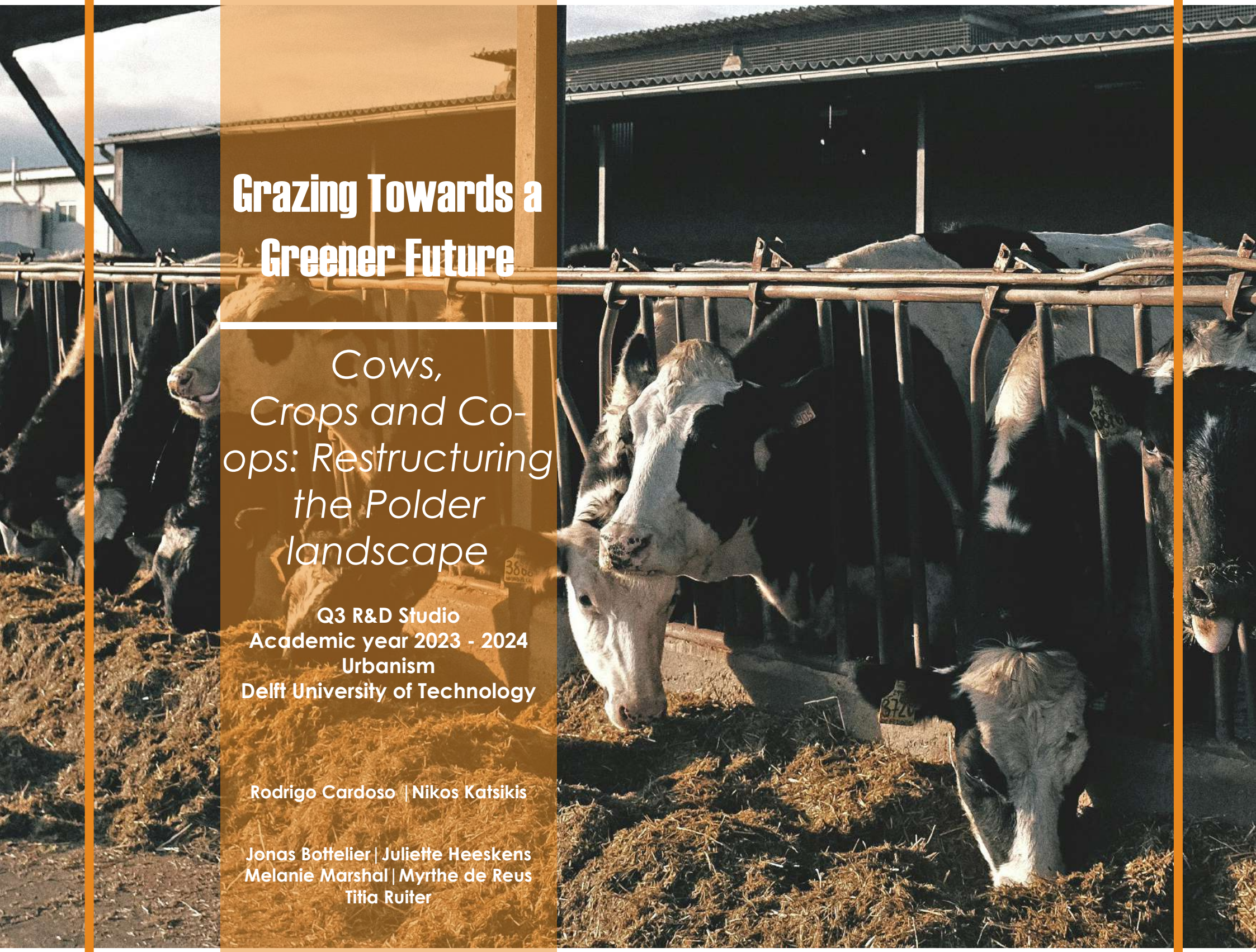


Grazing Towards a Greener Future

Cows, Crops and Co-ops: Restructuring the Polder landscape

Q3 R&D Studio
Academic year 2023 - 2024
Urbanism
Delft University of Technology

Rodrigo Cardoso | Nikos Katsikis

Jonas Bottelier | Juliette Heeskens
Melanie Marshal | Myrthe de Reus
Titia Ruiter

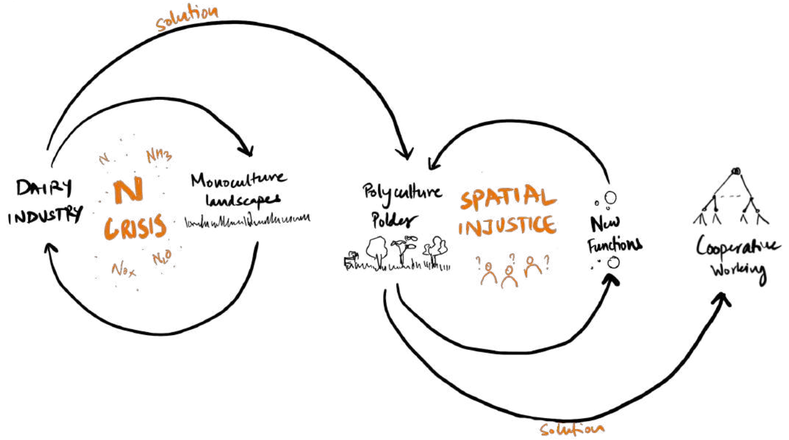
ABSTRACT

The Netherlands faces a growing challenge: the escalation of nitrogen pollution, closely tied to the expansive dairy and animal husbandry industry in the country. As a predominantly dairy-based culture, the dairy industry plays a significant role in the economy, contributing to an 8% trade surplus. Dairy farms occupy 30% of the Dutch land surface,producing 14 billion kilograms of milk per year, resulting in a highly efficient industry. However, at the expense of a degraded landscape and the escalating nitrogen crisis.

This project aims to explore the future of the dairy industry by creating a shift from the current monoculture and centralized dairy chain to a more local and self-restoring model. Recognizing the polder as a crucial spatial element of grasslands in the Netherlands, we view it as a fundamental unit for enhancing dairy industrial efficiency.

Our goal is to instill stewardship of the exhausted landscape, transforming polder typologies into regenerative ecosystems. Our focus is on the regions of SW Friesland, where the concentration of cows and nitrogen issues intersects with Natura-2000 areas. Our methodology aligns with the Netherlands' aspirations to foster a more biodiverse and multifunctional landscape by proposing a strategic plan for implementation of a green network and polyculture polders keeping in mind the social as well as physical transformations of the landscape. Cooperative systems organized around polder typologies serve as a framework for comprehending new social and economic configurations. A larger organizational structure in which polders co-operate is implemented to redistribute trade and production.

Ultimately, our project aims to establish a new localized, decentral dairy system alongside a toolbox of multifunctional polder-cooperation mosaics. These steps are designed to reduce nitrogen emission and loss, contributing to the overall sustainability and resilience of the dairy industry in the Netherlands.



Key words: Nitrogen Crisis - Sustainable Dairy farming | Cooperative Framing | Regenerative Farming | Polders | Mixed-use landscapes | Biodiverse Network | Monoculture | Decentralisation | Circularity

RESEARCH QUESTION

"How can we transform the polluting dairy industry into a circular one and make a shift towards a local, diverse and self-restoring agricultural network in South-West Friesland by 2055?"

Subquestions :

1. How can we rearrange the dairy industry in such a way that we minimize the negative externalities?
2. How can we create a spatial and social just system for the farmers?
3. In what manner can a biodiverse landsape be structured to sustain employment opportunities for its inhabitants
4. In what way can this new combination be implemented in the polder landscape?
5. Which tools and policies can be used to realise this vision?

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01 The Nitrogen Crisis

Why nitrogen?
What is the nitrogen crisis?

WHY NITROGEN


threatens Dutch environment—and economy

Ecological damage from manure fumes triggers calls for drastic change to livestock industry

By Erik Stokstad

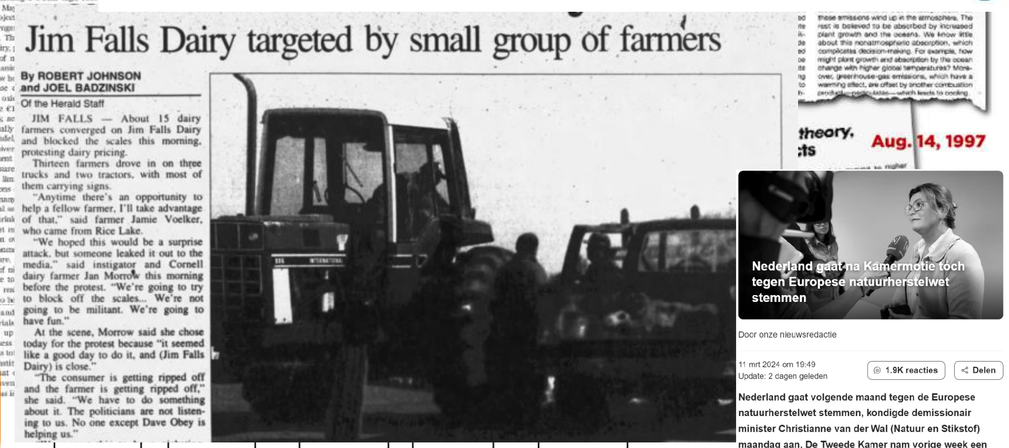
"They have picked up speed and set up more effective studies."

Ross McKinney, Association of American Medical Colleges


UK's largest dairy warns supermarkets face milk shortages unless farmers are paid more

Farmers are facing higher production costs and are struggling to keep up.

Zaina Alibhai • Friday 25 March 2022 09:10 GMT • 18 Comments


Jim Falls Dairy targeted by small group of farmers

By ROBERT JOHNSON and JOEL BADZINSKI

Of the Herald Staff

JIM FALLS — About 15 dairy farmers converged on Jim Falls Dairy and blocked the scales this morning, protesting dairy pricing.

Thirteen farmers drove in on three trucks and two tractors, with most of them carrying signs.

"Anytime there's an opportunity to help a fellow farmer, I'll take advantage of that," said farmer Jamie Voelker, who came from Rice Lake.

"We hoped this would be a surprise attack, but someone leaked it out to the media," said instigator and Cornell dairy farmer Jan Morrow this morning before the protest. "We're going to try to block off the scales... We're not going to be militant. We're going to have fun."

At the scene, Morrow said she chose today for the protest because "it seemed like a good day to do it, and (Jim Falls Dairy) is close."

"The consumer is getting ripped off and the farmer is getting ripped off," she said. "We have to do something about it. The politicians are not listening to us. No one except Dave Obey is helping us."

theory. Aug. 14, 1997

Nederland gaat na Kamermotie toch tegen Europese natuurherstelwet stemmen

Door onze nieuwsredactie

11 mrt 2024 om 19:49
Update: 2 dagen geleden

1.9K reacties · Delen

Nederland gaat volgende maand tegen de Europese natuurherstelwet stemmen, kondigde demissionair minister Christianne van der Wal (Natuur en Stikstof) maandag aan. De Tweede Kamer nam vorige week een

Why Nitrogen
The nitrogen issue is visible wherever we look. It is either in the papers, on the streets or on the news. Everytime we look on the internet there is a new message about the nitrogen crisis or a new angry rise with the farmer. The nitrogen crisis is contributing to both the climate and biodiversity crisis. It is important to understand, what does the nitrogen issue entail and what is the solution for both farmers and the municipality?

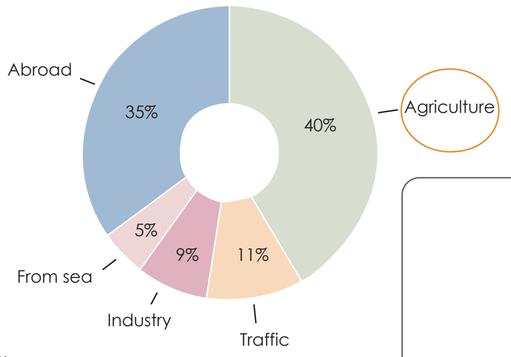
It attracts our attention and we want to find out what is going wrong in this decades-long problem and how we can solve this?

NITROGEN

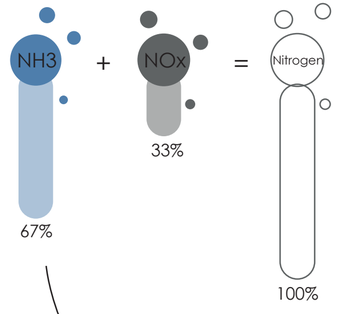
(Alibhai, 2022; Nu.nl, 2024; Voelker, 2019; SCRIBD, 1999)

NITROGEN

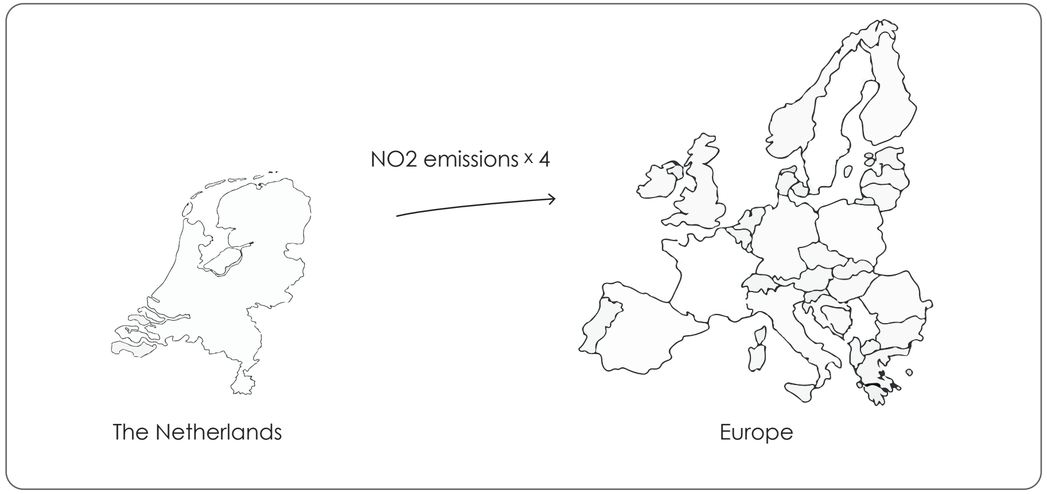
Total nitrogen emission in the Netherlands per sector



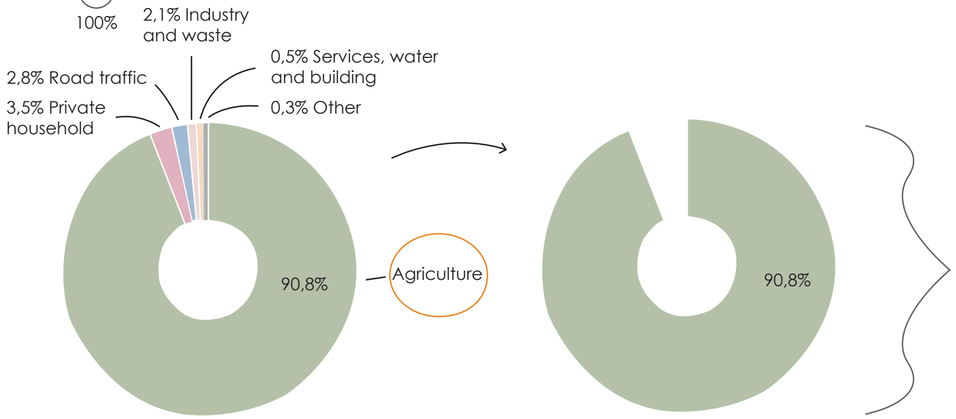
Nitrogen ratio



Relation to Europe

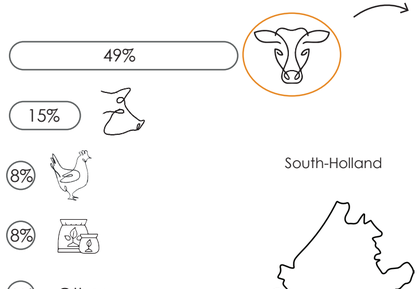


What is the Nitrogen Crisis
If we want to get into the solution and the analysis of this problem, we will have to start by explaining what the Nitrogen problem entails. The Nitrogen Problem is not the N_2. The Nitrogen problem is a combination of NH_3 (Ammonia) and NO_x (Nitrogenoxide). Two third of this problem is from the Ammonia of which 91% comes out of agriculture. 50% of this amount comes from cow farmers. From this fifty percent, 63% is from the dairy industry, making dairy industry the bad guy. Which is why, we are focusing on the dairy industry.

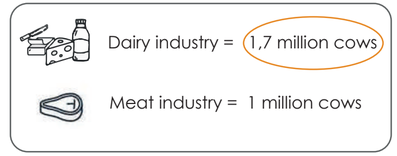


Ammonia emissions per sector

Ammonia emissions per aspect



Ratio meat and dairy industry



Total area of pastures for dairy industry

02 The problems of the Dairy Industry

The dairy industry section
Current Policies
Dairy Maps
Stakeholders
Problem I: Monoculture
Problem II: Centralised
Problem III: Linear
Focus area

CURRENT SECTION

OUR THREE MAIN PROBLEMS

The current dairy industry is drawn out in this section. Highlighting the three problems this project is going to focus on. The Linear problem includes both the monoculture and centralised problem. In this report, you will see that solutions for both the monoculture and centralised system will also aid and thus mitigate the linear problem.

