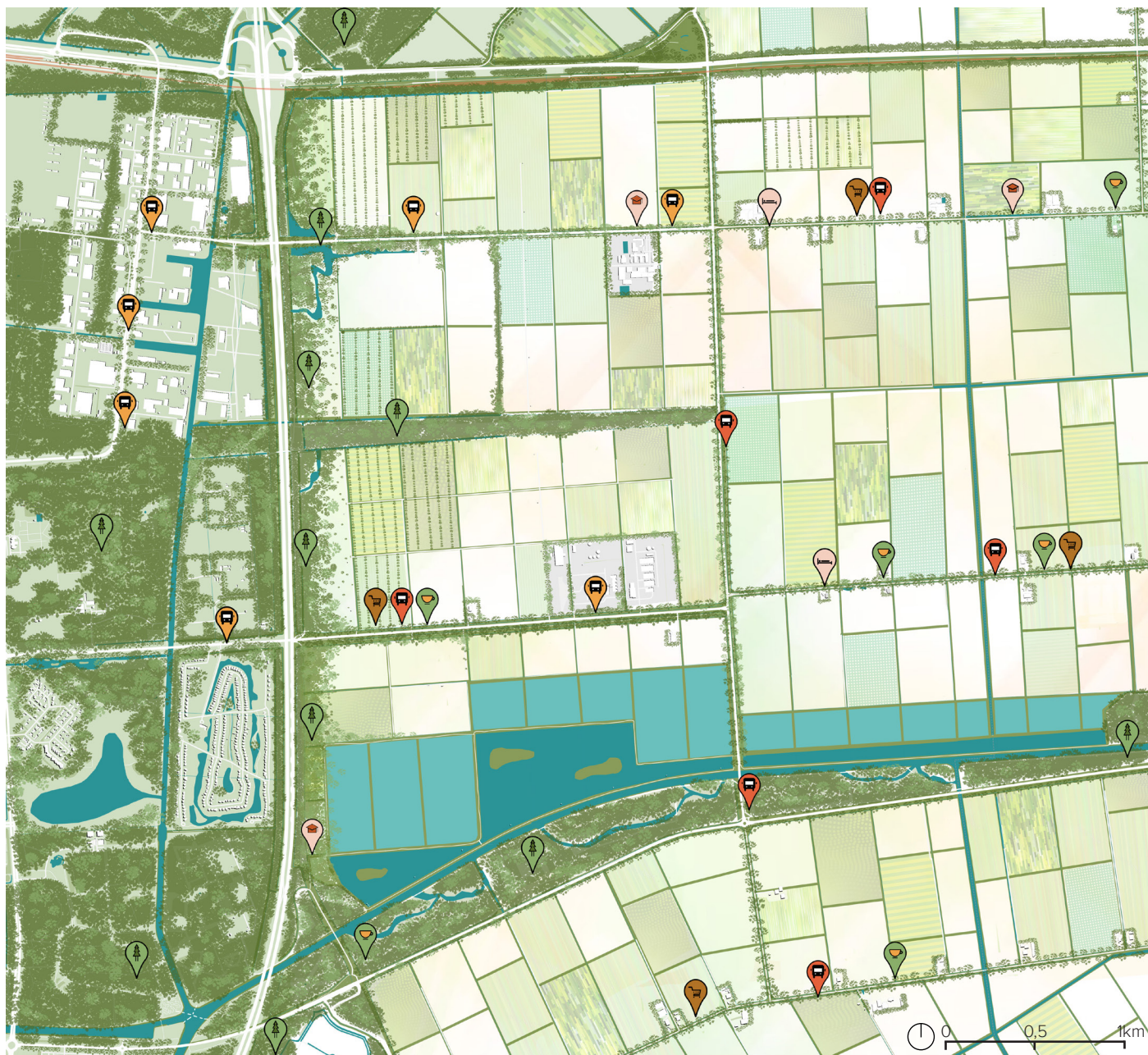


Fig 76: phase 2, by author

2030-2040

The second phase of the transformation aims to enhance nature and improve water retention in the area, see figure 76.

A new nature reserve will be established, featuring a forest with a focus on shelter and recreation, adjacent to the A6. This will help bridge the gap between the city and the countryside by creating a more gradual transition, as several forests already exist on the city side of the A6.

To increase the diversity of trees in Flevoland and strengthen the network, multiple varieties of trees will be planted in this forested area. Fruit and nut trees will be emphasized to allow people to enjoy the fruits while walking or biking.

Additionally, the Lagevaart forest will be reinforced by removing any ailing trees to create space for new trees, shrubs, and plants. The Lage Vaart occasionally flows through this wooded area, providing attractive recreational spots.

A water storage facility will be constructed on the north side of the Lage Vaart. This storage will utilize water from the Lage Vaart, retaining it in the area to provide a steady water supply during dry periods. Beyond its functional purpose, the storage will also expand the nature reserve and offer recreational opportunities, such as boating and fishing.

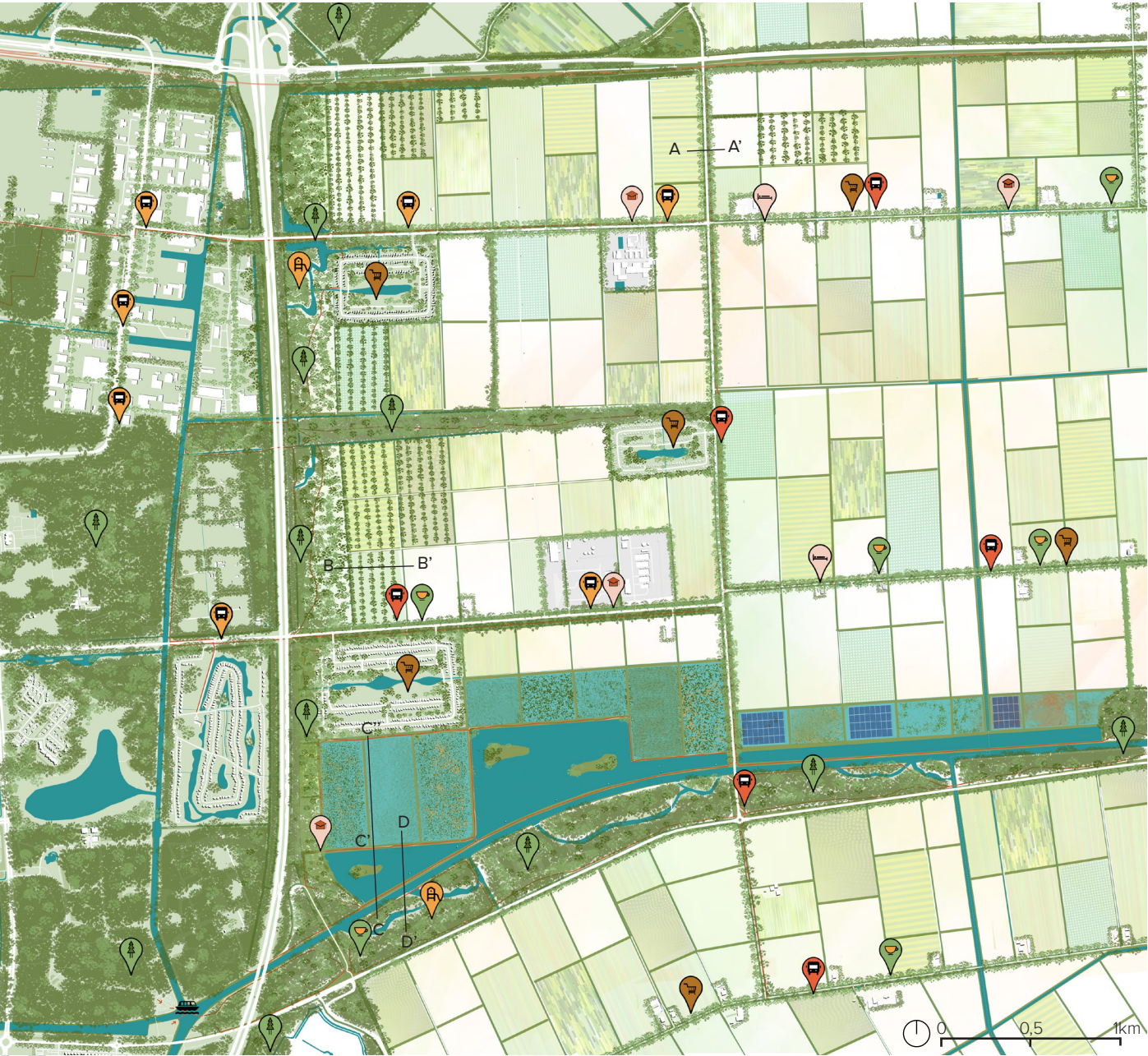
Furthermore, the area next to the water storage will be designated for paludiculture. This will allow the Farm of the Future organization to

experiment with various wet crops that are more nature-inclusive and to test the production of building materials such as cattail insulation.