LINEAR

MONOCULTURE
Problem I

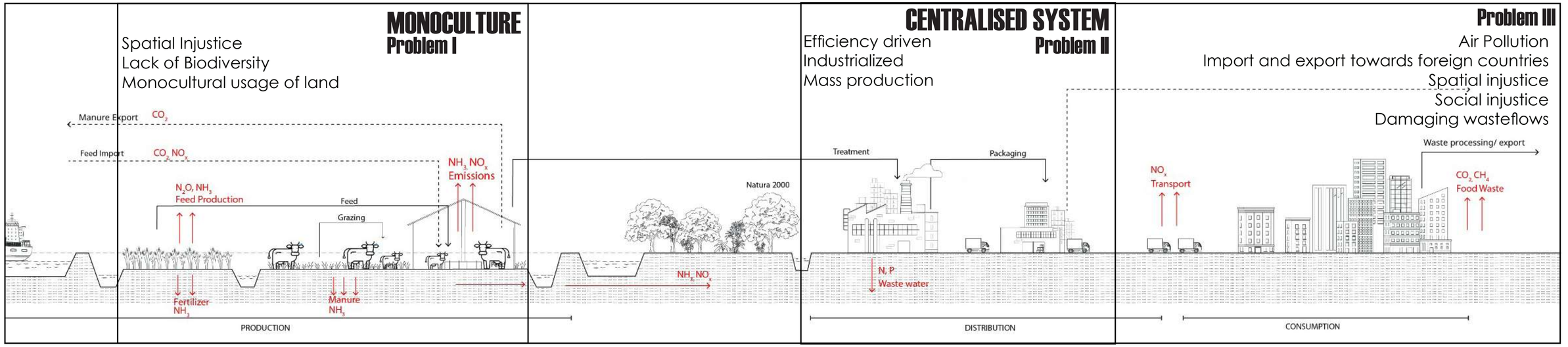
Spatial Injustice
Lack of Biodiversity
Monocultural usage of land

CENTRALISED SYSTEM
Problem II

Efficiency driven
Industrialized
Mass production

Problem III

Air Pollution
Import and export towards foreign countries
Spatial injustice
Social injustice
Damaging wasteflows



The European and Dutch policies

The Birds Directive (1979) and the Habitats Directive (1992) - EU

The European Union has set guidelines for safeguarding natural areas, which Netherlands must abide by. The Birds Directive (1979) and the Habitats Directive (1992) were created to help EU countries work together to protect and restore biodiversity. They help with stopping and reversing the decline of biodiversity in EU countries, contributing significantly to global biodiversity conservation efforts. In the Netherlands, these directives directly influence the protection of certain natural areas known as Natura 2000 sites. Among the 162 Natura 2000 areas in the country, 128 are particularly sensitive to nitrogen pollution (Wageningen University and Research, 2019). These areas are also situated in South-West Friesland. If there's a risk of these areas suffering from nitrogen-related habitat deterioration, the government must take appropriate steps to prevent it. This involves creating programs to restore the affected environmental conditions as quickly as possible, even if it means implementing measures beyond the boundaries of Natura 2000 sites. The goal is to improve habitat quality and achieve a favorable conservation status (Wageningen University and Research, 2019). These guidelines are the direct reason w hy the Netherlands must act as regards nitrogen emissions.

Coalition agreement Rutte IV - NL
The Rutte IV coalition agreement was crafted for the years 2021 to 2025. It clearly states that an integrated approach is necessary to address the nitrogen crisis. This agreement serves as one of the key guiding documents for further policy development and the formulation of laws and regulations concerning nitrogen and related themes. It specifically mentions initiatives such as regenerative agriculture, the creation of new business models, the development of a National rural area program, and the establishment of an accompanying transition fund (VVD, D66, CDA en ChristenUnie, 2021).

The Nitrogen Reduction and Nature Improvement Act (2021) – now in Omgevingswet - NL

The implementation of the Nitrogen Reduction and Nature Improvement Act (PSN) since July 1, 2021, includes provisions mandating the monitoring and assessment of measures outlined in the Nitrogen Reduction and Nature Improvement Program (PSN). Result-oriented environmental targets for nitrogen are incorporated into the PSN. According to the Ministry of Agriculture, Nature and Food quality (2022), "the key to addressing the nitrogen issue lies in an approach that focuses on reducing nitrogen deposition on nature (nitrogen reduction) and enhancing nature (nature improvement)".

"In the current Nitrogen Reduction and Nature Improvement Act (implemented as an amendment to the Nature Conservation Act and soon to be incorporated into the Environmental Act), the goal of the program SN is described in **two parts**:
a. Achieving the conservation objectives for nitrogen-sensitive habitats in Natura 2000 areas.
b. Reducing nitrogen deposition on the habitats mentioned in part a to comply with the statutory environmental standards." (Ministry of Agriculture, Nature, and Food Quality, 2022)

In the Coalition Agreement, it was decided to expedite the target from 2035 to 2030 (74% below the critical deposition value). To achieve this, the Rutte IV government has announced a follow-up approach focusing on nitrogen, water (Water Framework Directive), nature, soil, and climate. A transition fund of €25 billion will be made available, of which €25 billion is allocated until 2030. For this transition fund, a distinction has been made between two tracks:
"Track 1: Purchase, financial depreciation of land, and Water Framework Directive (WFD).
Track 2: Perspective for continuers: continuing with the established route towards sustainability" (Ministry of Agriculture, Nature, and Food Quality, 2022).

It is evident from this that the government strongly emphasizes reduction, primarily focusing on nature-inclusive agriculture for the agricultural businesses continuing their operations.

Year	2025	2030	2035
Legal environmental values in accordance with the current Nitrogen and Nature Act % area with nitrogen-sensitive habitats below the critical deposition value	40%	50%	74%

Nitrogen fund: measures per track in mln	2022 - 2030	2030 -2035
Track 1: Buying out, financial depreciation of land water framework directive	**13.800**	**3.681**
Buying ouy mix of dairy cows, poultry and pigs	6.100	1.315
Financial depreciation land (dairy cattle)	5.700	1.225
Expanding nature area (natura2000 exluded)	1.330	1.000
Additional for the purpose of water framework directive	670	141
Track 2: Perspective future farmers; proceed the route taken to sustainability	**4.350**	**943**
Regenerative agriculture	2.120	470
Innovation shedsystems and managementmeasures	1.000	212
Policy for strenghting the entrepreneurship and innovation	1.230	261
Implementation costs	**1.750**	**376**
Total	**20.000**	**5.000**

The National Program Rural Area (NPRA) (2023) – NL

The National Program Rural Area (NPRA) originates from the national spatial vision of the Netherlands. The government aims to focus on an integrated, area-oriented approach to challenges in agriculture and nature that not only address nitrogen. The NPRA also presents a strategy for addressing (European) standards and objectives regarding soil, water, climate, and biodiversity. "An important aspect of a sustainable future for rural areas is to restore the balance between land use and the limits of natural systems." One of the goals of this program is to complete the Dutch nature network by 2027 and achieve 10% green-blue penetration by 2050.

There is a clear emphasis on the provinces to achieve the nature objectives of the NPRA. In doing so, there is a structuring choice that requires the designation of so-called transition areas around Natura 2000 sites. These are areas adjacent to or near Natura 2000 sites that are crucial for nature restoration. This report indicates that the area requirement for creating additional nature by 2030 is largest in Friesland. Friesland ranks second in creating additional agricultural nature (Ministerie van Landbouw, Natuur en Voedselkwaliteit, Ministerie van Infrastructuur en Waterstaat en Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2023).

	Additional nature area target for 2030 (ha)	Additional agricultural nature target for 2030 (ha)
Drenthe	2.300	7.000
Flevoland	60	1.600
Friesland	2.700	35.600
Gelderland	2.200	15.300
Groningen	700	8.000
Limburg	1.300	11.100
Noord-Brabant	2.400	41.000
Noord-Holland	450	4.700
Overijssel	1.800	15.300
Utrecht	860	11.200
Zuid-Holland	1.500	19.000
Zeeland	180	11.400
National	**16.450**	**181.200**

Nitrogen Reduction Program Fryslan (2022) – Province

This is the program aimed at nitrogen reduction and nature restoration in the province of Friesland. It is a regionally focused translation of the NPRA. It describes how the province of Friesland will address these two challenges to comply with European and national policies, laws, and regulations. This report indicates that the province aims to be a pioneer in the Netherlands in regenerative agriculture. For nature restoration, the province primarily focuses on the Natura 2000 areas themselves along with their associated transition zones. Reduction efforts also include reducing the size of the livestock and the increased productivity of cows as mentioned components (Programmateam Stikstof Fryslân, 2022).

Recent trends

''Due to the recent revision of the Critical Deposition Values (KDWs) as a result of the latest scientific insights into the nitrogen sensitivity of nature, and the fact that the calculated nitrogen deposition is higher for the forecast years based on recent measurements, it has become clear that in order to achieve the environmental objectives, nitrogen emissions must be reduced more than when the Nitrogen and Nature Programme was established. The challenge has thus become greater" (Ministerie van landbouw, 2024). At this moment, the Netherlands has not achieved the goals for the critical deposition values because the challenge has become greater. Since a new cabinet needs to be formed, it is also up to this new cabinet to decide how to deal with this. During the formation process, the current goals and measures will be pursued.

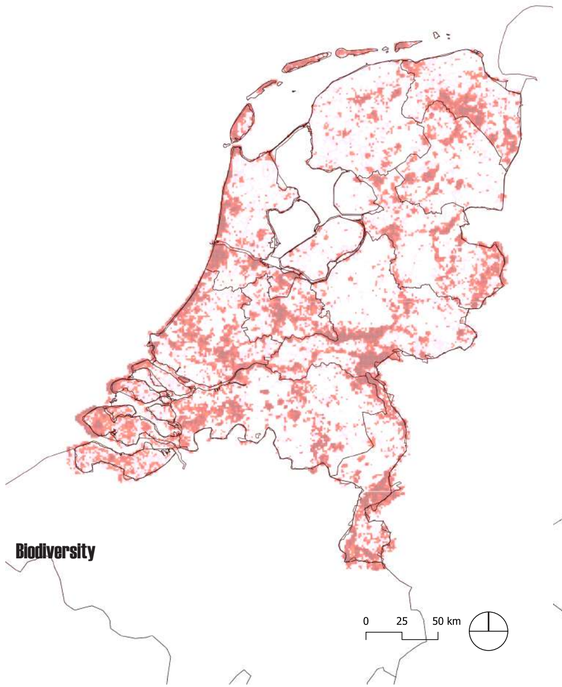
Conclusion

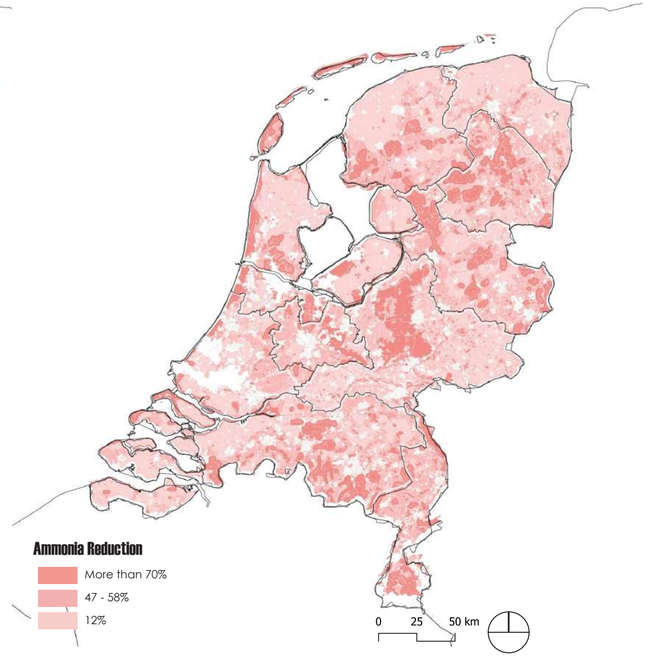
In the current policies of both the government and the province of Friesland, nitrogen reduction and nature restoration are positioned as the primary pillars. Circular agriculture is mentioned in almost all documents and appears to be a crucial concept in future policies. It becomes evident that an integrated approach is necessary from both European and national policies to successfully address all issues.

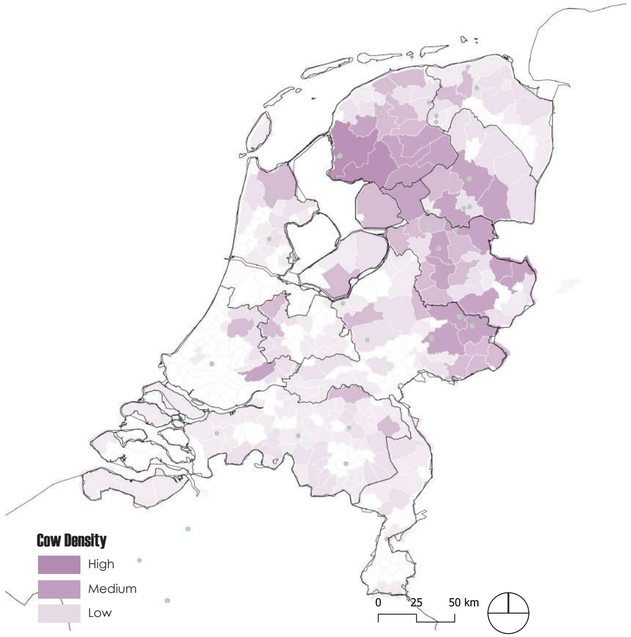
However, little to nothing is mentioned in all policies about a changing consumption pattern of meat and dairy. They highlight the trend of intensification in the dairy industry and increased efficiency of cows as examples for nitrogen reduction. Additionally, there is a strong focus on ending many businesses, primarily those around nitrogen-sensitive Natura 2000 areas. Moreover, significant investments are made in nature-inclusive agriculture (over 2 billion euros).

Friesland itself has indicated in the Nitrogen Execution Program that they aim to be a frontrunner in regenerative agriculture. It becomes clear in the NPRA that Friesland faces a significant challenge in creating additional (agricultural) nature compared to other provinces.

Dairy maps







30% landcover

The dairy industry starts at the pastures, the place where the cows are stationed. We will focus on the Netherlands because the pasture is more present than in the other EuroDelta countries. 30% of the landcover of the Netherlands is for pastures which would be the surface of South Holland, North Holland and Utrecht combined.

Biodiversity in cities

The highest biodiversity areas are in or around the cities. The areas with pasture have little to no biodiversity.

Ammonia and Natura2000

The Ammonia has to be reducted throughout the whole Netherlands. However, in the Natura2000 areas, the need for reduction is more extreme than in other parts of the country, because when the Ammonia deposits here, it harms the nature.

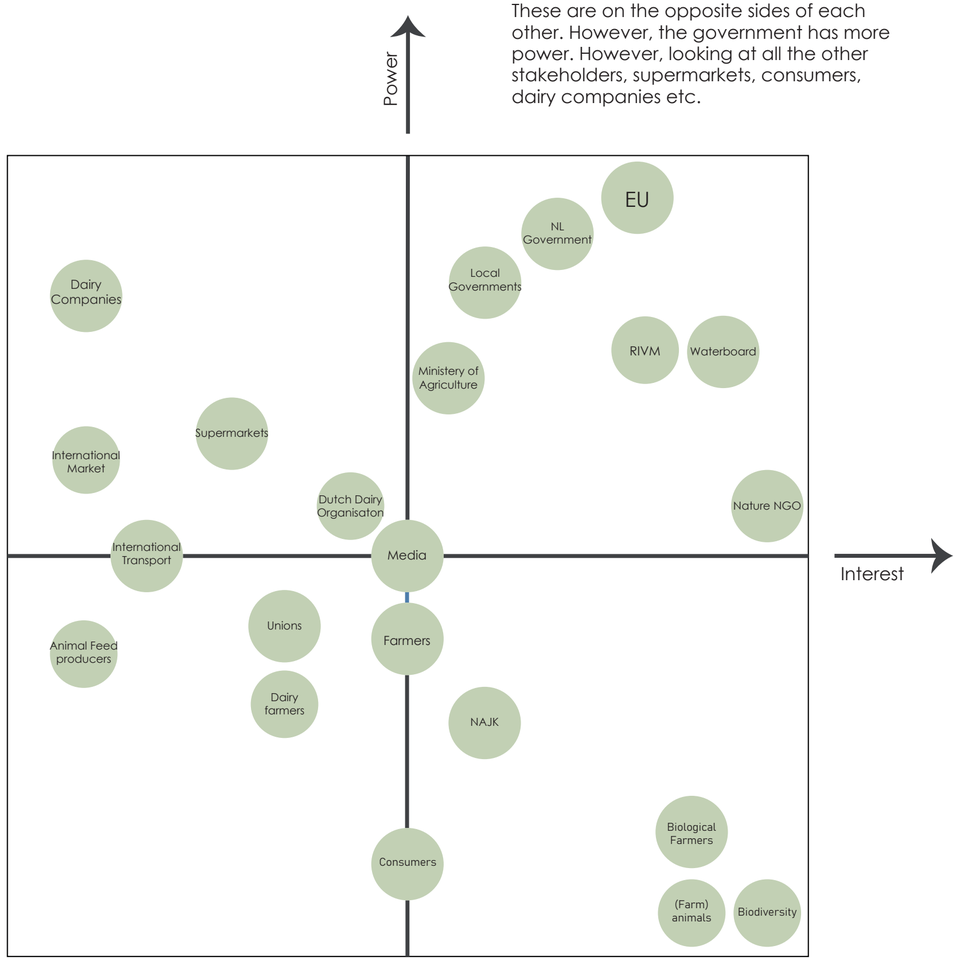
Highest cow density in South-West Friesland

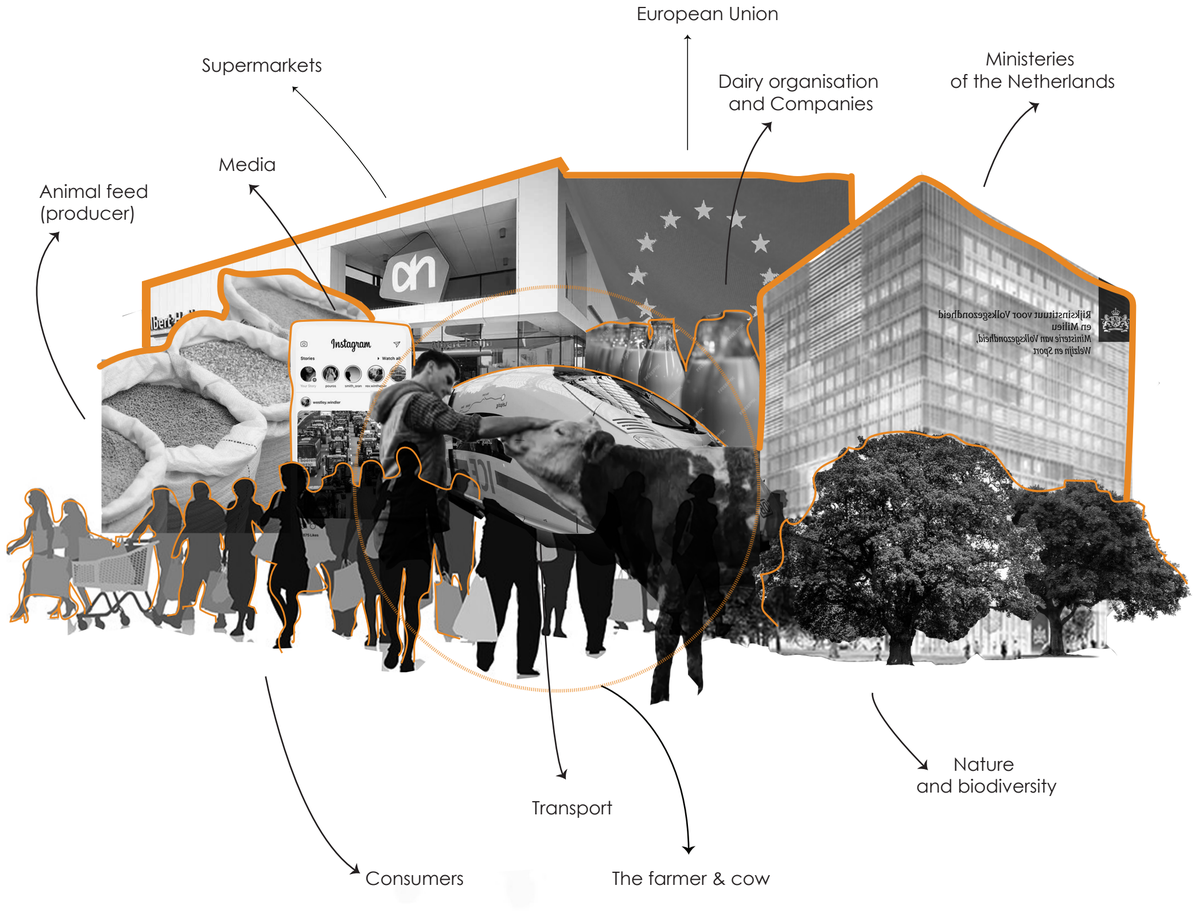
The cow density per munucipality can be seen n this map. The further you go to the North of the Netherlands, the higher the density of the cows are. With the biggest density located in South-West Friesland. This map complies at the same time with the Pastures map.