All of these developments will be complemented by recreational routes throughout the new and improved nature reserves, allowing for a harmonious interplay between the city, agriculture, and nature.

When it comes to agriculture, agroforestry will primarily target forested regions, while paludiculture will centre on the wetlands near Lage Vaart. In the remaining areas of the region, strip cultivation is currently being trialled. This differentiation mirrors the agricultural landscape of Oostelijk Flevoland, which is characterized by distinct zones of wooded perimeters, fresh water seepage rich zones, and

Phase 3



120

Fig 77: phase 3, by author

2040-2050

In the third phase of the plan, the aim is to improve the needs of both citizens and farmers, see figure 77. This will include enhancing recreational opportunities, developing efficient routes, promoting agriculture that is nature-inclusive, and introducing new residential communities with the 'Herenboeren' concept. The main focus in this phase will be on the high dynamic layer, which is only possible due to the improvements made to the low dynamic layer in phases 1 and 2. It is important to note that the high-dynamic layer will also have a significant impact on transforming the low-dynamic layer. By improving the physical and mental connection between the city and the countryside, it will be easier to transition to more sustainable agriculture practices.

To achieve this, new residential communities are designed in a way that connects them to the city through recreational routes. This will make the entire rural area next to Lelystad more recreational, ultimately creating an ecological network that connects the city, countryside, and nature.

In the pages ahead, the progression through these phases is captured through eye-level impressions in multiple locations.



future of the agriculture

Fig 78: impression transformation agriculture, by author



future of the unused space & villages

Fig 79: impression transformation unused space, by author



future of the Swifterringweg & water retention

Fig 80: impression transformation secondary green network, by author



future of the recreation in the Lagevaart Bos

Fig 81: impression transformation Lagevaart bos, by author

Chapter 7

Concluding

Main findings
Phasing Oostelijk Flevoland
Vision Oostelijk Flevoland
Recommendations for the provinces

main findings

Which landscape architectural strategies could be used to increase the effectiveness of ecological infrastructure in rural areas to connect landscapes, promote functional agrobiodiversity, and restore biodiversity?

Several strategies fall into different categories, depending on their intended outcomes., see figure 83. First, there are strategies to strengthen the green network to create an attractive, agroecological, and biodiverse landscape. These include robust ecological corridors, nature-friendly banks, healthier nature reserves, and field edges.

Second, the strategies which promote nature-inclusive agriculture for a more diverse agricultural sector and natural pest management through agroecology and water quality. These strategies include buffer strips, nature-inclusive field edges, nature-friendly banks, paludiculture, agroforestry, and strip cultivation.

Third, the water retention strategies. These are effective for improving the ecology of the landscape, mitigating the impacts of drought and salinization due to climate change, and can be combined with recreation. These strategies include water storage with recreation, plasticulture (water retention in combination with nature-friendly agriculture), and widening waterways.

Finally, the strategies to strengthen the connection between farmers and citizens. This is crucial for creating a connection between urban and rural areas, making the transition to a more sustainable landscape easier. This can be achieved through recreation, an attractive rural landscape (as

described above), education, recreational routes, and new residential communities.

By incorporating these landscape architectural strategies, it is possible to create a rural landscape in Lelystad that not only enhances agricultural biodiversity but also tackles climate issues and re-establishes the relationship between farmers and citizens. This will enable the creation of an agricultural landscape that is prepared for the future.

It is important to understand that the strategies used to complete the six design assignments have an impact on each other, see figure 82. As a result, the implementation of certain strategies may lead to outcomes that differ from what is described in this thesis, as they may not take into account input from the other integrated strategies.

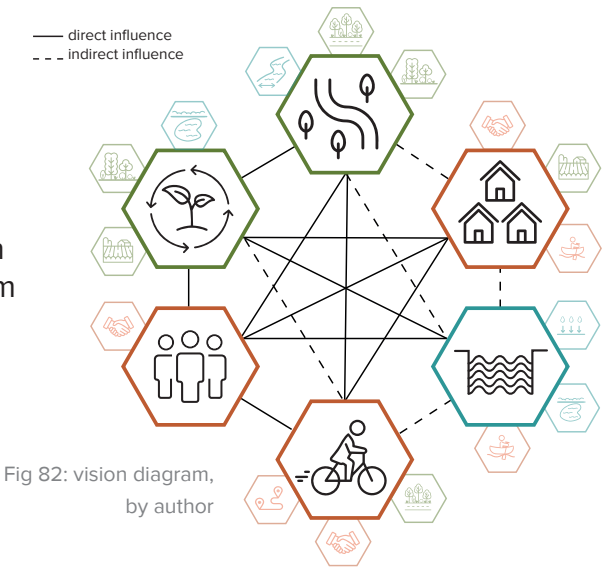


Fig 82: vision diagram,
by author

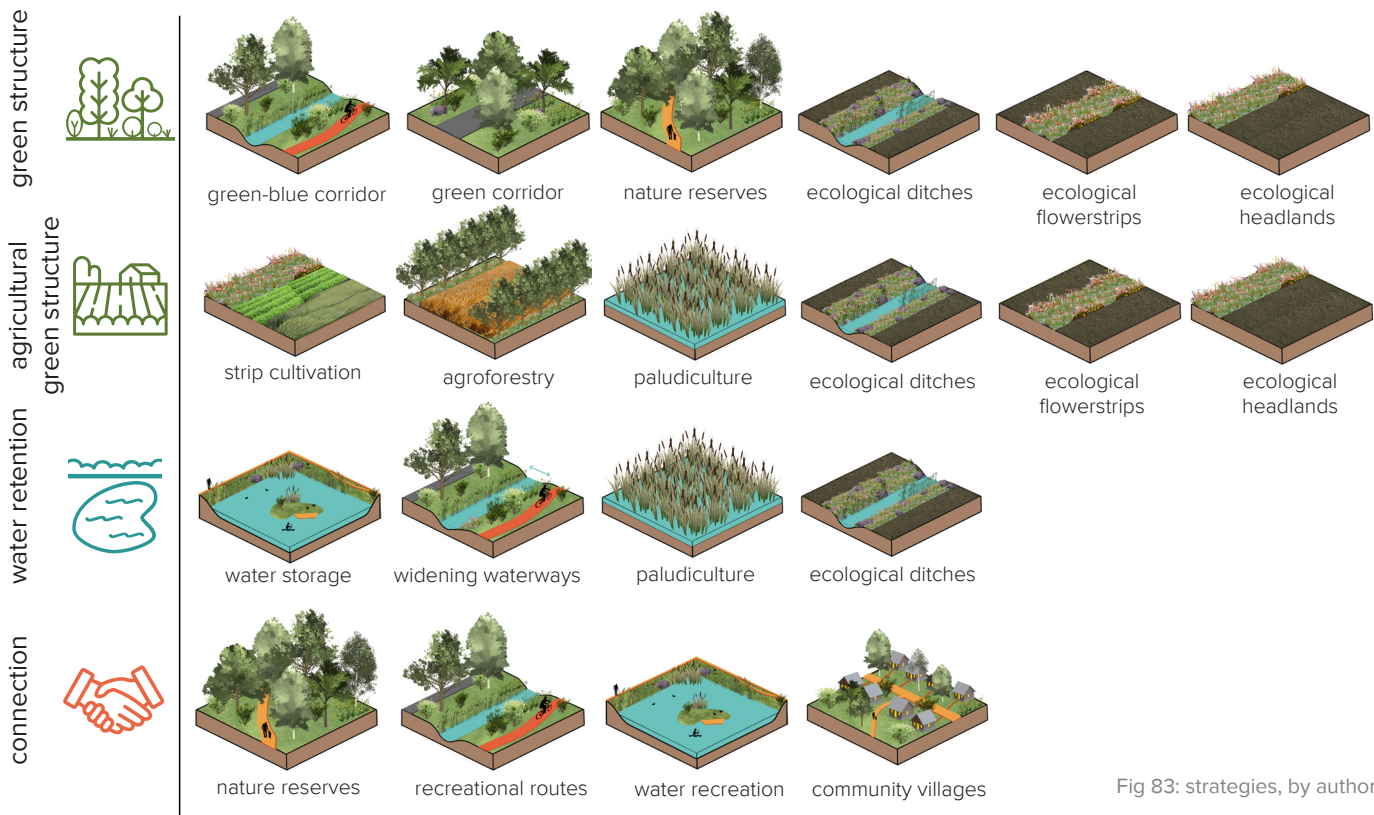
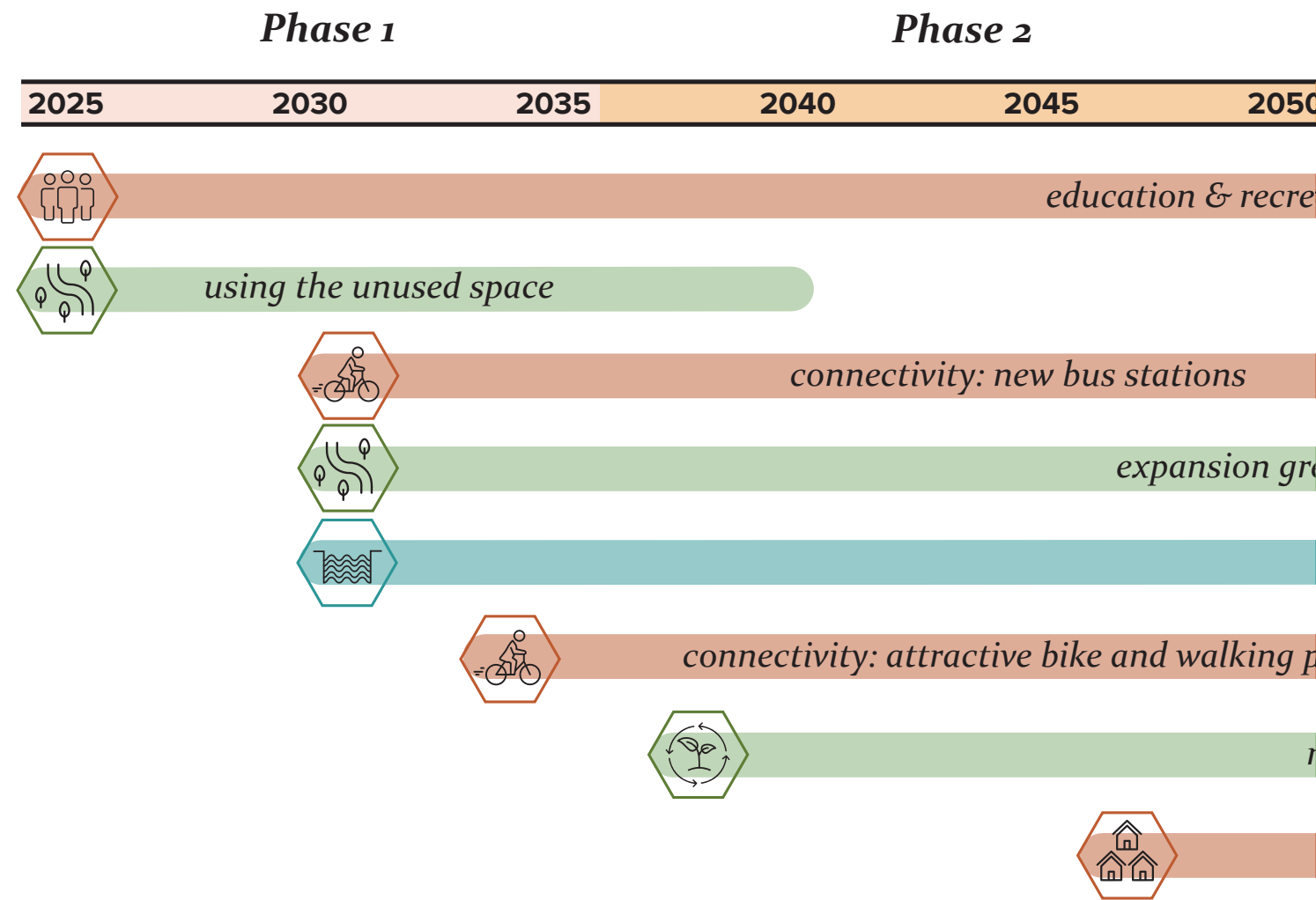


Fig 83: strategies, by author

Concluding

phasing Oostelijk Flevoland



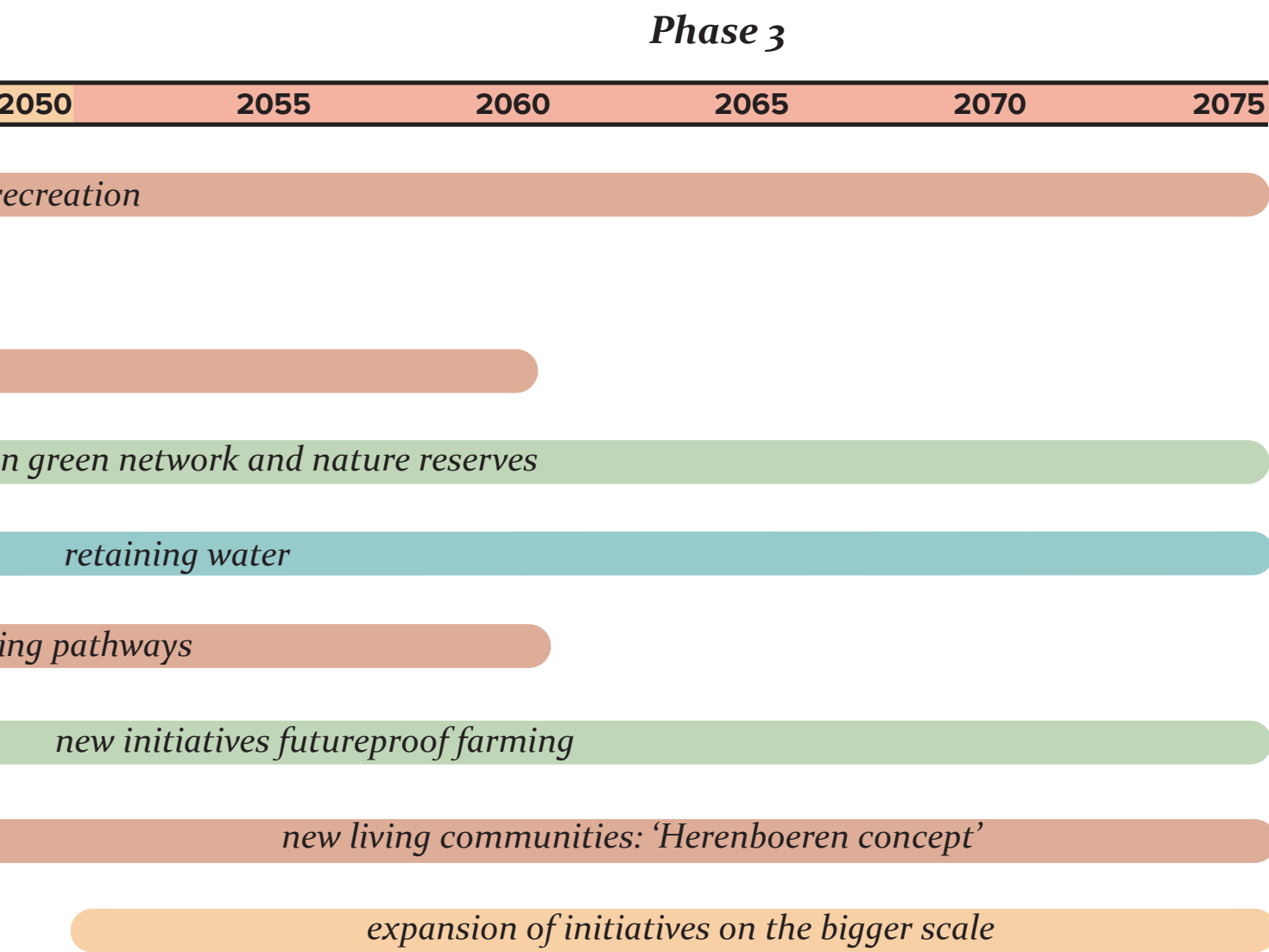


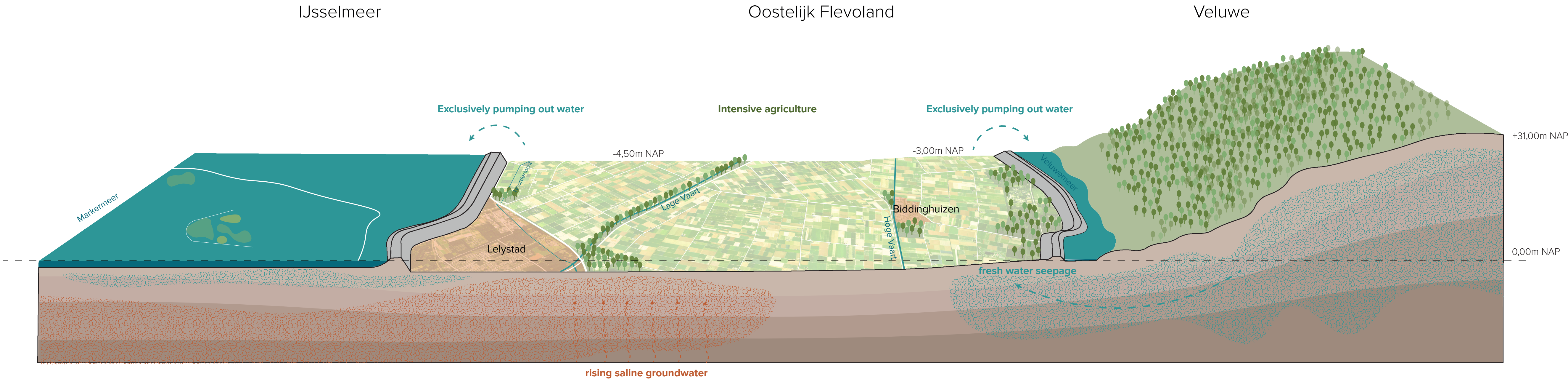
Fig 84: Phasing expansion strategies Oostelijk Flevoland, by author

Concluding

vision Oostelijk Flevoland

Displayed on the adjacent page is the present cross-section of Oostelijk Flevoland. The issues within the sub-area neighbouring Lelystad are of provincial significance, encompassing salinization, intensive agriculture segregated from natural surroundings, and the divide between farmers and citizens. This sub-area serves as a model for the strategies that can be implemented throughout the region.