(*Kaarten | Atlas Leefomgeving*, n.d.;*In 131 Gebieden Moet Stikstofuitstoot Met 70 Procent Omlaag*, 2022)

STAKEHOLDERS

We have several stakeholders who are interested in our project. The two biggest ones are the government and the farmers. These are on the opposite sides of each other. However, the government has more power. However, looking at all the other stakeholders, supermarkets, consumers, dairy companies etc.





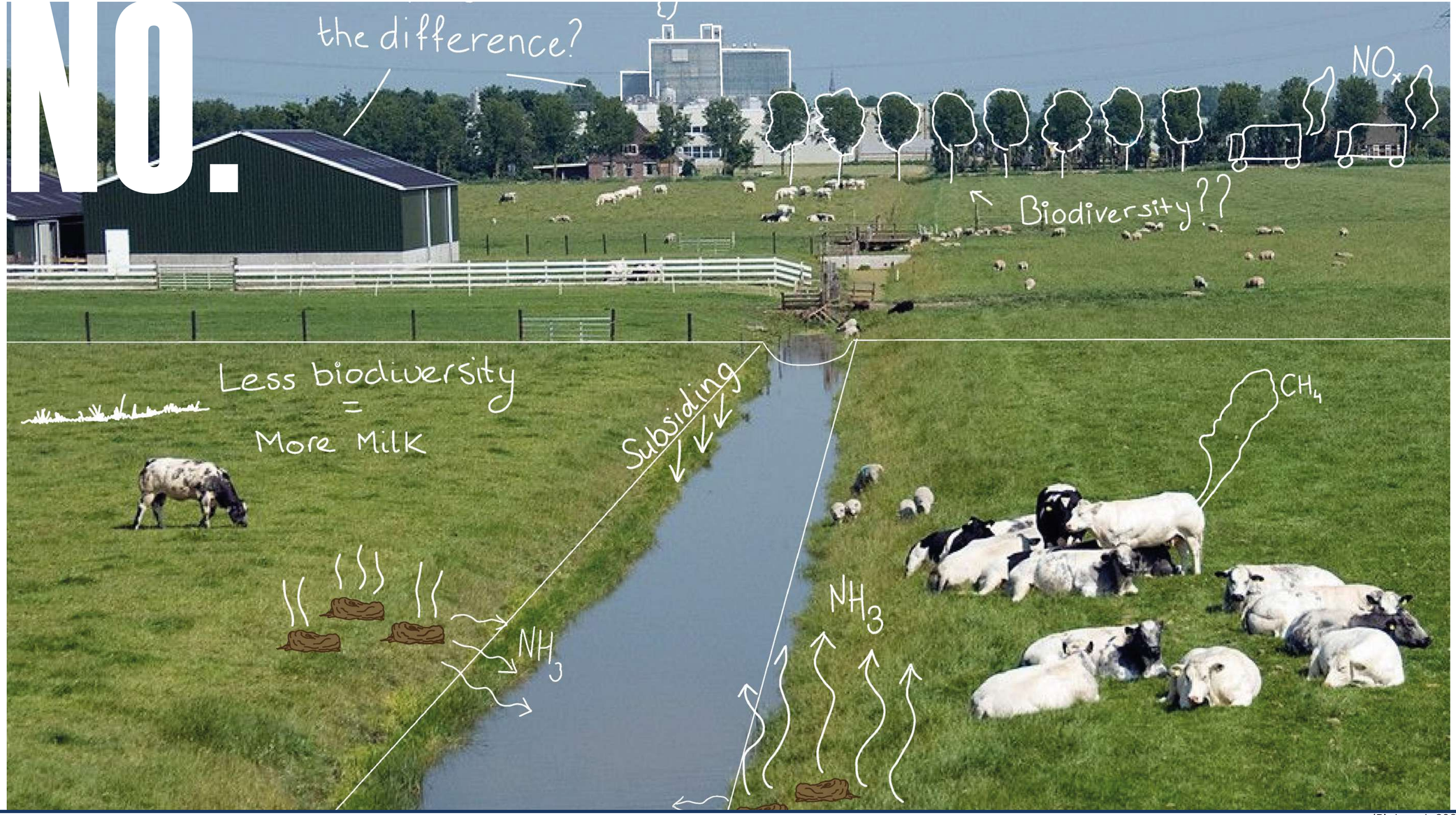
(Alle Treintickets, 2023; FastGrowingTrees, 2023; Freepik, 2024; Het Bedrijfsprofiel, 2016; Hub staff report / Published, 2015; iStock, 2021; NOS, 2019; Rijksoverheid, 2024; WeFix, 2021)

PROBLEM I

MONOCULTURE

IS THIS NATURE?

(Pinterest, 2024)



(Pinterest, 2024)

The Polderlandscape
It seems like a polder is a (bio) diverse landscape because of the green appearence. However when you take a closer look, you'll see that there is a lot of pollution coming from both the animals, transportation and factory. Moreover, there is little to no biodiversity at these landscapes. That is probably because of the usage of land. The more milk we want or produce, the smaller the biodiversity becomes. The use of this land for the dairy industry leads to subsiding of land.

All these elements add up to the negative externalities that come from the polder landscape nowadays. There is no biodiversity, a lot of subsidence and a lot of pollution.

BIODIVERSITY

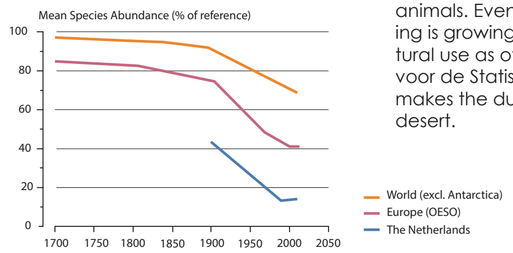
Biodiversity loss in the Netherlands

Biodiversity in the Netherlands have been decreasing fast. The amount of species has declined from 40% in 1900 to 15% in the year 2000 (Compendium Van De Leefomgeving, 2013). According to the Council for the living environment and infrastructure, the biodiversitycrisis is as great as the climate crisis (Raad voor de leefomgeving en infrastructuur, 2022).

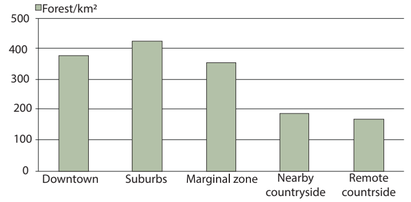
Agricultural land takes up more than half of the Dutch land and most of the time, this efficiency driven industry is not focused on improving biodiversity which continues the decline of variating species (CBS, 2020). Dairy farms, which take up more than a quarter of the Dutch land-use, have created a non-biodiverse, efficiency-driven mix of grass, which is easiest for cows to digest, which is followed by a higher production of milk (De Prijsknaller - Melk, 2022). On top of that, the use of pesticides also keeps off all kinds of animals. Even though biological farming is growing, it is only 4,4% of agricultural use as of 2022 (Centraal Bureau voor de Statistiek, 2022). Agriculture makes the dutch countryside a green desert.

Urban Blue green grids (n.d.) explains that cities have become islands of diversity. The variety that is found in cities causes a higher percentage of flora and fauna which is caused by multiple factors. The absence of pesticides, the variety of temperature and microclimates and other climate related factors, slower driving cars etc. are all causes of the islands with diversity (Urban Green-Blue Grids, n.d.). The diagrams and the map show this phenomenon.The green colour of the grass of the agricultural landscapes misleads people to think that it contains high biodiversity, but in reality there is little to no biodiversity (Urban Green-Blue Grids, n.d.).

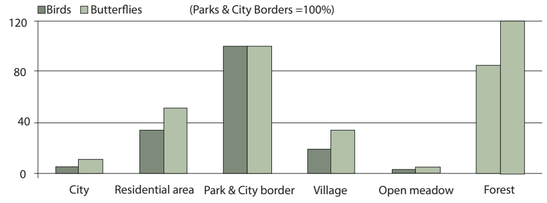
Biodiversity



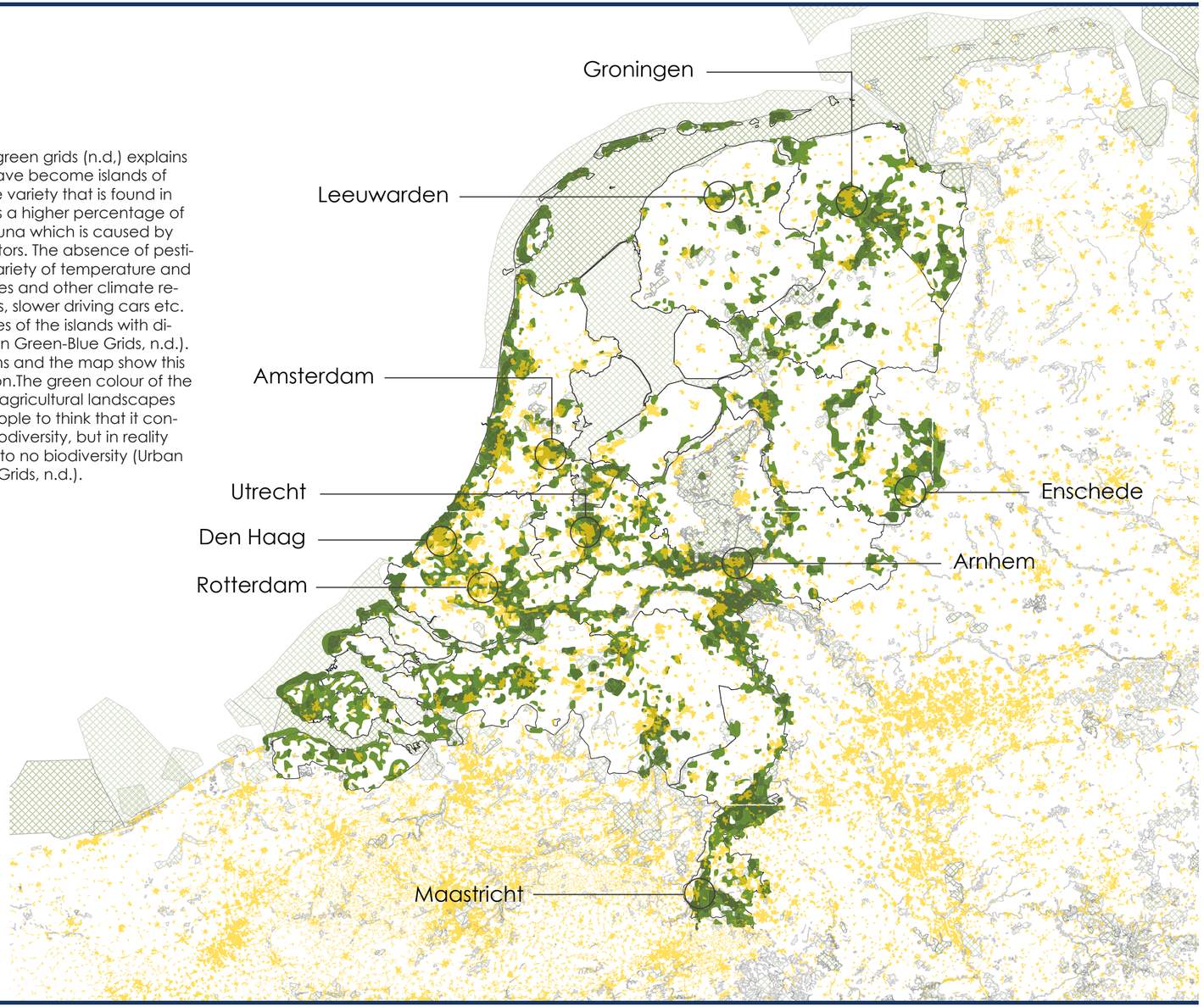
(Compendium Van De Leefomgeving, 2013)



(Urban Green-Blue Grids, n.d.)

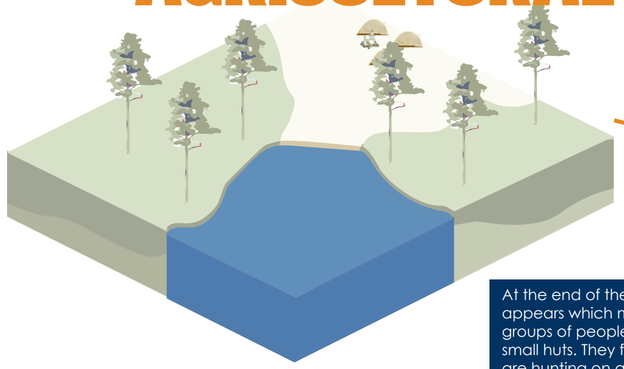


(Urban Green-Blue Grids, n.d.)



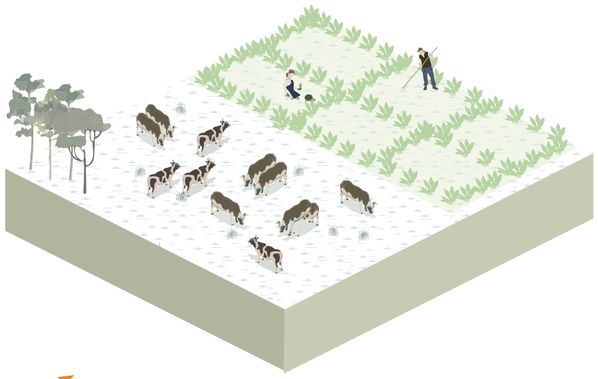
(*Kaarten | Atlas Leefomgeving*, n.d.)

HISTORY OF THE AGRICULTURAL LAND



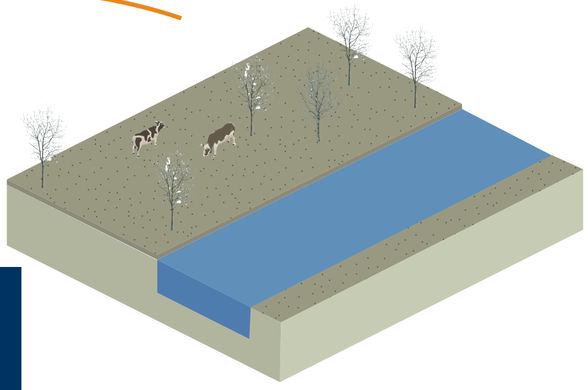
At the end of the ice age a climate change appears which makes living possible. For centuries, groups of people walked around liing in tents and small huts. They feed themselves by fishing, and are hunting on animals. From 5000 BC, the people burn down forests and make agriculture ground of it, when the soil is not giving them anything anymore, they move to the next one. But it still took some time until they changed their nomadic life for a farmers one.

There were a few cows to give the farmers food to keep on living, but it was mostly agriculture for corn etc.

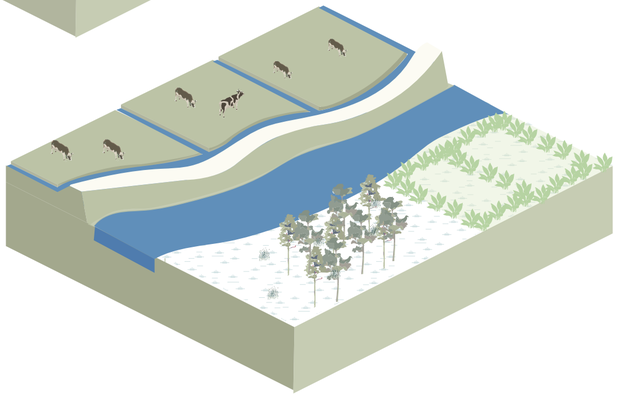


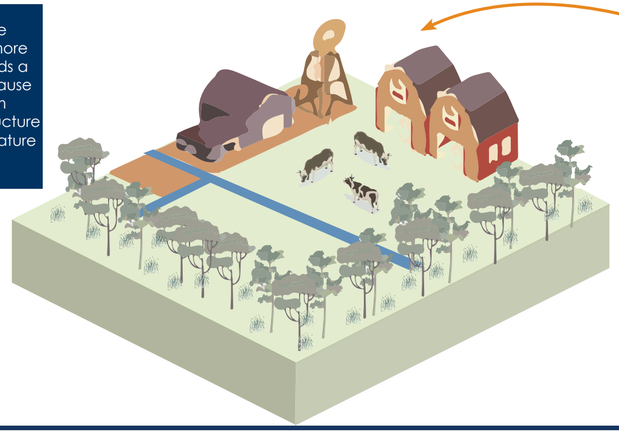
Then, the Romans came. The population grew and so did the demand of food. In the meantime, people found out that the cow is more profitable when it's alive. The cattle breeding was slowly replacing the agriculture. The biggest cattle breeding company had, among other cattle, 2000 cows.

Because of the intensive use of cattle breeding, most of the land got overgrazed and the quality of the grasslands got deteriorated really bad. In the mean time, the winning of peat created a lot of lakes and ponds which kept overflowing, killing the cattle and subsiding the soil.



The Peat winning continues and the insecurity for the farmers goes on as well. Farmers try to create dykes and windmills to keep the water out. They didn't always succeed, but over time they got better. In North-, South- Holland and Friesland they started to create polders and with the help of the windmills, the water in the agriculture changed. By creating new land, especially along the coast of Zeeland, Friesland and Groningen agriculture area was booming again. More money was made and the farmhouses got renovated from old wood to new brick dwellings.

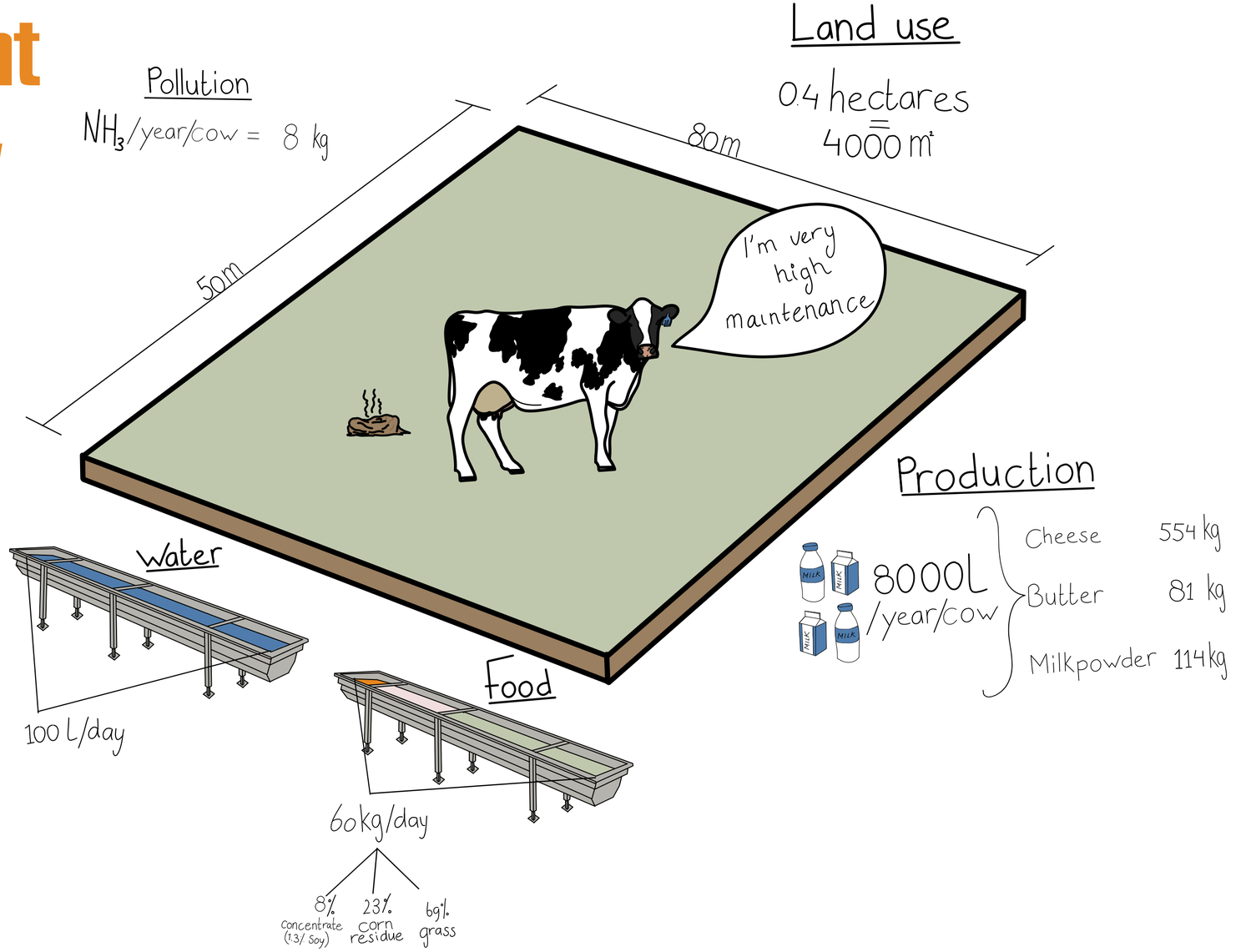




Economies of scale and industrialization dominated the last two decenia of the twentieth century. More and more food is produced and the Netherlands is shifting towards a industry country. The sheds are still getting bigger, because of the intensive cattle breeding. At the same time, from 1990 on municipalities created an ecological main structure which turned some parts of agriculture land towards nature areas.

(Rijksdienst voor het cultureel erfgoed, n.b.)

The Foodprint of the Cow



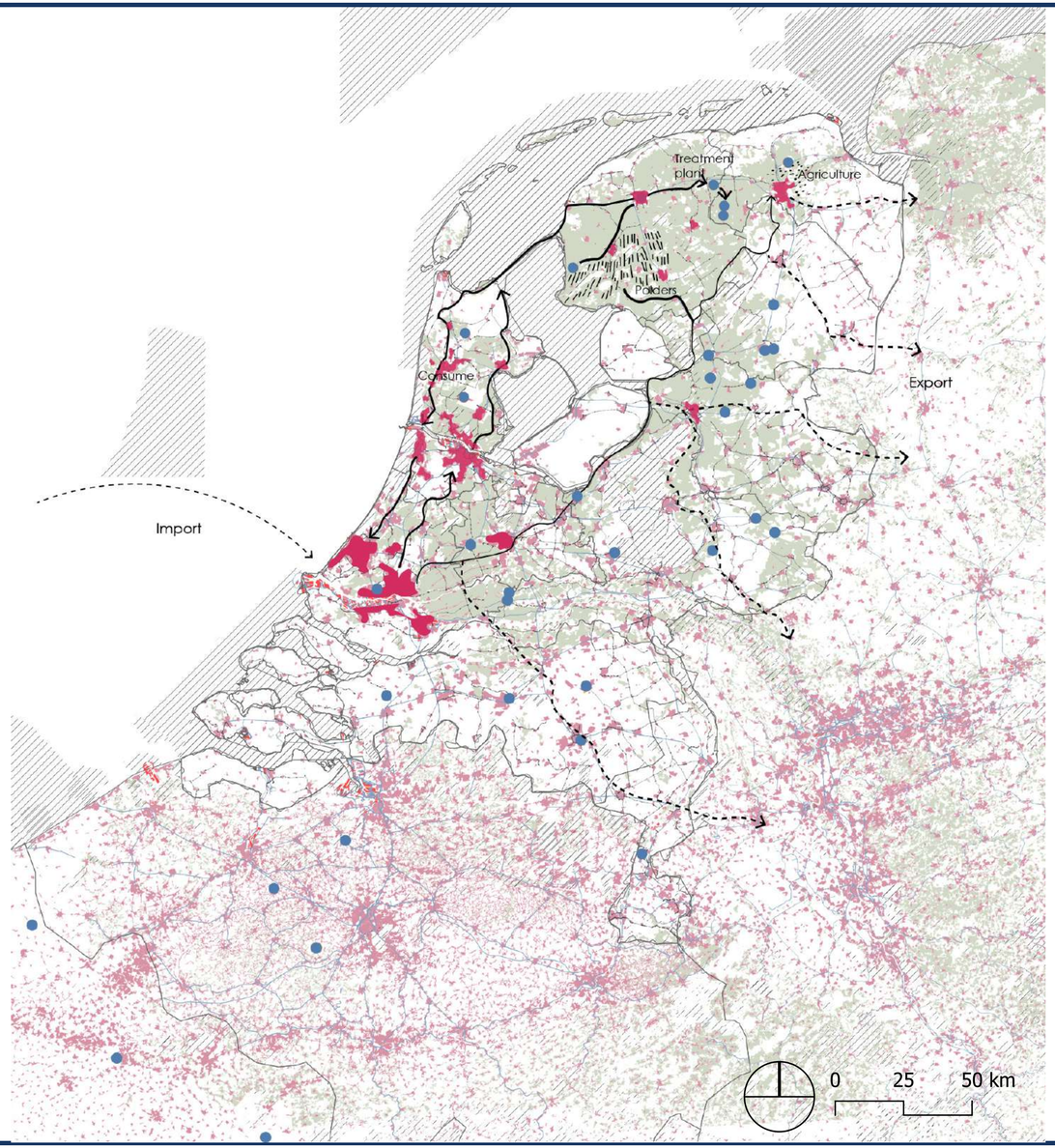
(*Cattle Feed - de Nederlandse Zuivel Organisatie*, 2017; Netherlands, 2023; *Wageningen UR Livestock Research Partner in Livestock Innovations Proceedings 2nd Meeting EGF Working Group Grazing Innovations in Grazing*, 2012; Statistiek, 2015)

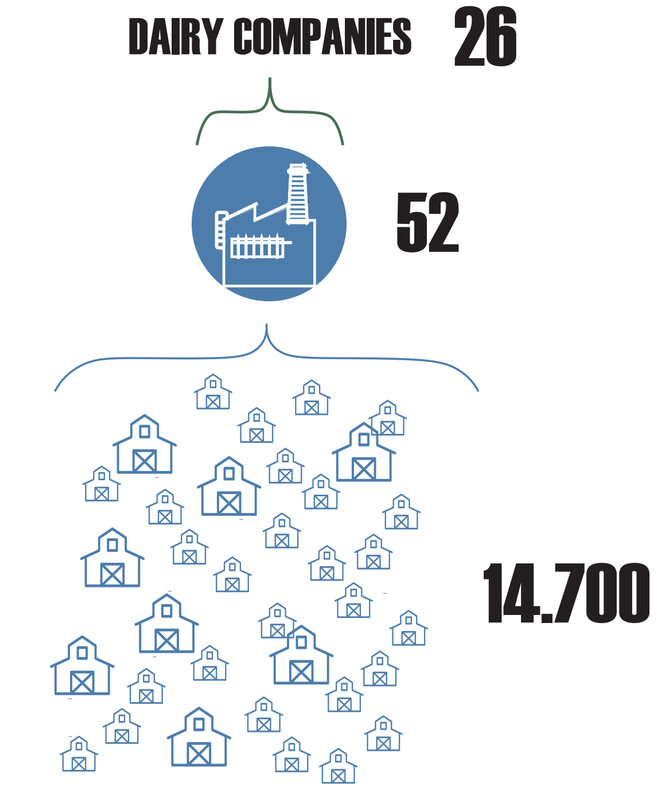
PROBLEM II

CENTRALISED SYSTEM

CENTRALISED SYSTEM

(B.V, n.d.; *Cows Walk to Pasture after Milking, Wyns, Friesland, Netherlands Stock Photo*, n.d.; *Food and Dairy Wastewater Treatment | Cleanawater*, n.d.; Leeson, 2022; lucy, 2023; *PARTRIDGE Has Impact in the Netherlands, Interreg vb North Sea Region Programme*, n.d.)





Natura 2000
Urban Area
Pastures
Treatment plants

The centralized dairy industry

The current dairy industry is a heavily centralized system. The Netherlands has around 14.700 dairy farmers, and only 26 milk treating companies (ZuivelNL, 2022). Of these companies, FrieslandCampina is by far the biggest, treating the milk of more than 9.000 dairy producers (FrieslandCampina, 2024). Of the 54 Dutch treatment plants, 19 are owned by FrieslandCampina (ZuivelNL, 2022).
This centralized structure results in a power imbalance, farmers must comply to the rules of these dairy companies as there are little other places to sell their raw milk. At the same time, one farmer protesting does not even harm the dairy companies a little, as there are plenty of other options to buy raw milk from.

Spatially, this system also encompasses a centralized structure. This map illustrates a hypothetical journey a nitrogen molecule. It starts with feed for cows or fertilizers for pastures arriving in a central point; the port of Rotterdam. Then, it's distributed over a pasture in either place of the 30% of the Netherlands, after which it is transported to one of the 54 centrally located treating facilities, probably one of FrieslandCampina, where it is treated into a typical Dutch cheese. Following probable cause, this molecule is exported to either Germany or Belgium through one of several roads illustrated with arrows, if it's not emitted through cow manure.

PROBLEM III

LINEAR SYSTEM

LINEAR

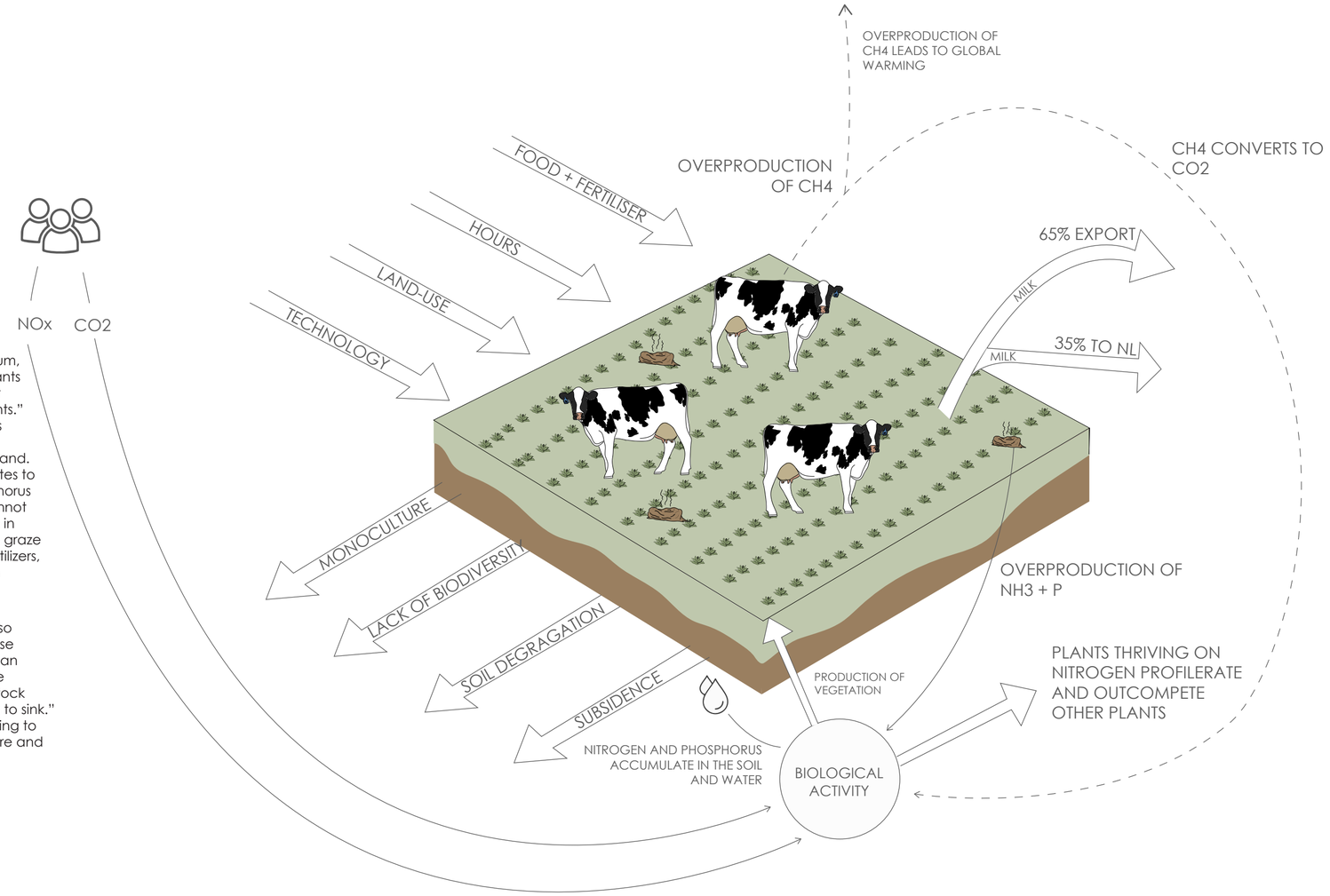
The externalities of conventional cattle farming
In conventional livestock farming, there are several externalities that contribute to linear livestock farming.

Nitrogen and Phosphorus
Nitrogen and phosphorus themselves are not harmful to humans and nature; in fact, they are important nutrients for plants. However, an excess of nitrogen and phosphorus harms the biodiversity of the Netherlands. Too much of these substances leads to poisoning, acidification, and eutrophication. An overproduction of ammonia, for instance, is directly toxic to (lichen) mosses and plants that thrive on nitrogen, causing them to proliferate and outcompete other plants, thus reducing biodiversity. Additionally, the soil becomes acidic as ammonia from manure settles on the ground.

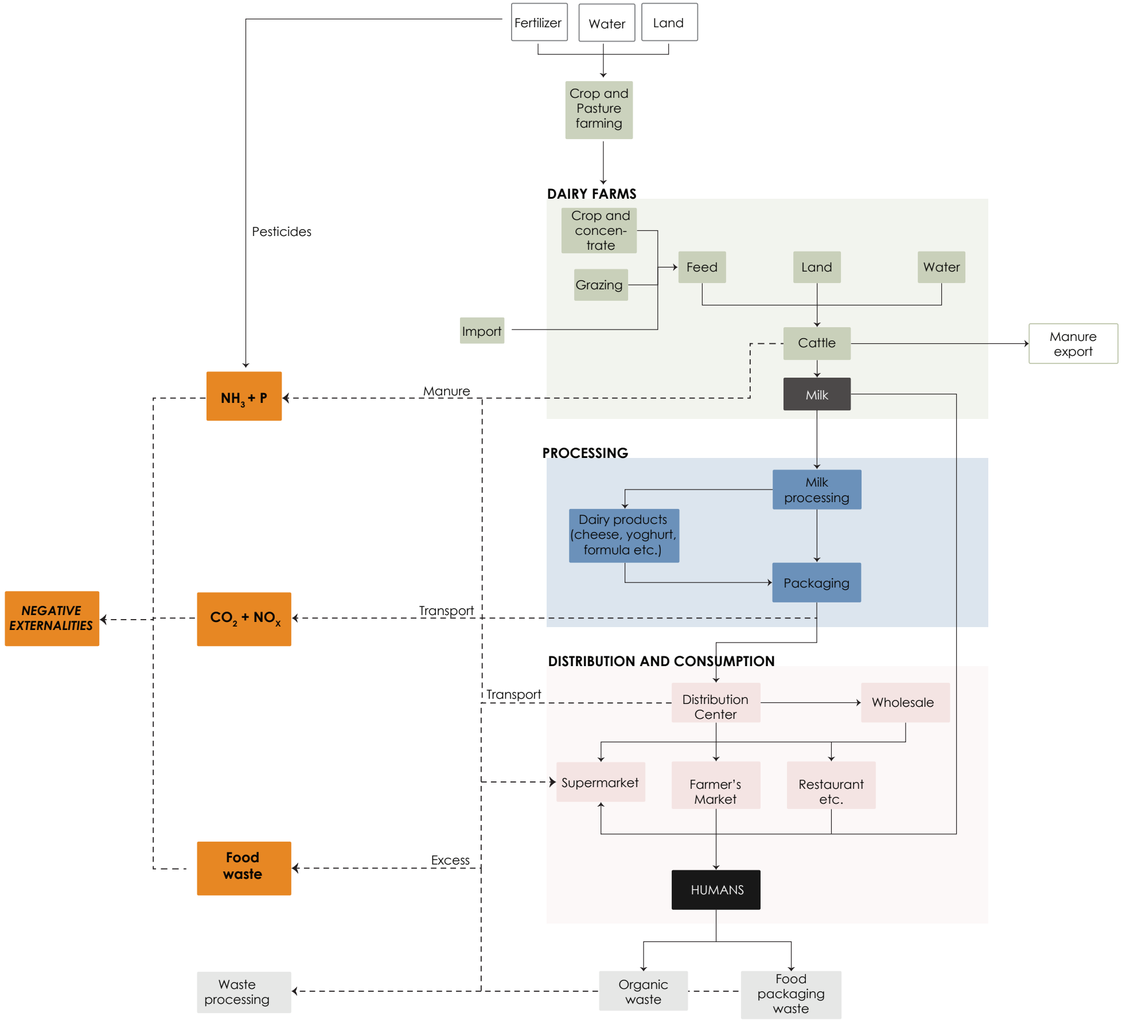
Methane
In addition to nitrogen, livestock farming also leads to an overproduction of methane. Methane is a potent greenhouse gas, approximately 34 times stronger than CO_2, and it accounts for about 20% of the greenhouse effect (Vellinga, 2021). Greenhouse gases are generally important for making Earth habitable because they form a warm blanket around the Earth. However, an excess of these greenhouse gases leads to global warming (Vellinga, 2021a).Next to the emissions of methane, nitrogen and phosphorus of the livestock farming, also humans produce nitrogen and CO_2 with other activities. Examples are the mobility sector, what contributes to the emissions of NOx or other industries that contribute to the emissions of CO_2. All these emissions contribute to an overproduction and contribute to the linear system.