Fig 85:
Cross-section current situation
Oostelijk Flevoland, by author



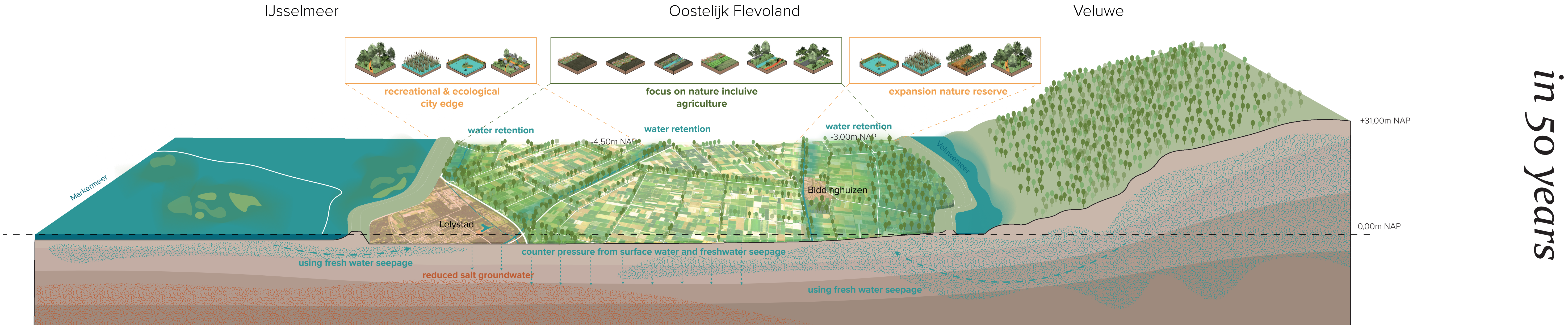
Current situation

Before

Concluding

vision Oostelijk Flevoland

The landscape of Oostelijk Flevoland will tackle these challenges and will be made more sustainable and future-proof by implementing the strategies outlined in the section by using the phasing plan, see figure 84. Efforts in the region's outskirts are focused on preserving freshwater seepage while promoting recreation, nature, and agriculture. Meanwhile, the central region will prioritize nature-inclusive agriculture, nature networks, and recreational connections.



After

Concluding

recommendations for the provinces

Figure 86 illustrates the important principles for each province. The strategies are categorized in the appendix per province.

The provinces of Flevoland, South Holland, North Holland, Friesland, and Groningen are facing significant biodiversity loss due to intensive agriculture and urbanization. They also struggle with salinization and declining peat soils. The strategies implemented in this project are highly relevant to these provinces.

In Limburg, Gelderland, and North Brabant, the loss of biodiversity in rural areas is a major concern, largely attributed to intensive agriculture and to urbanization in some places. The strategies for nature-inclusive agriculture and strengthening the green network are essential in

addressing these issues.

In Overijssel and Utrecht, biodiversity loss is primarily due to the removal of natural elements through urbanization and intensive agriculture. Strategies for nature-inclusive agriculture and strengthening the green network are critical in these provinces. Additionally, declining peatlands in these regions make paludiculture a valuable solution for conserving peatlands and promoting nature-inclusive agriculture.

Drenthe, being naturally green, focuses on strengthening the green network, while the most pressing challenge is the declining peat soils. Maintaining high water levels in these areas is crucial for preserving the peatlands. Paludiculture can help in this preservation effort and support nature-inclusive agriculture.

In Zeeland, widespread salinization poses a significant challenge. Retaining as much water as possible is essential to counteract the salty groundwater. All forms of water retention can be applied, with the option of switching to salt-tolerant crops if necessary.

It is crucial to acknowledge the significant relationship between farmers and citizens, as well as the connection between urban and rural areas in all provinces of the Netherlands, each of which comprises agricultural and urban components. The urban-rural distinction is anticipated to be more noticeable in highly urbanized provinces, necessitating greater emphasis on the transitional zone between urban and rural environments.

For the strategies per province see appendix C, D, E, F & G.

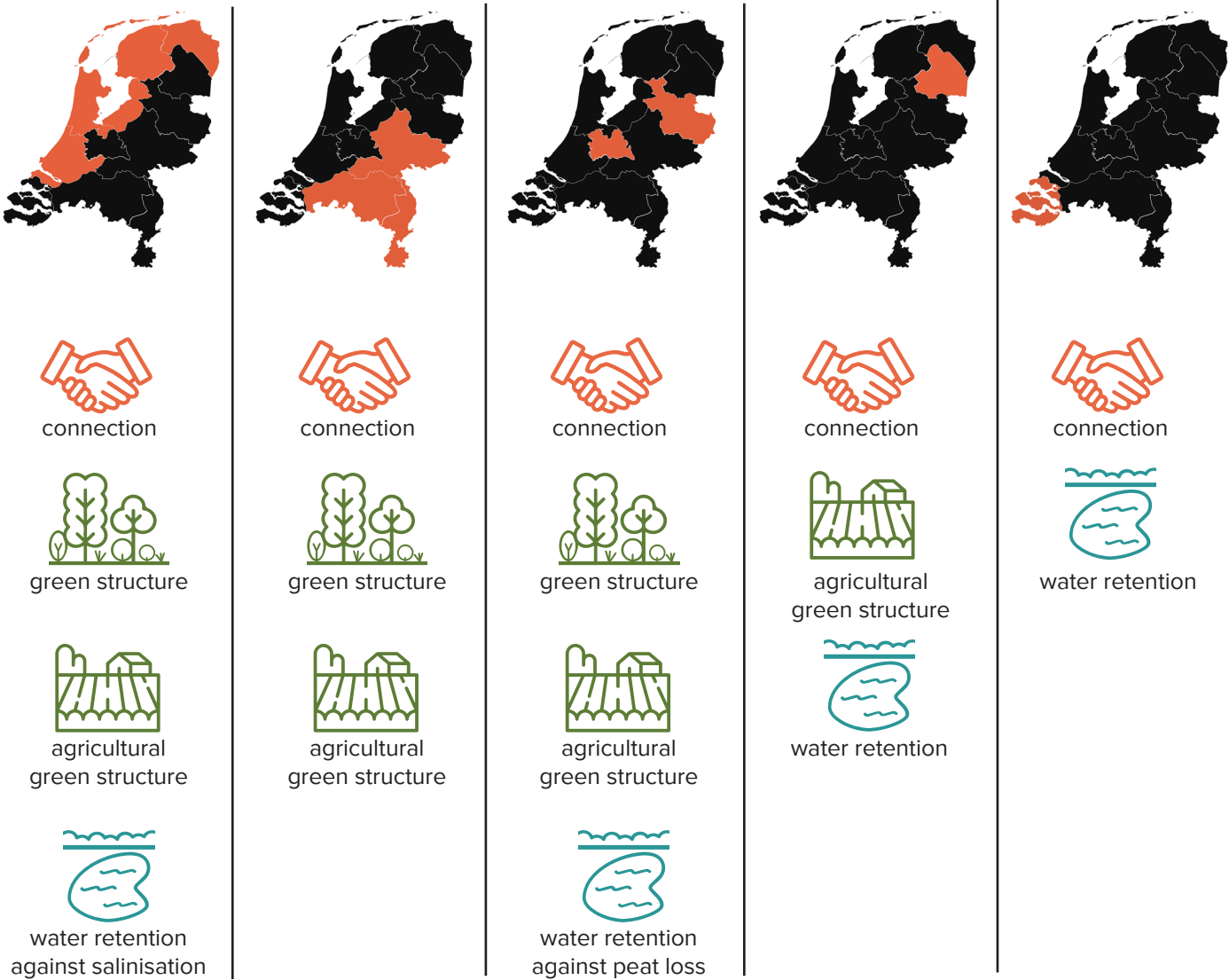


Fig 86: Most important principles per province, by author

for details see appendix C, D, E, F & G

Chapter 8

Reflecting

Relationship subject, studio & master's program

The significance of ecology is increasing not only in relation to nature but also in human interventions, particularly in the case of Urban and Rural Ecology. Flevoland being entirely man-made has disrupted natural processes, emphasizing the need to take into account these processes while designing both urban and rural areas. Ian McHarg, in his work *An Ecological Method*, states that ecology serves as the single indispensable foundation for landscape architecture and regional planning. He further adds that it has a profound relevance for city planning and architecture (McHarg, 1969). This perspective paves the way for ecology to provide a solution to the current agricultural situation in Flevoland. The rural area, being a functional landscape

designed for production, has strictly separated agriculture and nature. However, the benefits that ecology has to offer to agriculture have been overlooked, and this presents a solution for the future when reducing fertilizers and crop protection products will be crucial. Thus, ecology plays a significant role in designing landscapes, public spaces, and cities, which constitute our built world. In my opinion, landscape architecture and ecology form the basis for designing the most sustainable and optimal designs.

Influence of research & design/recommendations

After conducting a thorough analysis, research, and interviews, certain key findings have surfaced, namely the green network, the water network, and the interconnection between

urban and rural areas. These themes were identified based on the analysis and research of the high and low dynamic layers, as per the Casco concept (Kerkstra & Vrijlandt, 1988). As a result, I focused on incorporating these three themes during the design phase, which provided a clear boundary for the design process. By experimenting and designing with these themes, several principles emerged for each of them. Implementing these principles in the area, led to a holistic integration between the main themes, thereby complementing the research with a practical design.

Assessment of the approach

Establishing a comprehensive framework of the underlying theories provided invaluable support throughout the entire design process. Although there were times when this framework was deviated from, it helped me to realign and construct a cohesive narrative. The following passage describes the design process of Van Dooren et al., which is characterized by an interwoven approach where generic elements are distinguished but not separated (2013). As opposed to a fixed step-by-step sequence, the process is fluid and adaptable, as depicted in figure 87.

During the research phase, I particularly enjoyed conducting interviews as they served to validate my initial findings and contextualize them within a broader scope, ultimately

bolstering my confidence in the design process. Furthermore, the design has significant added value in its potential placement within a community with diverse stakeholders. The challenge of crafting a vision that presents opportunities for all parties involved was met with this method.

Through this thesis, I have discovered a passion for bridging the gap between stakeholders and the government/design bureau, finding it both enjoyable and stimulating. I look forward to pursuing this rewarding path in the future.

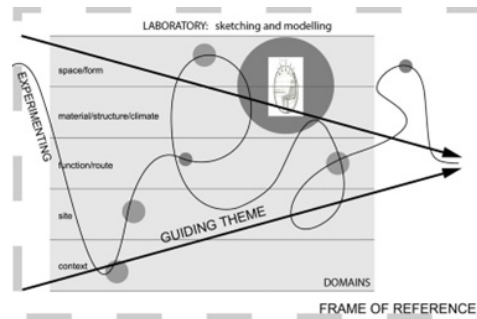


Fig 87: The generic elements in the design process by Van Dooren et al. (2013)

Scope of relevance

My graduation project focuses on the transition towards a sustainable agricultural sector, taking into account ecological, political, economic and social factors. The role of landscape architects is crucial in designing these agricultural landscapes. Thus, my research aims to contribute to the profession's understanding of creating resilient agricultural landscapes. It follows agroecological principles and provides valuable insights to both landscape architects and farmers, facilitating the integration of sustainable practices into their work and farmland management.

Moreover, the *Nationaal Programma Landelijk gebied* (NPLG) has set a target to create 10% green-blue interconnection before 2050, with an obligation for each

municipality to achieve 50% of this target within the next six years (Van Zelm Van Eldik, 2024). Therefore, this thesis provides an urgent call to action and offers tools on how to approach this target.

Agriculture is the backbone of production in Flevoland, but its sustainability is increasingly under discussion. By embracing nature-inclusive practices and agroecology, rural Flevoland can experience revitalization. Small-scale changes can produce remarkable results, creating a diverse and attractive environment. This attracts recreational activities and improves nitrogen uptake, provides farmers with sufficient water sources for production, and enables natural pest control through enriched agroecological practices.

These principles apply at different scales, from sowing field margins to setting up multifunctional agricultural businesses such as bed and breakfasts. Interventions can also be implemented on a larger scale, such as solutions for water storage, the development of recreational landscapes, and the expansion of nature reserves.

Transferability

The transferability of my project is based on several aspects. Firstly, the universally applicable principles of agroecology, such as creating natural buffer strips around fields and reducing plot sizes, are highly relevant for polder areas that lack natural landscape elements.

Furthermore, the water principles developed in the Flevoland project can

be applied in areas where salinization is becoming a growing concern, such as in Zeeland.

Additionally, the relationship between the city and the countryside is an important point of attention in many Dutch cities. By fostering a better understanding of agriculture, we can achieve a more sustainable system with greater ease.

In short, several aspects of my project can be employed on a larger scale and in other locations independently, making the transferability of the project results very high.

What I would do differently next time

If I were to revisit my thesis, I would like to delve deeper into the fascinating green-blue vein and agricultural aspects that captivated my attention during the project. As a landscape designer, I appreciate the significance of synthesizing information and transforming it into a coherent idea. Therefore, I recognize that it may not be the most effective approach to become overly absorbed in the details.

What I have learned about myself

My graduation experience taught me a great deal about myself. Devoting a year to a single topic in a rural environment was a demanding task, and I found myself constantly contemplating Flevoland agriculture, the agricultural sector, and

agroecology. This led to restlessness, and I struggled to achieve a healthy balance between my studies, work, and leisure time. However, I gradually honed my time management skills each month, which helped me identify my most efficient working methods and boosted my energy and motivation levels.

I have discovered my true passion and vision for the future. Rather than focusing on designing and visualizing, I am interested in global ideas, policies, networking, and connecting. My graduation project was a significant factor in igniting my interest in the transformation of agriculture, which has motivated me to pursue this field in the future. I have discovered my true passion and vision for the future. Rather than focusing on designing and visualizing, I

am interested in global ideas, policies, networking, and connecting. My graduation project was a significant factor in igniting my interest in the transformation of agriculture, which has motivated me to pursue this field in the future.

References

References

- Agriculture of the future. (n.d.). WUR. Retrieved May 6, 2024, from <https://www.wur.nl/en/research-results/research-institutes/plant-research/field-crops/agriculture-of-the-future.htm>
- Akkerranden en bloemstroken. (2021). *Landbouw Met Natuur*. Retrieved May 2, 2024, from <https://www.landbouwmetsnatuur.nl/maatregelen/akkerranden-en-bloemstroken/>
- Allema, A. B., & Huiting, H. F. (2021). *Functionele akkerranden voor plaagbestrijding* (Nr. 594311). Wageningen University & Research. Retrieved May 1, 2024, from <https://www.bo-akkerbouw.nl/files/Pdfs-Kennis-en-Innovatie/Kennistransfer-plantgezondheid-Factsheet-Functionele-Agrobiodiversiteit.pdf>
- Blom-Zandstra, M., Wolters, W., Heinen, M., Roest, C. W. J., Smit, R. W., & Smit, A. L. (2014). *Perspective for the growth of salt tolerant cash crops: A case study with potato*. Retrieved April 15, 2024, from <https://edepot.wur.nl/315166>
- Boerderij van de toekomst (2023). *Boerderij Van De Toekomst*. Retrieved February 10, 2024, from <https://farmofthefuture.nl/>
- Bokhorst, J. (2017). *Oernatuur is overal: Kijk vanuit de bodem en je vindt oorspronkelijke natuur*. In goedbodembeheer. Retrieved October 5, 2023, from <https://www.goedbodembeheer.nl/Publicatie>
- Canon van Flevoland. (z.d.). *Canon van Nederland*. Retrieved November 8, 2023, from <https://www.canonvannederland.nl/nl/flevoland/flevoland>
- CAP at a glance. (2024, April 25). *Agriculture and Rural Development*. Retrieved May 1, 2024, from https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en
- Central Bureau for Statistics. (2017). *CBS Statline*. Retrieved April 25, 2024, from <https://opendata.cbs.nl/statline/#/CBS/nl/dataset/70262ned/table?dl=2C288>
- Dawson, A., & Norén, I. S. (z.d.). *Inspiratie voor een biodiverse akkerbouw: Bouwstenen voor integratie van biodiversiteit in de bedrijfsvoering*. Wageningen University. Retrieved April 21, 2024, from <https://www.wur.nl/nl/show/Inspiratie-voor-een-biodiverse-akkerbouw.htm#:~:text=Planten%20hebben%20behoefte%20aan%20een,kunnen%20we%20de%20biodiversiteit%20Oversterken>
- Defacto Stedenbouw. (2021). *Versnelde zeespiegelstijging IJsselmeergebied: Verslag gebiedssessie Kennisprogramma Zeespiegelstijging IJsselmeergebied*. In Nationaal Deltaprogramma Rijksoverheid. Retrieved December 7, 2023, from https://www.deltaprogramma.nl/binaries/deltacommissaris/documenten/publicaties/2021/09/01/verslag-gebiedssessie-kennisprogramma-zeespiegelstijging-ijsselmeergebied/20210901+KP+ZSS_Verslag+IJsselmeergebied_kennisvragen_versie2_Defacto_webversie.pdf