"Important minerals such as calcium, potassium, and magnesium dissolve and wash away. Plants that cannot tolerate acidic soil will disappear because they cannot absorb the right nutrients." (Natuurmonumenten, 2024) Currently, there is a significant overproduction of nitrogen and phosphorus in the polders of South-West Friesland. This overproduction is so large that it contributes to a linear system because nitrogen and phosphorus accumulate in the soil and water. The soil cannot process the amount of nitrogen, so it ends up in groundwater. Often, the pasture where cows graze is fertilized with liquid manure and artificial fertilizers, which partly contributes to this accumulation (Staatsbosbeheer, 2022).

Subsidence
Moreover, conventional livestock farming also leads to land subsidence. This occurs because the water level is kept low so that livestock can continue to graze in the pasture. "Due to the ongoing drainage required by modern livestock farming, the soil in peat meadows continues to sink." This process releases a lot of CO_2s, contributing to global warming (Ministry of Education, Culture and Science, 2019)."



THE DAIRY INDUSTRY



Linear Flows
The diagram shows the dairy industry's flow within the European food system. This system is marked by significant external inputs, including fossil fuels, fertilizers, and pesticides, alongside lower labor inputs and extensive supply chains. However, it also exhibits diversity, featuring numerous small-scale family-based producers coexisting with large-scale globalized food companies and suppliers. (Food in Green Light, n.d.)

The process is categorized into three parts - production, processing and consumption, each step producing certain externalities that impact the environment. These externalities appear, because the flows are linear and out of balance. The expansion of larger specialized production units has resulted in monocultures, significantly impacting the environment, reducing diversity, and raising consumer concerns regarding food quality (EPSC, 2016). The chain shows a high efficiency driven model, where there is no attention to the circular ecological ecosystems.

The current diet
The current average menu of the Dutch does not meet the guidelines of the Health Council (Gezondheidsraad, 2015). Dutch people eat too little vegetables, fruit, fiber, and too much alcohol, meat, salt, and saturated fatty acids. The current dietary pattern consists of 60% animal products and 40% plant products. Additionally, this dietary pattern is very burdensome for biodiversity, climate, air and water quality, soil quality, and animal welfare. Thus, the Dutch diet is highly burdensome for the environment.

This burden mainly occurs during the primary production process on farms and in fisheries. "Of the total Dutch consumption footprint, Dutch food consumption is responsible for nearly 40 percent of the land footprint and approximately 13 percent of the greenhouse gas footprint" (Muilwijk et al., 2019). According to a study by the PBL (Netherlands Environmental Assessment Agency) on sustainable diets for the citizens of the Netherlands, there are several factors that play a role in a more sustainable diet, such as reducing food waste and producing more efficiently. The main factor is sustainable eating itself. The PBL presents various possible diets, such as "vegetarian with fish," "two days a week without meat," and "sustainable and healthy."

FLOWS AND CONSUMPTION

The Netherlands has one of the world's largest trade surpluses.

7,1 BILLION EUROS

Worth in dairy products is exported per year

Dairy is used for domestic consumption

35%

8%

Of the National trade surplus comes from the dairy sector

45%

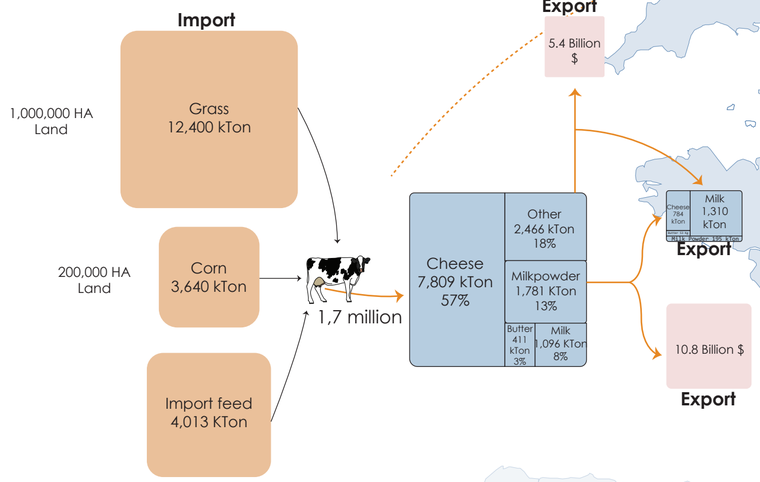
Dairy products are exported to Belgium, Germany, France and UK

25%

Dairy products are exported to Asia, Africa, and the US

20%

Of dairy products are exported to the world market

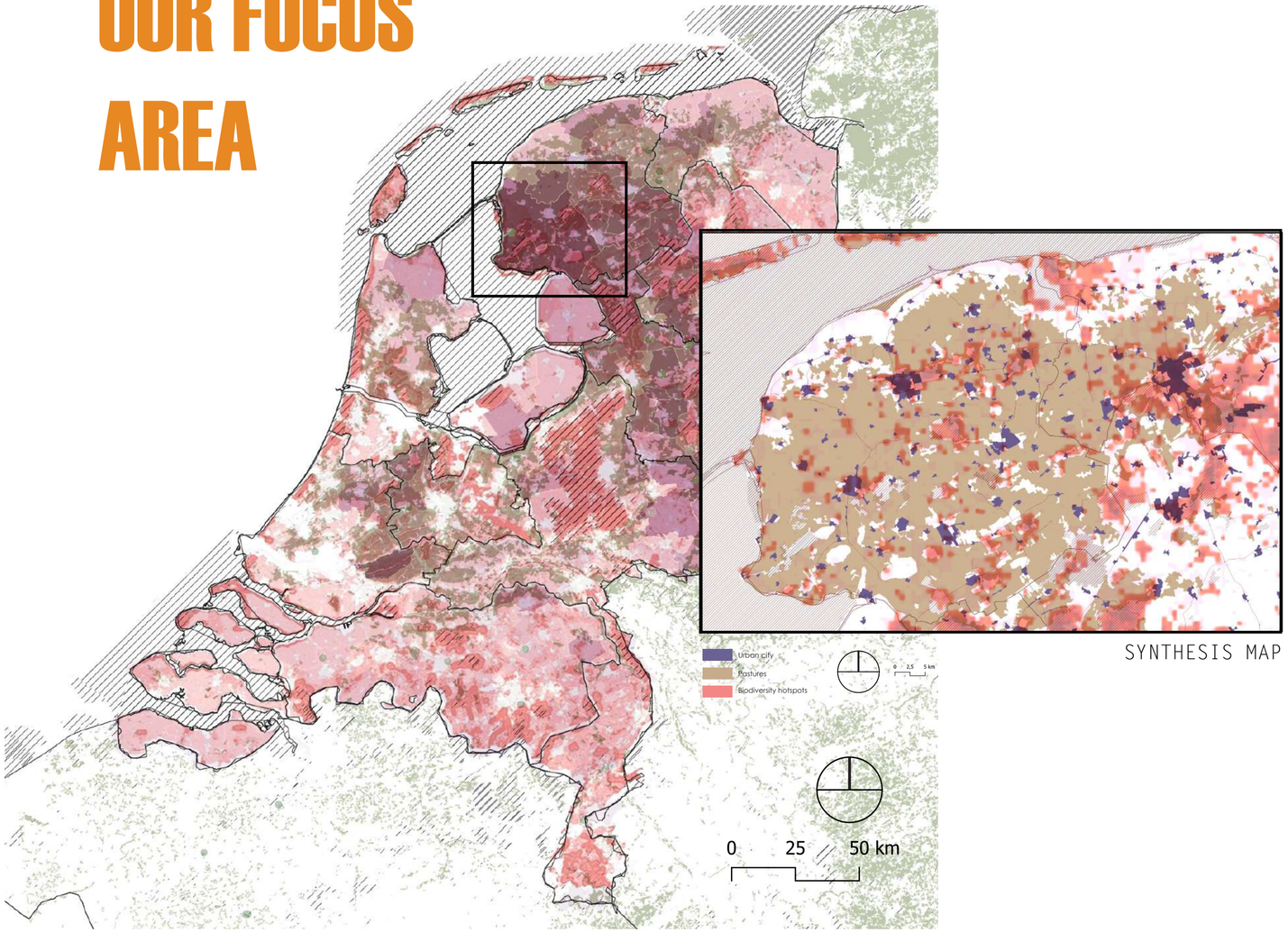


The Netherlands has one of the largest trade surpluses, 8% of which comes from the dairy industry. About 35% is used for domestic consumption and the remaining 65% is exported. This means a lot of externalities build up in the Netherlands, while it is not for local consumption. This exhausts the ecological system within the Netherlands.

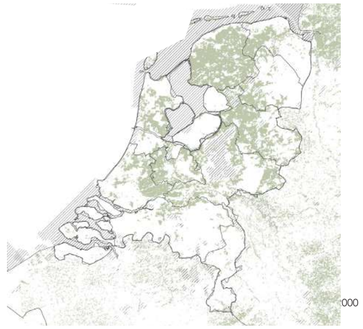
The chart below shows the quantities of materials that go into the dairy production and the outputs. This process is made highly efficient such that 1.7 million cows produce 1310KTon of milk for domestic consumption per year, among other dairy products. (CBS Statline, n.d.) However, European countries are also dependent on overseas land for its own production and consumption, such as the import of feed from South American countries. This import of feed is used to give the cow partly a protein rich diet. Producing soy has a destructive effect on the ecological systems in South-America (Food in a Green Light, n.d.). Concluding, the flow of the cattle feed is not a circular system, but an exhaustive chain. It is the same in the case of fertilizers that are oversupplied to the soil, degrading it. This harms the biodiversity and the water quality of the Netherlands.

("Handboek Snijmaïs," n.d.; 2023; CBS Statline, n.d.; Nederlandse Zuivel, n.d.; The Atlas of Economic Complexity by @HarvardGrwthLab, n.d.; THE POWER of DAIRY the POWER of DAIRY READY for TOMORROW'S CHALLENGES a REPORT on the SOCIAL and ECONOMIC ASPECTS of the DAIRY SECTOR in the NETHERLANDS, n.d.)

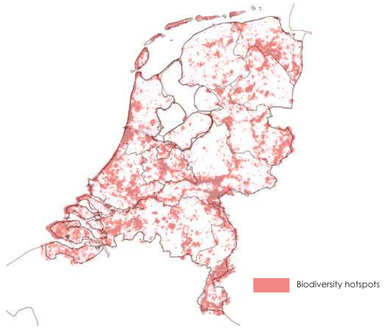
OUR FOCUS AREA



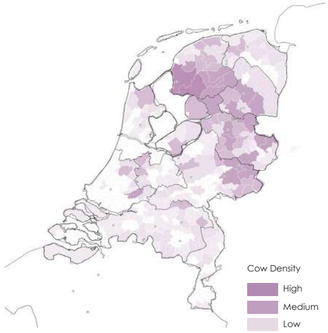
SYNTHESIS MAP



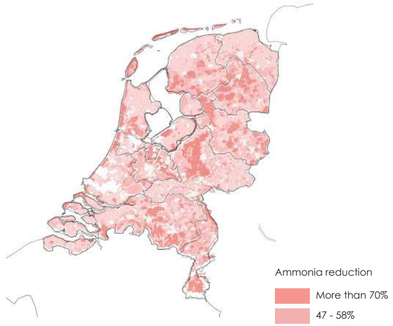
Pasture and Natura-2000



Biodiversity



Cow amount per municipality



Ammonia Map

Overlaying maps
Several analysis maps are overlayed to understand what is happening on the larger scale due to the dairy industry,

At first, the pasture and natura2000 give an indication where nature and pastures meet. The biodiversity map shows a lack of biodiversity in these pastures, which have negative results on the environment and society. Furthermore, the cow density map displays the areas with a high density of cows. The Ammonia map shows us the areas which have the most priority with the nitrogen issue. These maps on top of each other highlight the South-West Friesland area, which is why this is the start to shift towards a greener future.

(*Kaarten | Atlas Leefomgeving*, n.d.;*In 131 Gebieden Moet Stikstofuitstoot Met 70 Procent Omlaag*, 2022)

03 Research Design Framework

Problem statement and questions
Conceptual framework
Consumption
SDG's and Scope
Goals and Criteria
Methods we Used

Problem statement

The dairy industry is one of the biggest industries in the Netherlands. The country has 1,7 million cows, each using 0,4 hectares of land. The cows consume 60 kilograms of feed per day, which includes 55 kg of grass and corn residue. To meet these requirements, the dairy industry turned the agricultural land into monoculture, producing 14 billion kilograms of milk per year on 30% of the Dutch land area. This equals the surface of North-Holland, South-Holland and Utrecht combined. The population of The Netherlands consumes up to 265 liters per year per person. Besides local consumption, the Netherlands is responsible for 7,6% of the world's total milk supply, accounting for 7,6 billion euros. It seems to be an amazing business model. However, this type of land-use produces many harmful emissions, like CO2, ammonia and methane. It has long-term effects on both the air and water quality. Besides, this type of land use causes subsidence caused by controlling the water level. The monocultural land is also degrading the biodiversity, resulting in little diversity of flora and fauna, hence worsening the accumulation of pollutants. Moreover, the dairy industry contributes only 0,8% to the BBP of the Netherlands. It is therefore a big polluting and land-consuming industry, with relatively low economic benefits as compared to the environmental degradation. It is necessary to look into new types of land-usage, which are economically viable and with less negative externalities.

SUBQUESTIONS

1. How can we rearrange the dairy industry in such a way that we minimize the negative externalities?

2. How can we create a spatial and social just system for the farmers?

3. In what manner can a biodiverse landsape be structured to sustain employment opportunities for its inhabitants

4. In what way can this new combination be implemented in the polder landscape?

5. Which tools and policies can be used to realise this vision?

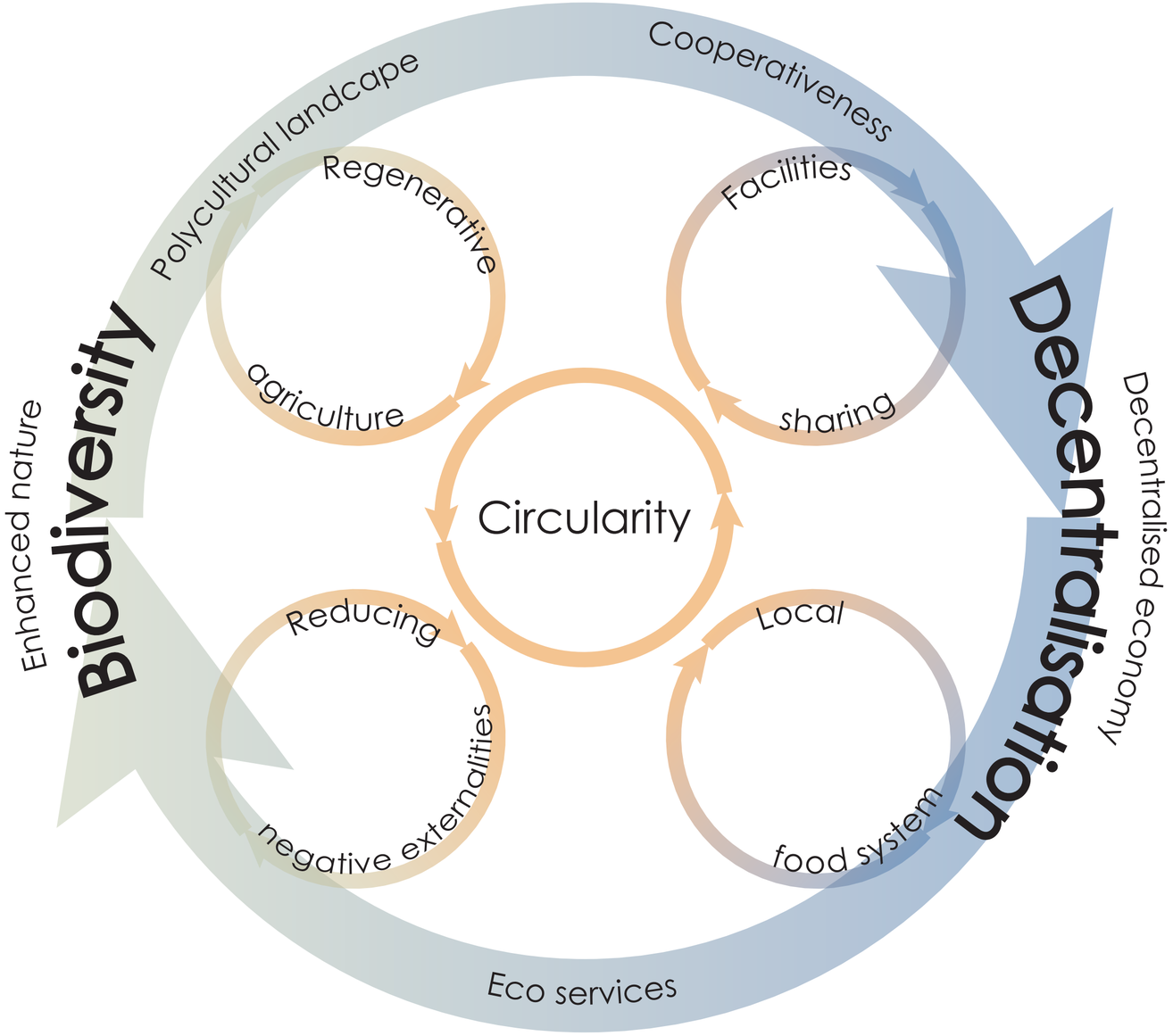
RESEARCH QUESTION

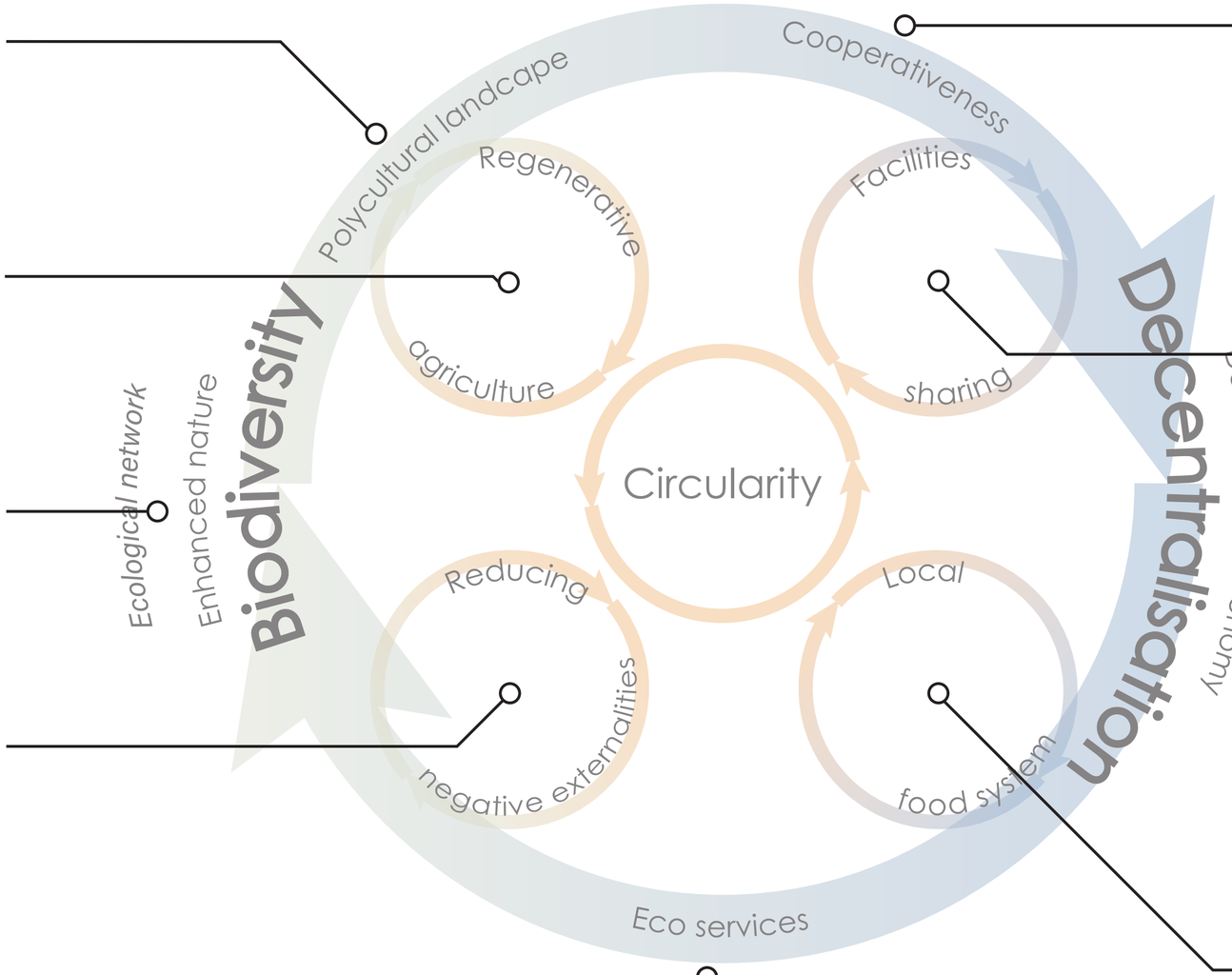
"How can we transform the polluting dairy industry into a circular one and make a shift towards a local, diverse and self-restoring agricultural network in South-West Friesland by 2055?"

CONCEPTUAL FRAMEWORK

Introduction
The aim of this project is captured in three main concepts; circularity, decentralisation and biodiversity, our pillars. All of these pillars play a role on their own, but are at the same time dependent on each other. Biodiversity and decentralisation are the two main objectives of this project and the vision will address these two identified problems with appropriate solutions. Circularity is considered a broader pillar encompassing both biodiversity and decentralisation.

Within the main pillars, more detailed concepts arise. These are placed in the conceptual framework either solely in one of the bigger pillars, or in between them, simulating their position completely dependent on the pillars or play a bridging role between them. Bridging concepts are either necessary to achieve the opposing pillar, or are formed as a natural result of both.





A shift from a monocultural landscape towards a more bio-inclusive and diverse polycultural landscape is proposed.

New functions and responsibilities arise from the shift towards a polycultural landscape. To mitigate and distribute these, a cooperative system is proposed. This system can share the burdens and facilitate an equal distribution.

Regenerative agriculture entails a diverse use of soil and space, resulting in a circular use of products and wasteflows. Therefore positioned exactly between both and bridging this gap.

Through more intensive cooperation and within cooperatives, increased trust and shared responsibility result in a more supporting environment to share facilities and amenities.

Through enhanced nature and ecological networks, biodiversity is restored. Together,they form the foundation for increased biodiversity.

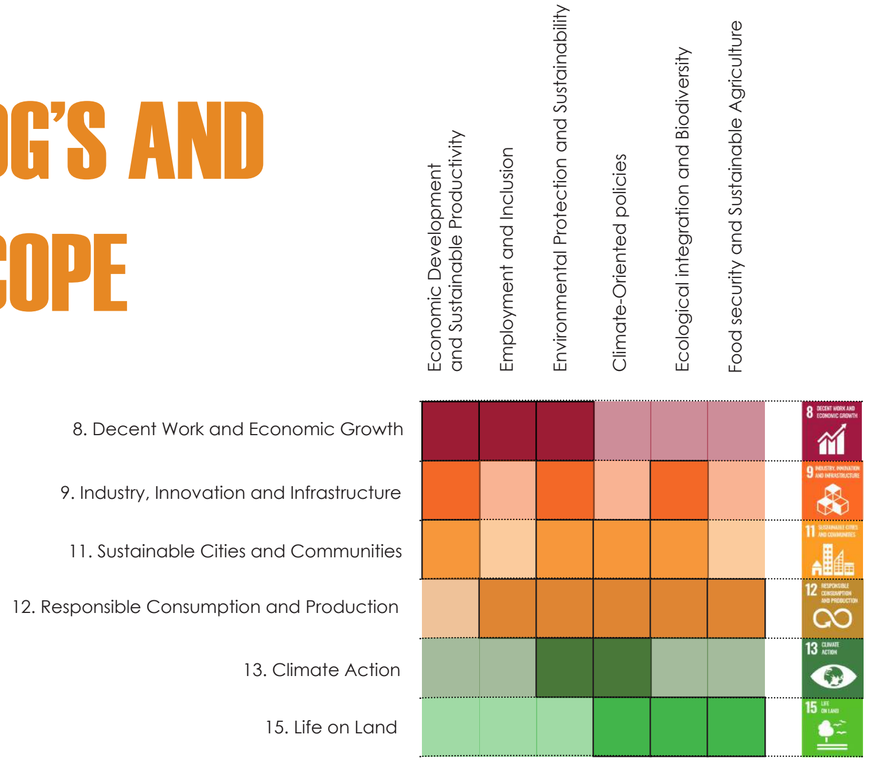
Increased cooperativeness results in a more powerful and local stakeholders. Cooperatives can self-organise former centrally organised functions, paving the way for a decentralised and localised industry.

Through an increased focus on eco-services and increased biodiversity, externalities will be reduced, resulting in a more circular material usage.

A decentralised industry is more inclined to consider various local stakeholders, including those focused on maintaining biodiversity within the landscape. Thus, decentralisation results in increased ecological services.

Decentral treatment and production result in a stronger local identity. This will set the stage for a local food system.

SDG'S AND SCOPE



The goals that we established are related to the sustainable development goals created by the United Nations (United Nations, n.d.) These are Decent work and Economic Growth (Goal 8), Industry, Innovation and Infrastructure (goal 9), Sustainable communities (Goal 11), Ensure sustainable consumption and production patterns (goal 12), Climate action (Goal 13), Life on Land (goal 15).

All these SDGs address our strategy, talking about the awareness of climate change and the deteriorating air quality. Creating new jobs and new sorts of incomes, promoting local products and creating strong communities focused on biodiversity and green public spaces. Touching upon the social, economical but also ecological aspects.

There are more SDG´s, but for our project, we are focusing on these in the are of South-West Friesland, eventually continuing on the rest of the polders in the Netherlands.

Decent Work and Economic Growth (Goal 8)
- Creating economic productivity
- Innovative activities
- Highlighting sectors with a high contributed value and high intensive labor.
- Promotion of policies that develop efficient activities who create worthy jobs
- Growth and foundation of small and medium big companies
- Policies that implement and aid by the creation of jobs in tourism and activities
- Promoting local culture and products

These aspects are part of our strategy because we are looking, among other things, at local production and creating jobs in different sectors (small to big). This will result in a new economy and hopefully a mix between different sectors as well. Changing and improving the status quo economical aspect.

Industry, Innovation and infrastructure (Goal 9)
- Development of qualitative, sustainable and trustworthy infrastructure,
- Road are contributing less pressure on the environment

We are looking at the development of biodiversity. Right now, the biodiversity is deteriorating. We want to relieve some pressure on the flora and fauna by changing the polders design, but also the environment around the polders. At the same time, we aim to strengthen existing nature areas by creating new nature corridors, enhancing the biodiversity in both these areas and agricultural land.

Sustainable communities (Goal 11)
- Heighten the effort into the protection and security of the cultural and the ecological heritage
- Looking at the disadvantages of a city for the environment
- Give attention to air quality, municipalities and waste streams
- Inclusivity and accessible green and public spaces
- Positive influences on the economy, social and ecological aspects by increasing the relationship between cities and rural areas

There is a lot of nitrogen pollution and a lot of green space. However this space is not public and it is also not aiding with the biodiversity or function of the space. It is a monocultural use. In our strategy we are looking at ways to create a multi-functional area, housing public space with flora and fauna, accessible for everyone and looking into ways where we can mitigate the nitrogen pollution. Moreover, to minimize the distance between the polders and rural areas, make them work together aiding the social aspect.

Ensure sustainable consumption and production patterns (Goal 12)
- Minimize the food waste by recycling and reusing
- Promote companies to shift to a sustainable way of manufacturing
- Insights for people about sustainable development
- Harmony with nature.
- Develop job opportunities in the tourism sector
- Promotion of local products and culture

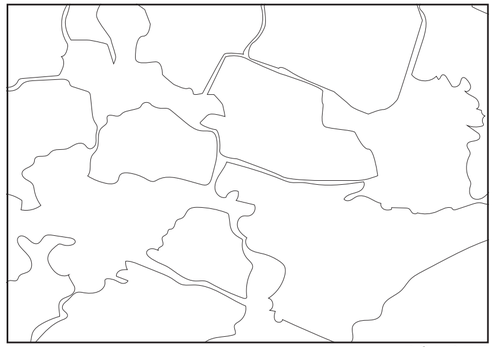
This goal addressed our strategy while it is talking about the way to work with food, a shift in companies to a sustainable way. Overall, to change the way the polder structure works right now. We want to create new job opportunities, having different kinds of people / jobs next to each other. Create more local production and consumption and to promote a healthy relationship with nature. Looking at either social as well as ecological as well as economic part.

Climate action (Goal 13)
- Making regulations surrounding the climate change
- Improving the awareness of the our capacity to - mitigate the climate change

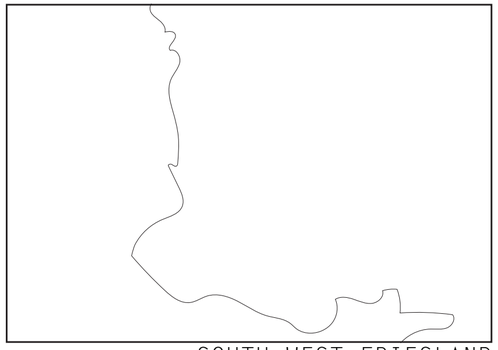
This is in compliance with our strategy while the long term goal is to lessen climate change. To work towards a more sustainable future.

Life on land (Goal 15)
- Conservation, repair and the sustainable use of ecological aspects, especially in forests, dry areas
- Promote and expand implementation of sustainable maintenance of all kinds of vegetation landscapes.
- Repair the degrading soil
- Guarantee of the biodiversity and improving the flora and fauna
- Integrating the ecological and biodiversity systems into national and local planning

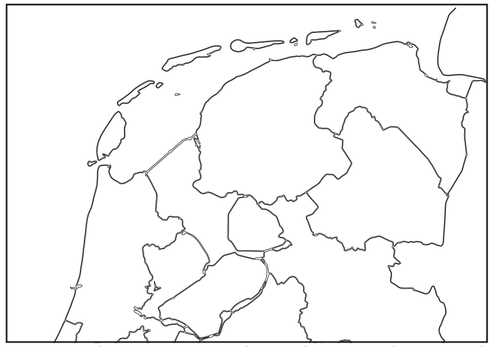
Life on land fits with our strategy because it looks at the ecological part. Repairing the soil, attracting more flora and fauna which will improve the biodiversity and to look at the different systems on a national and local scale.



POLDER



SOUTH-WEST FRIESLAND



FRIESLAND AND SURROUNDING AREAS

EURODELTA

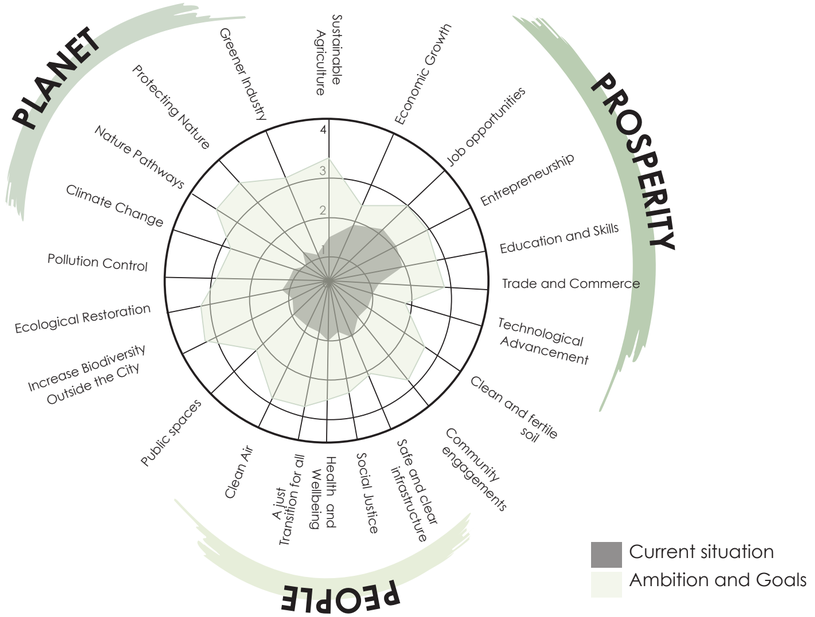
GOALS AND CRITERIA

We have established several different criteria and goals for this project. These are set to realise the shift towards a local and self-restoring dairy industry in South-West Friesland and the Netherlands. The goals for this ambition can be differentiated in two categories. One is a transformation of the polderstructure to a polypolder, creating new businesses and community engagements. The second category is to create a as fair as possible change for everyone.

A transformation of the polderstructure means a reboot of the polder. A nature connection will be the base of the new structure. This green network connects different Natura2000 areas together, creating a safe passage for flora and fauna. Improving the biodiversity which is lost within the polders. Nature will go its own way, creating space for both recreational activities as regenerative farming practices. These practices will lead to a more healthy soil and a sustainable movement on the dairy industry improving the environmental quality and reducing the nitrogen pollution at the same time.

The result of this new polypolder will change the polders in South-West Friesland first, followed by the rest of the polders on national scale. Creating a new mosaic polder structure containing three poldertypes. These contain different activities and functions, all aiming for social and spatial justice touching upon but not minimized to the EuroDelta scale. Creating new business models allows the farmer to keep the same wage. Whereas the spatial justice focuses on the distribution of locally qualitative produced products. To ensure that everybody, regardless of their location, will have equitable access to these products, a healthy environment and socio-economic opportunities. Aiming to a just transformation at the same time.

To complete this just transformation, we are shifting from a centralised system and the lineair chain that it produces. By creating cooperatives between the farmers and polders (cooperative clusters). Where they can share amenities, knowledge creating an improved social interaction within the community engagements. Minimizing the distance between the farmers themselves and the consumers as well.



METHODS WE USED

INTRODUCTION

We have systematically analysed different academic texts, media and documents to identify patterns, themes and biases over the Nitrogen pollution. After reading all the public opinions expressed in the media, we decided to what our project would be about: the dairy industry.

DISCOURSE ANALYSIS

ANALYSIS

SOCIAL NETWORK ANALYSIS

We have looked at the relationships between the cows and the farmers, the dairy industry and the farmers, treatment plant within the dairy industry and the way we consume the dairy.

DOCUMENT REVIEW & ARCHIVAL RESEARCH

We have looked at the history of agriculture, read multiple policies and previous planning interventions. That is how we created our conceptual ideas.

SITE VISIT

We have visited specific locations, mainly the polders to understand the physical characteristics, the spatial arrangements and the relation between the natural and built environments and the society.

ENVIRONMENTAL ASSESSMENTS

When we were at the site, we were looking at the physical and ecological aspects. Observing the biodiversity, quality of land etc. and noted these aspects per area to see the differences.

STAKEHOLDER MAPPING & ENGAGEMENT

We have mapped different actors who are involved in our project to see and understand the different perspectives and to build consensus on the planning approaches.