- Dudley, N., & Alexander, S. (2017). Agriculture and biodiversity: a review. *Biodiversity*, 18(2–3), 45–49. Retrieved February 21, 2024, from <https://doi.org/10.1080/14888386.2017.1351892>
- Gemeenschappelijk landbouwbeleid (GLB) 2023. (2024, April 23). RVO.nl. Retrieved April 17, 2024, from <https://www.rvo.nl/onderwerpen/veranderingen-2024-agrarisch-ondernemers#glb>
- Graß, I., Loos, J., Baensch, S., Batáry, P., Librán-Embid, F., Ficiciyan, A., Klaus, F., Riechers, M., Rosa, J., Tiede, J., Udy, K., Westphal, C., Wurz, A., & Tschardtke, T. (2019). Land-sharing/-sparing connectivity landscapes for ecosystem services and biodiversity conservation. *People and Nature*, 1(2), 262–272. Retrieved November 4, 2023, from <https://doi.org/10.1002/pan3.21>
- Hatt, S., Lopes, T. C. M., Boeraeve, F., Chen, J., & Francis, F. (2017). Pest regulation and support of natural enemies in agriculture: Experimental evidence of within field wildflower strips. *Ecological Engineering*, 98, (p.240–245). Retrieved April 6, 2024, from <https://doi.org/10.1016/j.ecoleng.2016.10.080>
- Herenboeren. (2024, March 28). *Herenboeren - Wat is Herenboeren?* Retrieved May 7, 2024, from <https://herenboeren.nl/over-ons/>
- Jorritsma, M. (2022, September 8). *Verzilting: een bedreiging voor ons drinkwater?* Drinkwaterplatform. Retrieved April 10, 2024, from <https://www.drinkwaterplatform.nl/verzilting-drinkwater/>
- Kay, S., Graves, A., Palma, J., Moreno, G., Rocas-Díaz, J. V., Aviron, S., Chouvardas, D., Crous-Duran, J., Ferreira-Domínguez, N., De Jalón, S. G., Măciacășan, V., Mosquera-Losada, M. R., Pantera, A., Santiago-Freijanes, J. J., Szerencsits, E., Torralba, M., Burgess, P., & Herzog, F. (2019). Agroforestry is paying off – Economic evaluation of ecosystem services in European landscapes with and without agroforestry systems. *Ecosystem Services*, 36, 100896. Retrieved May 3, 2024, from <https://doi.org/10.1016/j.ecoser.2019.100896>
- Kerkstra, K., & Vrijlandt, P. (1988). Het landschap van de zandgebieden; Probleemverkenning en oplossingsrichting. Retrieved October 5, 2023, from <https://edepot.wur.nl/398422>
- Matar, Z. (z.d.). Financial performance of strip cropping in the Netherlands under high uncertainty: a Monte Carlo analysis [Master Thesis, University of Technology Delft]. Retrieved May 6, 2024, from <https://repository.tudelft.nl/islandora/object/uuid:66076685-d03c-4060-8d68-81ca3068c802/datastream/OBJ/download>
- Ministerie van Landbouw, Natuur en Voedselkwaliteit. (2023, May 17). Landbouwbeleid. Landbouw En Tuinbouw | Rijksoverheid.nl. Retrieved February 10, 2024, from <https://www.rijksoverheid.nl/onderwerpen/landbouw-en-tuinbouw/landbouwbeleid>
- Oude Essink, G., de Louw, P., van Vliet, M., van Baaren, E., Goes, B., Prevo, C., Sergi, F., Marconi, V., Vos, P., & Post, V. (2008). *Zoet-zout studie Provincie Flevoland* (092.79146). TNO Bouw en Ondergrond. Retrieved November 9, 2023, from https://geo.flevoland.nl/DOC_bodematlas/Zoetzout_Flevoland.pdf

References

- Pantera, A., Mosquera-Losada, M. R., Herzog, F., & Herder, M. D. (2021). Agroforestry and the environment. *Agroforestry Systems*, 95(5), 767–774. Retrieved May 3, 2024, from <https://doi.org/10.1007/s10457-021-00640-8>
- Paulin, M., T. D. N., Koopman, R., Otte, J., & Rutgers, M. (2023). *Social cost-benefit analysis of field margins in the Hoeksche Waard, the Netherlands*. In rivm.openrepository.com. Rijksinstituut voor Volksgezondheid en Milieu RIVM. Retrieved May 11, 2024, from <https://doi.org/10.21945/RIVM-2023-0381>
- Provincie Flevoland. (2022). *Voortgangsrapportage Landbouw Meerdere Smaken*. Retrieved February 21, 2024, from, van <https://www.flevoland.nl/getmedia/8a5d8553-b595-4720-8224-69fb51869f8b/3083160-Voortgangsrapportage-Landbouw-Meerdere-Smaken-dva.pdf>
- van Alebeek, F. A. N., Schaap, B. F., Willemse, J., & van Rijn, P. (2011). *FAB en omgeving - Het belang van groene en blauwe netwerken*. Praktijkonderzoek Plant & Omgeving. Retrieved May 2, 2024, from <https://edepot.wur.nl/188872>
- Van Bakel, J., Poelman, A., Kielen, N., & Hoogewoud, J. (2009). Waterreservoirs op bedrijfsniveau alternatief voor zoetwatervoorziening landbouw. *H2O: Tijdschrift Voor Watervoorziening en Afvalwaterbehandeling*, 42(18), 43–46. Retrieved May 11, 2024, from <http://edepot.wur.nl/341475>
- Van Dooren, E., Boshuizen, H. P. A., Van Merriënboer, J., Asselbergs, T., & Van Dorst, M. (2013). Making explicit in design education: generic elements in the design process. *International Journal Of Technology And Design Education*, 24(1), 53–71. Retrieved May 11, 2024, from <https://doi.org/10.1007/s10798-013-9246-8>
- Van Duursen, J., Nieuwenhuijs, A. (2016). *Marktverkenning Paludicultuur: Kansen voor de landbouw in veenweidegebieden met behoud van veen* (B. Van de Riet, N. Hogeweg, & R. Van Gerwen, Reds.). Retrieved May 6, 2024, from, van <https://www.veenweiden.nl/wp-content/uploads/2017/11/Marktverkenning-Paludicultuur.pdf>
- Van Loon, K. (2024, April 2). *Biologische landbouw*. De Groene Rekenkamer. <https://groene-rekenkamer.nl/14018/biologische-landbouw/>
- van Rijn, P., Willemse, J., & van Alebeek, F. A. N. (2011). *FAB en akkerranden voor natuurlijke plaagbeheersing*. Praktijkonderzoek Plant & Omgeving. Retrieved May 1, 2024, from <https://edepot.wur.nl/188870>
- Van Zelm Van Eldik, D. (2024, April 16). *Groenblauwe dooradering: naar verweven landbouw en natuur - MooiNL*. MooiNL. Retrieved May 11, 2024, from <https://www.mooinederland.nu/longread/groenblauwe-dooradering-naar-verweven-landbouw-en-natuur>

Appendix

Appendix

A

Value of agroforestry versus normal situation. (Kay et al., 2019)