PUBLIC PARTICIPATION GIS

We have looked at different data-sets in Qgis, which spatialised the different aspects of the dairy industry and gave an overall view of how certain aspects are distributed.

DESIGN RESEARCH

PARTICIPATORY WORKSHOPS

We have gotten a lot of knowledge and input by the workshops which were provided every Thursday. We could brainstorm and draw or write down our ideas to create a clear image of our project / process at that time.

We kept documentating our analysis, and put it in use during the workshops. We used the knowledge of the analysis to design our assignments for this chapter. While at the same time using the knowledge of the workshops in our analysis.

BASE

We used all this information, starting from the introduction, into our vision and eventually our strategy.

PHOTOGRAPHY AND VIDEO DOCUMENTATION

We have captured visual data and documented these to look at the existing conditions, to illustrate the spatial relationships and to support analysis and our mid- and final presentation.

How can we rearrange the dairy industry in such a way that we minimize the negative externalities?
- Social network analysis
- Site visit
- Document review and archival research
- Environmental assessments
- Public participation GIS
- Participatory workshop

What tools and policies are required to realise this vision?
- Document review and archival research
- Participatory workshop

VISION AND STRATEGY

DISCUSSION AND REFLECTION

We have discussed our findings and talked a lot about decisions for the vision and strategy. We argumented our personal visions and ideas about specific topics and tried to understand each others' points of view. During the discussions, it was possible to give feedback about the ideas and emphasize the strong and weak aspects of them.

COMPROMISE

How can we create a spatial and social just system for the farmers?
- Social network analysis
- Stakeholder mapping and engagement
- Document review and archival research
- Participatory workshop

In what manner can a biodiverse landscape be structured to sustain employment opportunities for its inhabitants?
- Social network analysis
- Stakeholder mapping and engagement
- Document review and archival research
- Participatory workshop

In what way can this new combination be implemented in the polder landscape?
- Document review and archival research
- Participatory workshop

(Dąbrowski & Rocco, 2024)

04 Self-restoring Agricultural Network

Vision
Vision statement and Main Goals
The Re-imagined Self-restoring Agricultural Network
Solution I) The Polyculture Polder
Solution II) Decentralised System
Solution III) The Circular Network
Conclusion on the Big Scale
Diagram

VISION

VISION

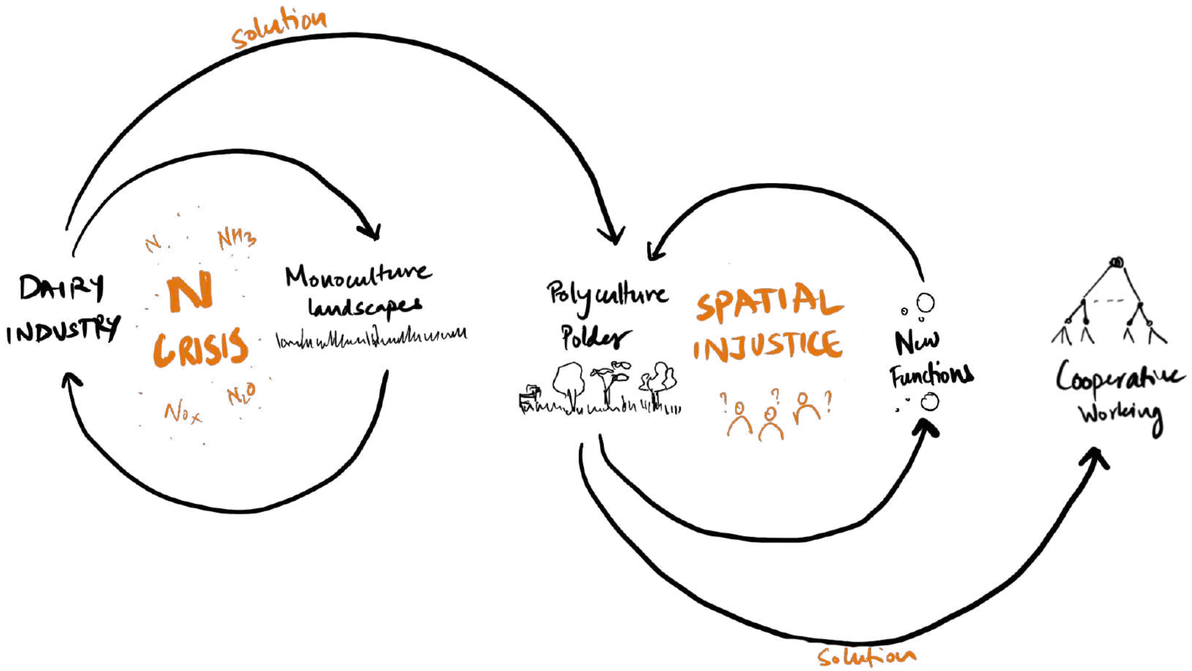
Statement

From globalised linear chain to a localised circular biodiverse agricultural network.

Our future vision for the dairy industry in Friesland aims to shift from an efficiency-driven, monocultural, and linear chain towards a regenerative and circular approach to production and consumption. The goal is to redirect focus towards establishing a more biodiverse and locally-centered network, promoting sustainability and resilience in the dairy sector. We will use the existing polder structure to redefine the landscape and create a multipurpose mosaic, which contributes to qualitative land use. To design with natural challenges like loss of biodiversity, nitrogen, soil-subsidence and climate change. Whilst creating a balance between control and nature taking its course.

On the national scale, the future dairy industry will transform from a centralized to a decentralized production and consumption. On the regional scale, the polder structure in Friesland is going to get a more active function. Including different social, ecological and economic activities, creating a mosaic landscape. On the local scale, the dairy farms are going to transform into regenerative farms with healthy soil as the base of their practice.

All these scales contribute to a more biodiverse, locally-centered dairy industry in Friesland, which creates a breeding ground for more cooperation and trust between civilians and farmers. In this way, Friesland will set an example for the whole country to transform from an industrialized landscape to a balanced one where dairy farming is in harmony with nature.



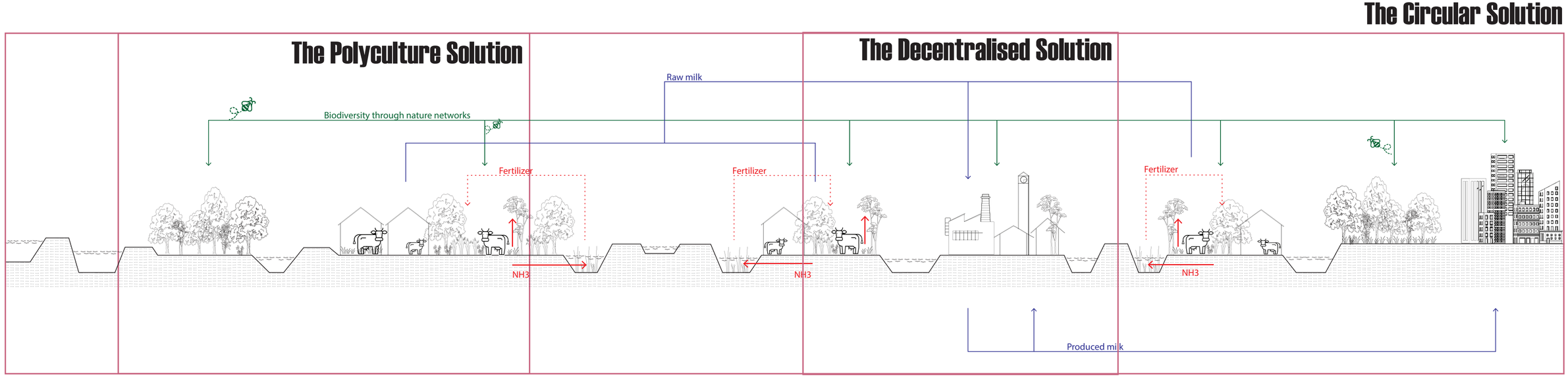
MAIN GOALS

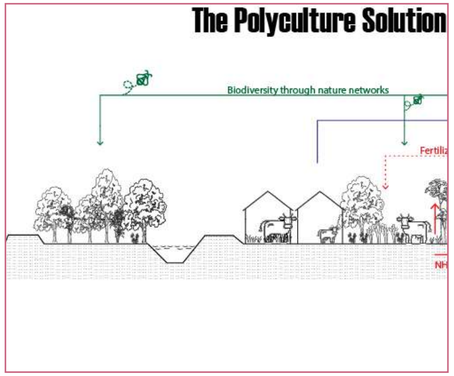
100% of the dairy farms in Friesland are regenerative in 2055
The mix-use of the polders will generate an alternate income for the farmers
The production and distribution will be localised

Cooperatives will be formed, mixing type one, two and three in one cooperative
The polders will be divided in 30% type 1, 10% type 2 and 60% type 3
Establishing a decentralised network with new business functions and local production and consumption

A new nature network connects Natura2000 areas
The new nature network will be connected to the existing one in the Netherlands
The import for the dairy industry will be completely local

THE RE-IMAGENED SELF-RESTORING AGRICULTURAL NETWORK





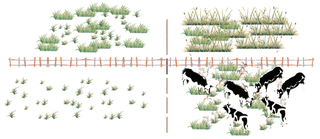
REGENERATIVE FARMING

What is regenerative Agriculture?
This vision places a strong emphasis on regenerative agriculture. Currently, regenerative agriculture does not have a comprehensively described scientific definition (Schreefel et al., 2020). Schreefel et al. (2020) tried to describe regenerative farming. According to them, regenerative agriculture can be described as an approach to farming that uses soil conservation. They use this as a starting point to regenerate and contribute to multiple provisioning, regulating and supporting services. This will result in enhancing the environmental, as well as the social and economic dimensions of sustainable food production (Schreefel et al., 2020). availability" (Schreefel et al., 2020).

Regenerative agriculture encompasses various themes "such as enhancing and improving soil health, optimising resource management, alleviating climate change, improving nutrient cycling and water quality and availability" (Schreefel et al., 2020). Regenerative agriculture thus strongly focuses on improving soil quality and making a positive impact on the land. It represents a holistic approach to agriculture.

"Conventional agriculture: You seek to create as many of one thing as possible"
(Sol, 2020)

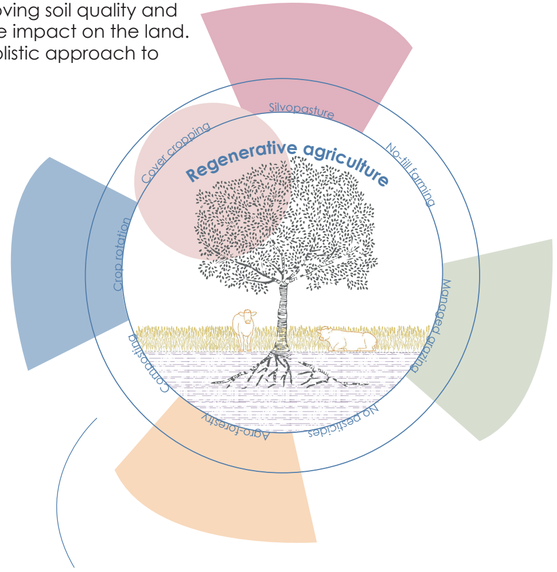
Managed grazing



This approach employs short-duration grazing periods followed by long, adaptively varied post-grazing plant recovery periods (Teague & Kreuter, 2020). This ensures that an ample amount of carbon can be sequestered back into the soil, thereby mitigating desertification by preventing overgrazing (Sol, 2020). It necessitates multiple paddocks per herd to ensure sufficient residual biomass and necessitates adjusting animal numbers in response to changing environmental and economic conditions (Teague & Kreuter, 2020)

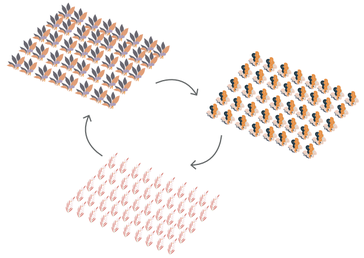
Silvopasture

Silvopasture is an integrated land use practice that combines trees, forage and livestock. According to Jose and Dollinger (2019), an increasing volume of research suggests that agroforestry, under appropriate design and management, has the potential to meet the public's call for environmental responsibility while also improving production outcomes (Jose & Dollinger, 2019).



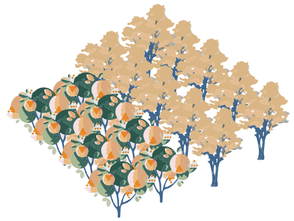
"Regenerative agriculture is an approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple ecosystem services"

Crop Rotation



Crop rotation involves the practice of cultivating various types of crops in a sequence or over successive seasons. Rotation intervals may range from 2 or 3 years to more extended periods. The rationale behind crop rotation lies in the diverse needs of different crops. By incorporating both leguminous and non-leguminous plants, crop rotation proves to be a beneficial strategy for enhancing soil productivity. This approach ensures that soil health is not overexploited, promoting more efficient utilization and enabling preservation of its quality. "Crop rotation is the most important cropping system that can help to minimize the application of fertilizers and herbicides, thereby decreased food contamination with agrochemical residue and increase structure of soil microbial communities" (Selim, 2019).

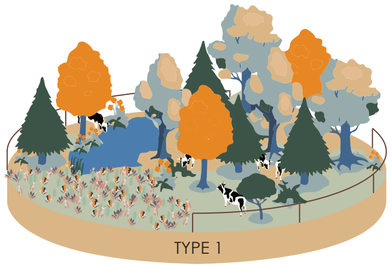
Agro-Forestry



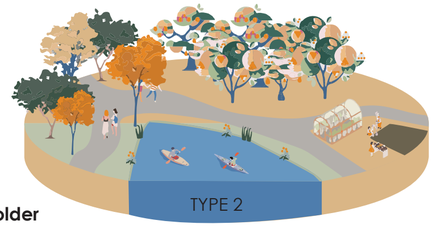
A food forest is defined as a human designed system with a variety of edible species grown in vertical layers based on the example of a natural forest (Nico van Eeden, 2020). As global populations continue to grow, there is an urgent need to substantially enhance food production in the next two decades to ensure global food security. Achieving this necessitates an agricultural system capable of multifunctionally increasing food production while concurrently improving social and environmental outcomes. Trees play a crucial role in this regard, as they offer a multitude of benefits: protecting against soil erosion, purifying the air, sustaining above- and below-ground organisms, offering shade and building materials, yielding food and medicine, and providing various other environmental, economic, and societal advantages (Kiss the Ground, 2024). Food forests consist often of 7 layers: the root, the groundcover, herb, shrub, low tree, high three and the vine layer. They include perennials and native species as much as possible (Sol, 2020).

"Regenerative agriculture: You seek to create as many relationships between things as possible" (Sol, 2020)

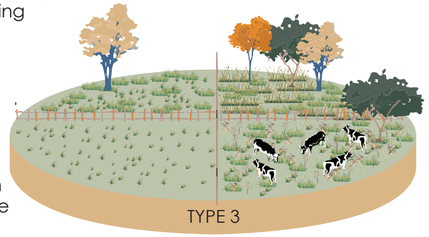
TYPOLOGIES AND MOSAIC



Nature oriented polder
In the farm-oriented polder, a more intensive form of agriculture takes precedence. Regenerative farming practices are still employed, albeit on a larger scale. These practices include among other things crop rotation and controlled grazing. Within these polders, production levels are elevated compared to the other polder types, while remaining within the confines of ecological sustainability. Despite the heightened production in comparison to other polders, there persists an enhancement of biodiversity within this domain. Creating a close bond between the natural and agricultural elements.



Recreational oriented polder
In this polder type, the emphasis lies on improving the connection between humanity and nature. This typology contains recreational amenities such as parks, community gardens, petting zoo's and interactive food forests. These features inherently improve the biodiversity of the polders, thereby contributing to their enhancement. Moreover, the elements diversify the functional landscape of the polder, offering a richer array of experiences and opportunities for engagement with the natural environment. This typology provides a lot of job opportunities in the recreational sector and is oriented towards social cohesion. This type brings people closer to nature and farming practices.