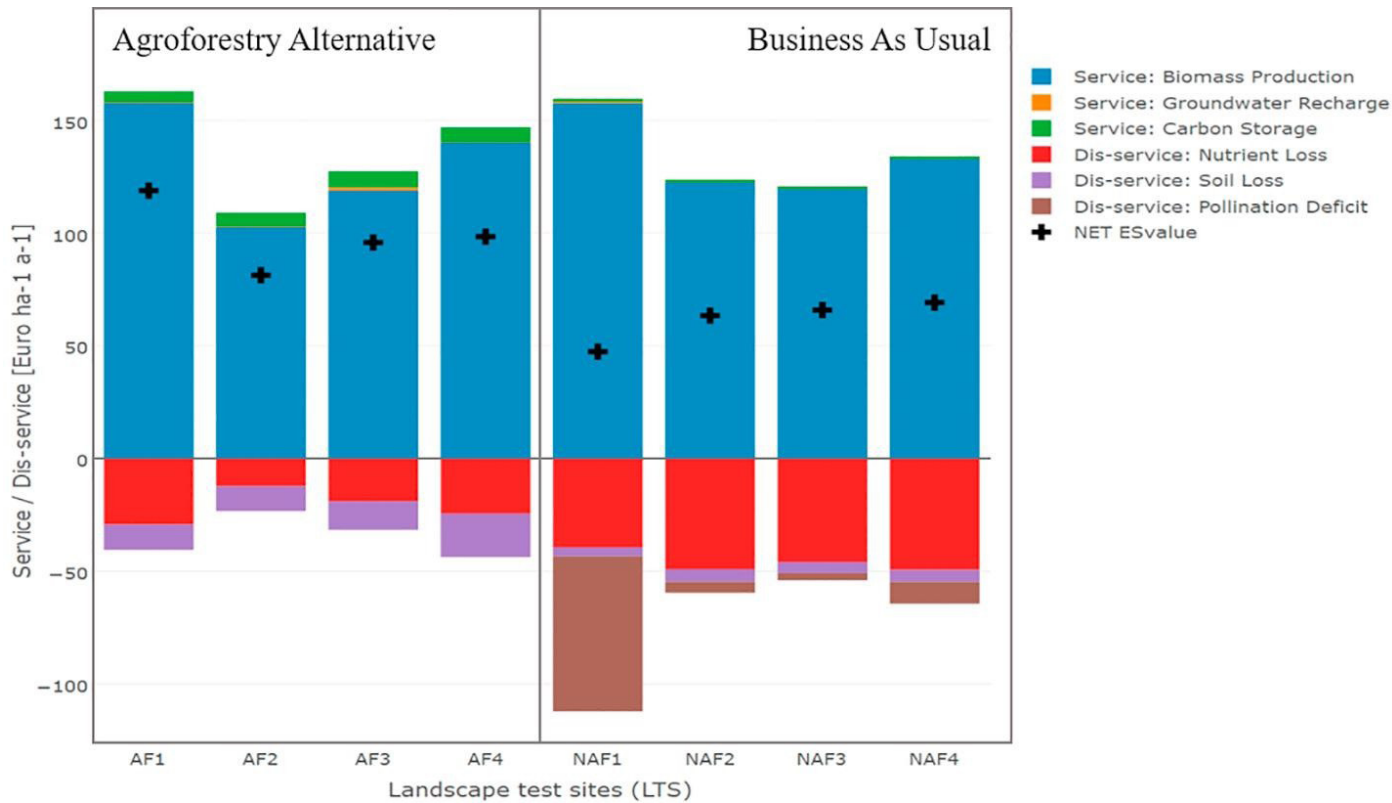


Table 2: Change in variables of strip cropping compared to monocropping

The breakdown of crops is presented in the table. Based on this data, it can be inferred that certain crops, such as onions, potatoes, and beans, are more conducive to strip cultivation. Conversely, barley and beetroot thrive in a monoculture environment (Matar, z.d.).

Crop	Onions	Potatoes	Barley	Beetroot	Beans	Average
Revenue						
Kg yields	-30%	0%	-13%	-10%	-9%	-14%
Price/ kg	49%	0%	0%	0%	0%	7%
cash yield	4%	0%	-13%	-10%	-9%	-2%
By-product	-100%	0%	0%	0%	0%	-83%
Total money yield	3%	0%	-12%	-10%	-9%	-2%
Inputed costs						
Seed	58%	3%	0%	0%	0%	14%
Fertilization	-25%	-25%	-25%	-50%	-18%	-33%
Crop protection	-67%	-82%	-70%	-45%	-67%	-69%
Fuel price	0%	0%	0%	0%	0%	0%
Fuel liters	6%	1%	7%	3%	4%	4%
Fuel costs	6%	1%	7%	3%	4%	4%
labor price/h	0%	0%	0%	0%	0%	0%
labor hours	29%	6%	30%	143%	0%	39%
labor costs	29%	6%	30%	143%	0%	39%
Other costs	15%	0%	0%	0%	0%	1%
Total accrued costs	-3%	-13%	-11%	17%	-17%	-4%
Profit	7%	9%	-14%	-50%	11%	0%

Table 4: Monocropping data

Crop	Onions	Potatoes	Barley	Beetroot	Beans	Average
Revenue						
Yields (Kg)	64594	45000	8000	100000	6800	44878,80
Price/ kg	€ 0,15	€ 0,35	€ 0,20	€ 0,06	€ 0,30	€ 0,21
cash yield	€ 9.559,91	€ 15.750,00	€ 1.600,00	€ 6.000,00	€ 2.040,00	€ 6989,98
By-product	€ 20,00	€ 0,00	€ 0,00	€ 0,00	€ 0,00	€ 5,00
Total money yield	€ 9.579,91	€ 15.751,00	€ 1.601,00	€ 6.001,00	€ 2.041,00	€ 6994,78
Inputed costs						
Seed	€ 760,00	€ 1.550,00	€ 100,00	€ 800,00	€ 280,00	€ 698,00
Fertilization	€ 600,00	€ 450,00	€ 200,00	€ 800,00	€ 170,00	€ 444,00
Crop protection	€ 1.001,00	€ 1.100,00	€ 200,00	€ 550,00	€ 330,00	€ 636,20
Fuel price	€ 1,10	€ 1,10	€ 1,10	€ 1,10	€ 1,10	€ 1,10
Fuel liters	170,00	255,00	124,00	175,00	125,00	169,80
Fuel costs	187,00	280,50	136,40	192,50	137,50	€ 186,78
Labour price/h	€ 25,00	€ 25,00	€ 25,00	€ 25,00	€ 25,00	€ 25,00
Labour hours	35,00	80,00	10,00	35,00	15,00	35,00
Labour costs	€ 875,00	€ 2.000,00	€ 250,00	€ 875,00	€ 375,00	€ 875,00
Other costs	€ 52,00	€ 850,00	€ 45,00	€ 352,00	€ 150,00	€ 289,80
Total accrued costs	€ 3.475,00	€ 6.230,50	€ 931,40	€ 3.569,50	€ 1.442,50	€ 3129,78
Profit	€ 6.104,91	€ 9.520,50	€ 669,60	€ 2.431,50	€ 598,50	€ 3865,00

Table 5: Strip cropping data

Crop	Onions	Potatoes	Barley	Beetroot	Beans	Average
Revenue						
Yields (Kg)	45000	45000	7000	90000	6200	38640
Price/ kg	€ 0,22	€ 0,35	€ 0,20	€ 0,06	€ 0,30	€ 0,226
Cash yield	€ 9.900,00	€ 15.750,00	€ 1.400,00	€ 5.400,00	€ 1.860,00	€ 6862
By-product	€ 0,00	€ 0,00	€ 0,00	€ 0,00	€ 0,00	€ 0,00
Total money yield	€ 9.900,00	€ 15.751,00	€ 1.401,00	€ 5.401,00	€ 1.861,00	€ 6862,8
Inputed costs						
Seed	€ 1.200,00	€ 1.600,00	€ 100,00	€ 800,00	€ 280,00	€ 796
Fertilization	€ 450,00	€ 338,00	€ 150,00	€ 400,00	€ 140,00	€ 295,6
Crop protection	€ 330,00	€ 200,00	€ 60,00	€ 300,00	€ 110,00	€ 200
Fuel price	€ 1,10	€ 1,10	€ 1,10	€ 1,10	€ 1,10	€ 1,1
Fuel liters	180,00	257,00	133,00	180,00	130,00	176
Fuel costs	€ 198,00	€ 282,70	€ 146,30	€ 198,00	€ 143,00	€ 193,6
Labour price/h	€ 25,00	€ 25,00	€ 25,00	€ 25,00	€ 25,00	€ 25
Labour hours	45	85	13	85	15	48,6
Labour costs	€ 1.125,00	€ 2.125,00	€ 325,00	€ 2.125,00	€ 375,00	€ 1215
Other costs	€ 60,00	€ 850,00	€ 45,00	€ 352,00	€ 150,00	€ 291,4
Total accrued costs	€ 3.363,00	€ 5.395,70	€ 826,30	€ 4.175,00	€ 1.198,00	€ 2991,6
Profit	€ 6.537,00	€ 10.355,30	€ 574,70	€ 1.226,00	€ 663,00	€ 3871,2

Tables made by Matar (z.d.)

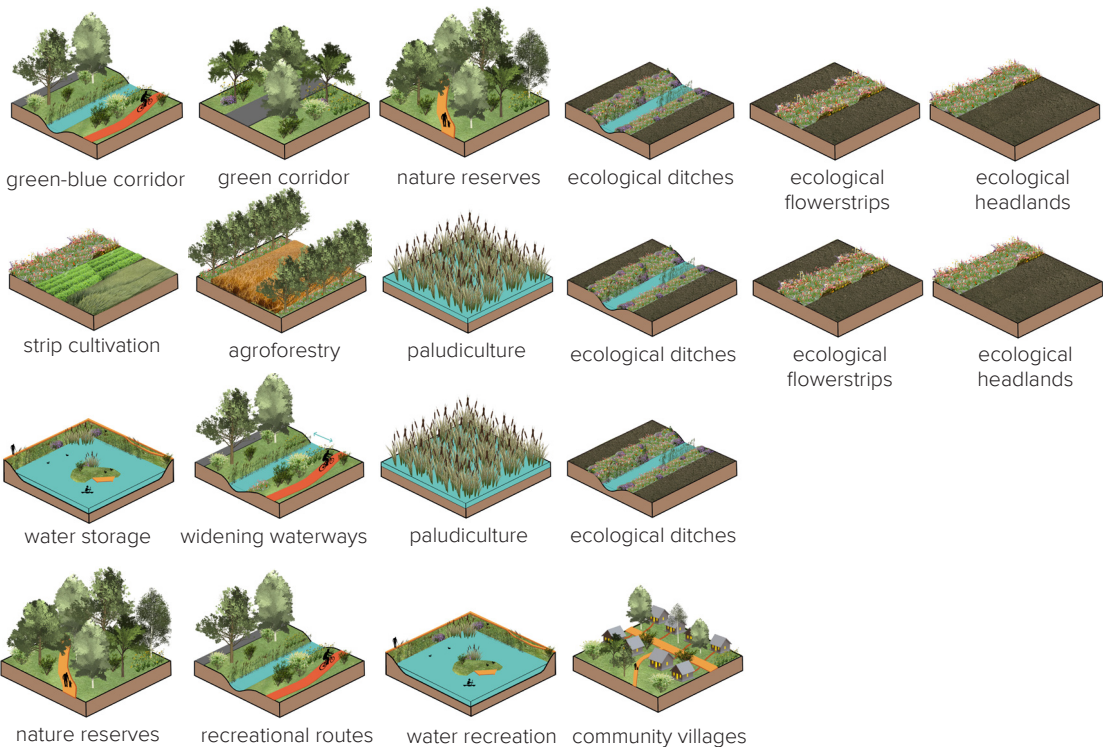
Appendix

C



Flevoland, Zuid-Holland, Noord-Holland, Friesland & Groningen

Main focus on these strategies:





Gelderland, Noord-Brabant & Limburg

Main focus on these strategies:



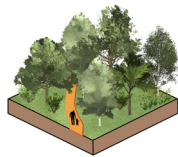
connection



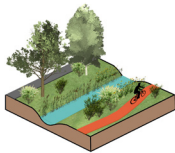
green structure



agricultural
green structure



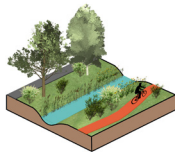
nature reserves



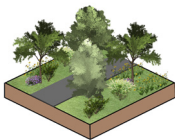
recreational routes



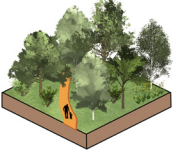
community villages



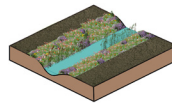
green-blue corridor



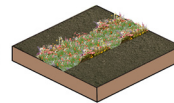
green corridor



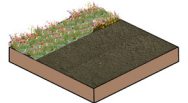
nature reserves



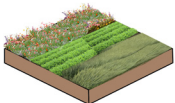
ecological ditches



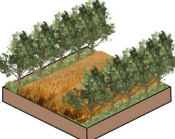
ecological
flowerstrips



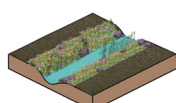
ecological
headlands



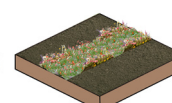
strip cultivation



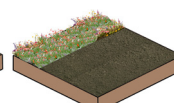
agroforestry



ecological ditches



ecological
flowerstrips



ecological
headlands

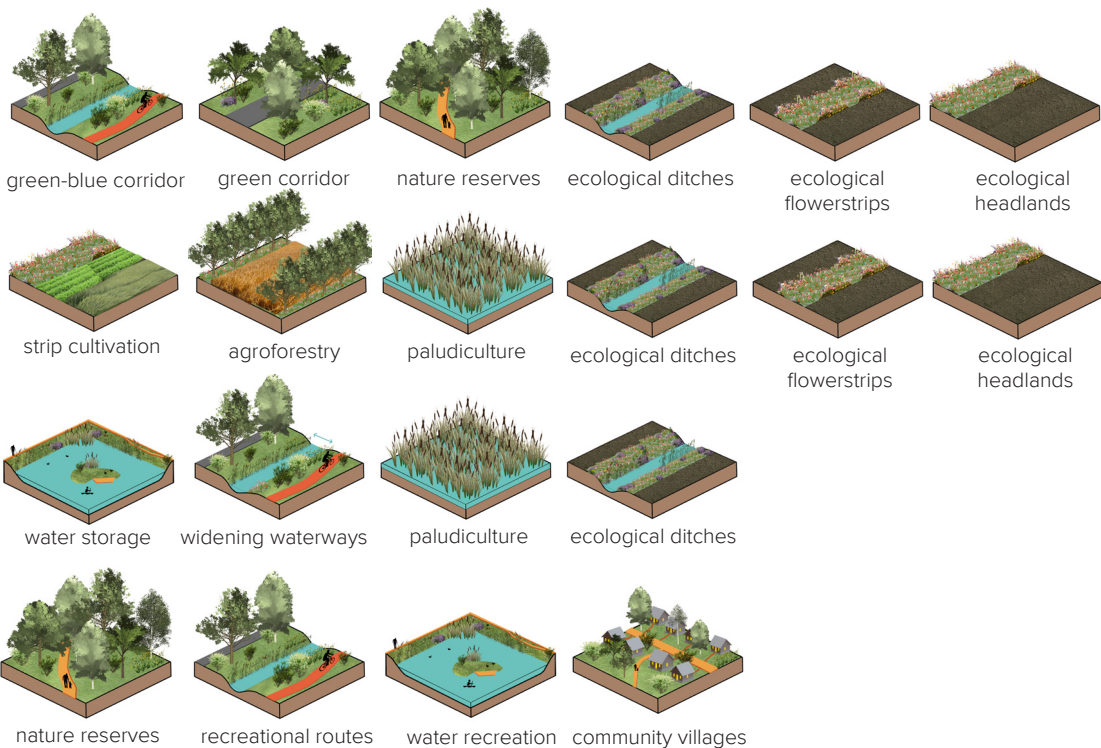
Appendix

E



Overijssel & Utrecht

Main focus on these strategies:





Drenthe

Main focus on these strategies:



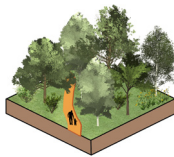
connection



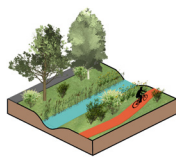
agricultural
green structure



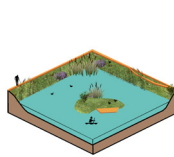
water retention



nature reserves



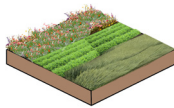
recreational routes



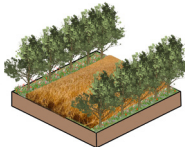
water recreation



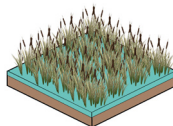
community villages



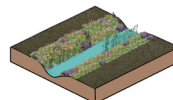
strip cultivation



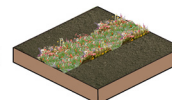
agroforestry



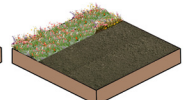
paludiculture



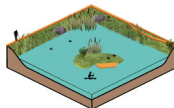
ecological ditches



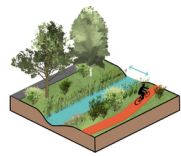
ecological
flowerstrips



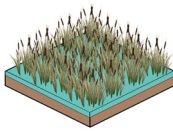
ecological
headlands



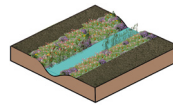
water storage



widening waterways



paludiculture



ecological ditches

Appendix

G



Zeeland

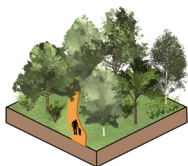
Main focus on these strategies:



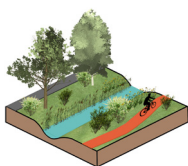
connection



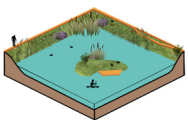
water retention
against salinisation



nature reserves



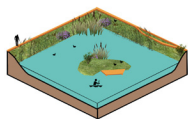
recreational routes



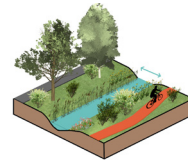
water recreation



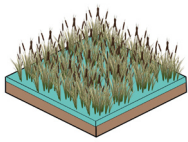
community villages



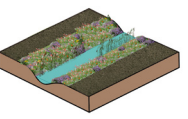
water storage



widening waterways



paludiculture



ecological ditches