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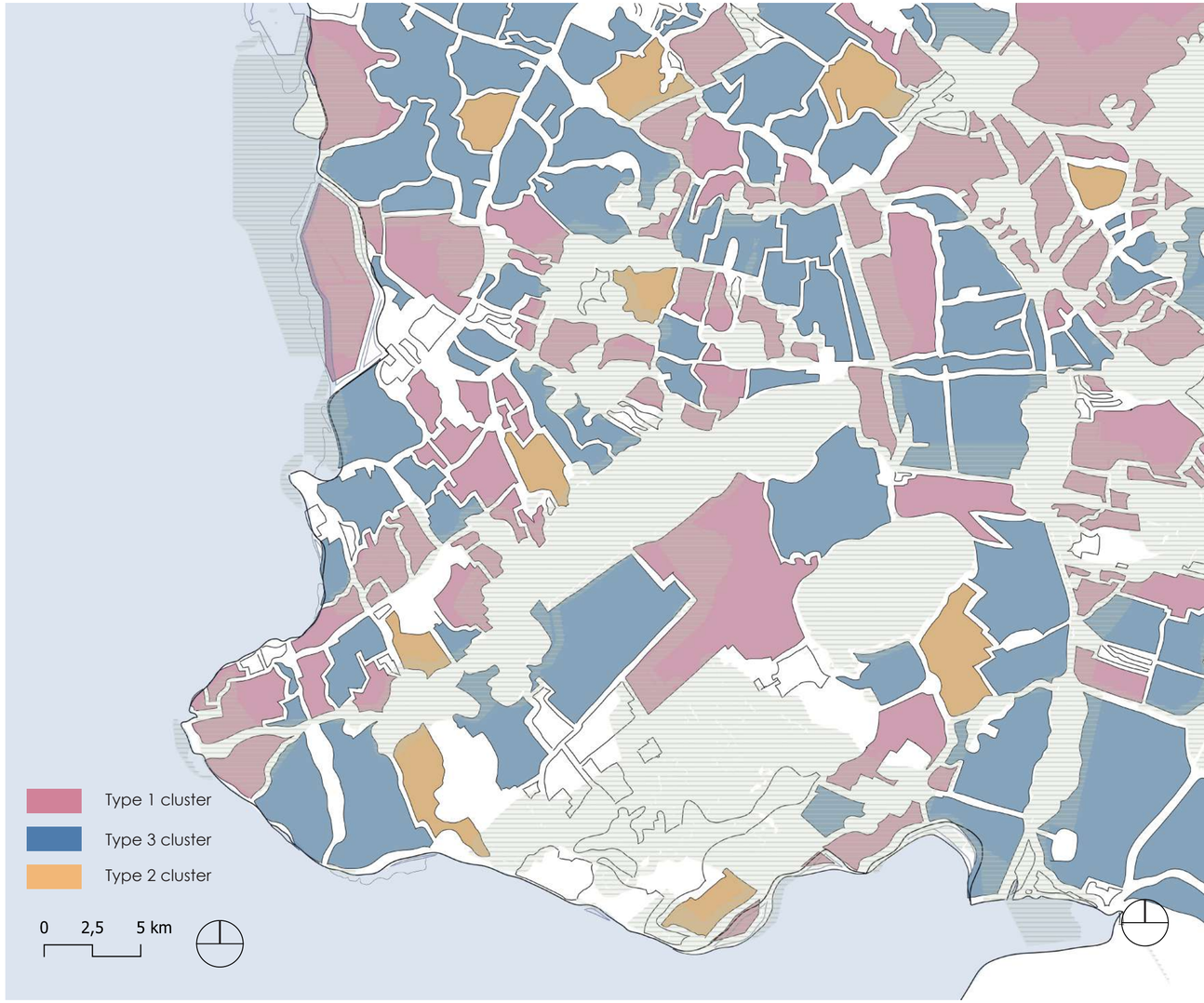
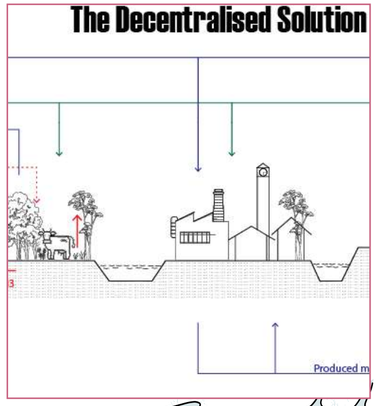


(*Waterstaatskaart van Nederland*, n.d.; *Kaarten | Atlas Leefomgeving*, n.d)

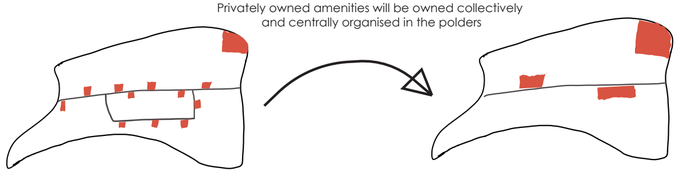


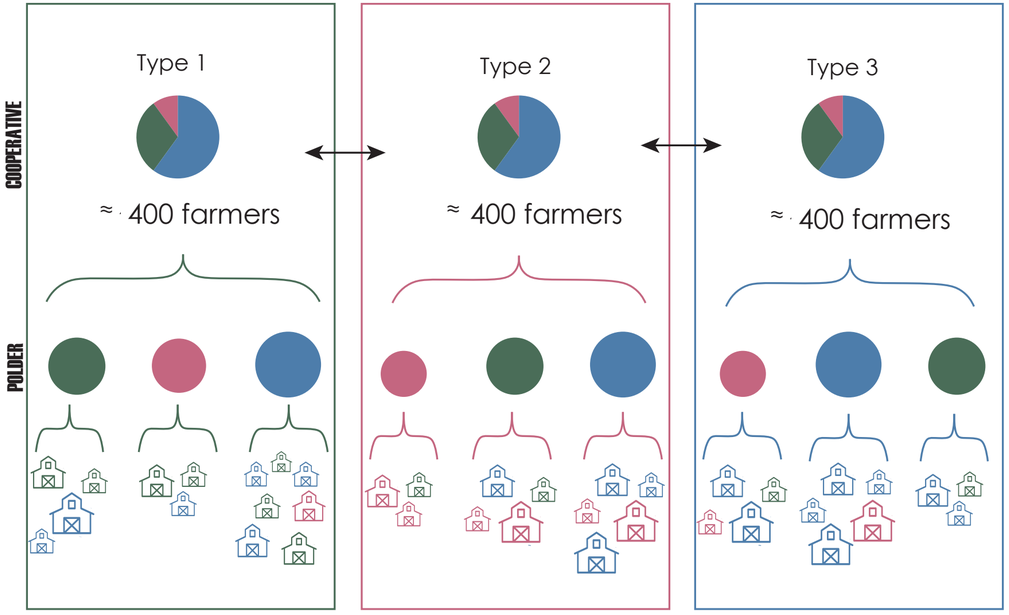
COOPERATIVES

Cooperative system

In addition to the spatial aspect, our vision also encompasses a structural component. This arises to ensure the equitable distribution of new spatial functions, while also aiming to secure a stronger negotiating position in the dairy industry, distribute various facilities, and facilitate streamlined collaboration necessary for regenerative agriculture. The structural vision operates at two distinct levels, each with its own responsibilities and functions. The first one is at the polder level, involving polder cooperatives. The second one is at the regional level, involving cluster cooperatives.

Cooperative agriculture has recently gained popularity and is increasingly receiving attention from global institutions and governments such as the EU and the World Bank (Bijman & Hanisch, 2020).This interest stems from a recognition that cooperatives in rural areas can provide a means to cope with adversities, as well as to counterbalance the ever-expanding supermarket chains (Bijman & Iliopoulos, 2014). Consequently, the European Union launched a significant pilot program in 2012 to promote support for farmer cooperatives (Bijman et al., 2012).





Polder cooperative
The polder cooperatives entail a highly intensive collaboration among farmers within the respective polder. The size of the cooperative is thus dependent on the size of the polder, resulting in significant variations in cooperative sizes. The polder cooperatives will function as production cooperatives and have joint ownership, placing them in the respective classification and subclassification prescribed by Helm (1968) and Bijman and Hanisch (2012). Membership of these cooperatives will not be open, as members are bound to their location (polder). This makes the cooperatives, based on their principles, a Traditional cooperative, rather than a Rochdale cooperative (Barton, 1989). At this level, the cooperatives aim to operate and produce collectively.

New functions emerging within the polder will be undertaken by the cooperatives, which distribute these tasks among the members of the cooperatives, or rather the farmers, through democratic decision-making processes. The land within the polder will be a part of the cooperative. This choice is made to ensure the equitable distribution of new functions and any potential disparities in productivity among the cooperative members. Consequently, this approach enhances the acceptance of such new land use practices, as no individual will be unfairly disadvantaged; any burden will be collectively shared by the cooperative. Furthermore, an additional benefit of the intensive collaborative operations at this level is the centralization of facilities required for agricultural use at the polder level.

This consolidation leads to substantial reductions in material costs, a significant expense for farmers.

Land consolidation
As mentioned in the previous paragraph, the land within the polder will be owned by the polder coops to equally distribute the responsibilities and new functions among the members. Giving up private land to a collectively owned cooperative is a process that will not be easily accepted by everyone. Therefore, a legal framework in the form of a land consolidation law, streamlining this process is designed.
A land consolidation law has a history in The Netherlands. Redistributing the land seemed necessary in the early 20th century as the yields were low and the then-current state of agriculture was not effective enough to produce for the rising population in The Netherlands.

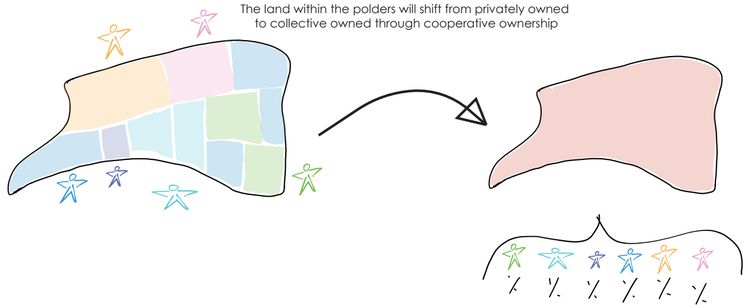
This was mainly due to the fragmentation of plots. The redistribution was first done voluntarily and unanimously; every farmer had to agree to redistribute their land, and therefore it was very ineffective and not done often.

This changed after a successful pilot on Ameland, an island in the north of The Netherlands. Up 119 farmers redistributed their land from 3569 plots to 500 plots, increasing their plot size (Schroor, 2019).

This massively increased the efficiency which opened the door for the first law on land consolidation in 1924. This law made it possible for a group of farmers to redistribute their land, even if not all farmers agreed to it. If a minimum of 50% of the farmers and 50% of the farmland in question agreed to redistribute, other farmers were forced to cooperate (Blom et al., 2016).

This law was later modified to decrease the requirements for land distribution to happen. In 1954, the law was again updated and modified to give the government a bigger part in the land distribution. Governments were given the power to incentivise land consolidation and also reserve a plot of land for public good. The law was active until 1985 when it was replaced by the Land Development Act, which extended the focus to more than only agricultural land (Blom et al., 2016).

A similar law to the land consolidation law should make it possible for cooperatives to take over the land, even if not all individual farmers agree to it. The laws and acts mentioned above give precedent for implementing such a law and also prove their effect on production. This will set the legal framework for collective ownership. At the same time, policies, funds and subsidies should be imposed to financially and legally stimulate collective ownership.



Cooperative system
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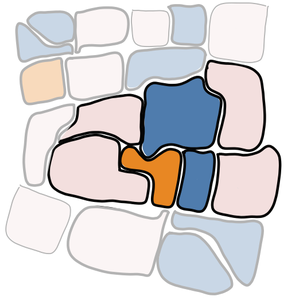


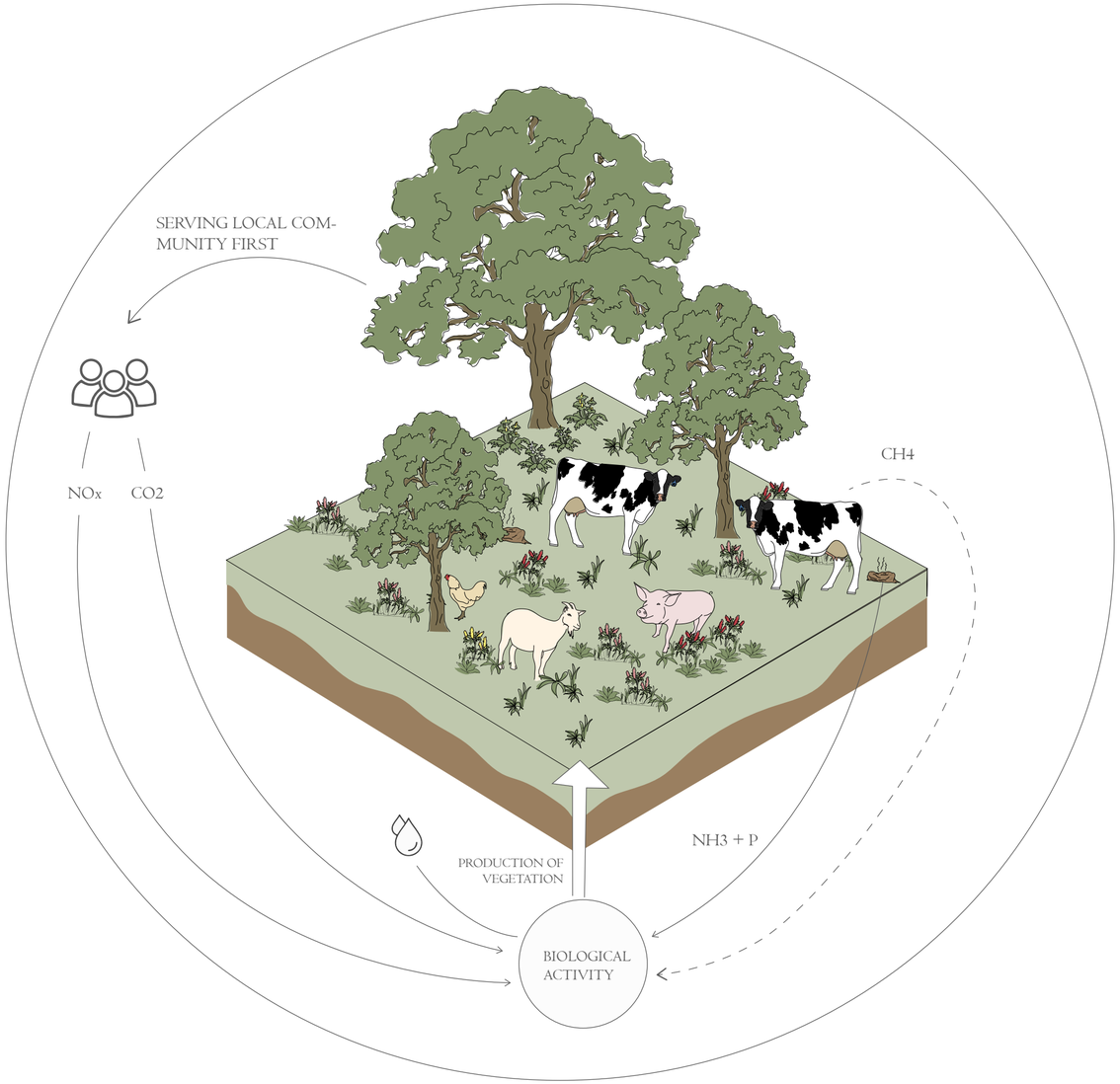
Cluster cooperatives are formed
of several polder cooperatives of different typologies.

CIRCULAR SYSTEM

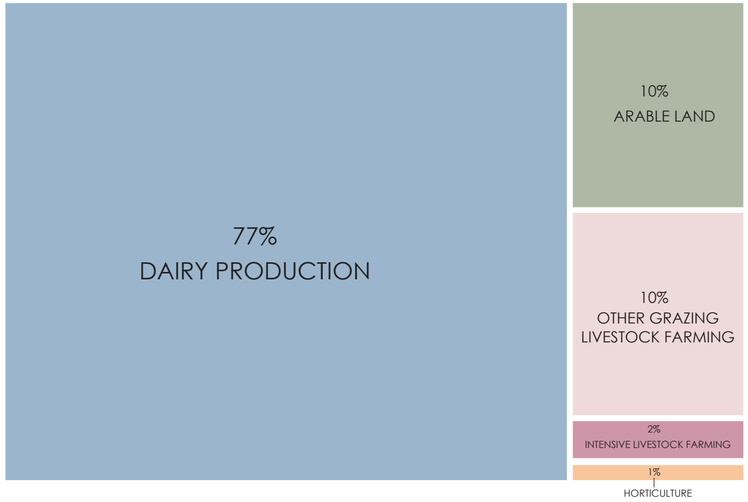
The third issue addressed previously is overarching of the other two addressed problems: monoculture and centralized system. Diversifying the landscape and decentralizing the dairy industry both contribute to addressing the linear system. In this perspective, the circulatory system primarily focuses on ecological circularity and circularity in distribution and trade.

Regenerative agriculture
Regenerative agriculture focuses on ecological circularity at a local scale. In regenerative agriculture, various agricultural practices are combined to improve soil quality. This can happen, for instance, by avoiding overgrazing or by retaining multiple nutrients in the soil through the use of diverse crops. Currently, the ecological system is often strongly separated, whereas regenerative agriculture brings it back together. This also enables nature to absorb more externalities since it is more balanced. By envisioning a polder area where every farmer practices regenerative agriculture, we are making a shift from ecological linearity to ecological circularity.
In the new agriculture model, cattle and vegetation work together in a circular system.

In line with the nitrogen reduction and nature improvement program, we focus on both reducing nitrogen and strengthening nature (Ministry of Agriculture, Nature, and Food Quality, 2022). By creating alternative business models, such as cultivating wet crops, vegetables, and fruits, as well as promoting recreation, a reduction in the number of livestock is also achieved. This leads into no more overproduction of methane and nitrogen, which means that the microbial communities and nutrient cycling in terrestrial ecosystems are in balance again (Wang et al., 2020). Additionally, regenerative agriculture strengthens soil health and allows for natural restoration efforts.

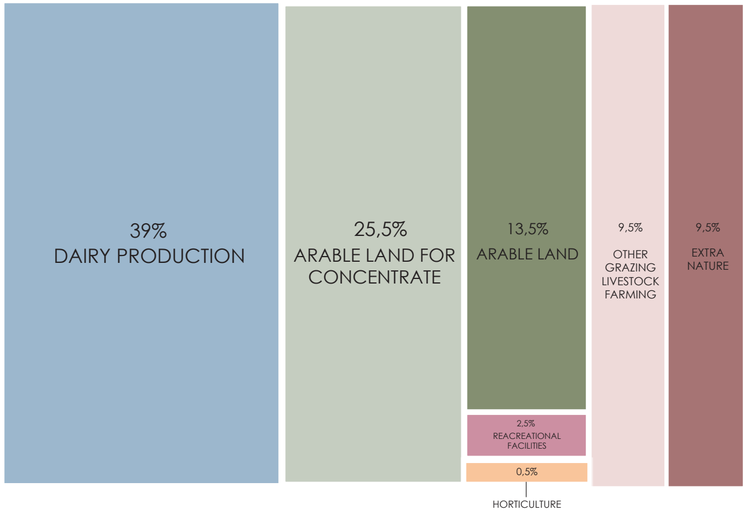


CURRENT AGRICULTURAL LAND-USE FRIESLAND



The Current Weight diagram
The land use of the province of Friesland consists of 65% agricultural area. Of this, dairy farming is the most important sector and occupies the largest land area at 77%. Arable farming and other livestock farming come in second place, each representing 10% of the total (Agricola, 2023). However, a small part is filled by greenhouse horticulture and intensive livestock farming. Therefore, the current economic model of the agriculture of Friesland largely relies on dairy farming.

FUTURE AGRICULTURAL LAND-USE FRIESLAND



The externalities of conventional cattle farming
As indicated earlier in this report, the economy of agriculture in Friesland is mainly based on dairy farming. By implementing the vision, the ratio of revenue models also changes. More business models are created in other sectors such as recreation and nature management. Regenerative agriculture allows more space for livestock, resulting in more grass available, thereby reducing the need to import roughage. All roughage comes from the own land or the immediate surroundings. Additional protein-rich concentrate feed is limited and comes from own farmland, the immediate surroundings, or the Netherlands (NZO Dutch Dairy Organization, 2019). Because the vision focuses on reducing or eliminating the import of this protein-rich concentrate feed from abroad, it becomes more important to grow it on one's own land.

689,576,250 /12,000 = 57,464.69 ha required for alfalfa production. This is rounded to 57.465 ha. This is much more land than the current arable land, which is 229 ha. However, a lot of agricultural land is freed up by reducing the number of cows and thus the reduction in dairy production.
For nature-inclusive agriculture, it is stated: "On a large home parcel with a livestock occupancy of up to about 5 dairy cows per hectare, grazing can be well managed." (Bestman et al., 2024). 229,000 (number of cows)/5 = 45,800 ha required for good grazing. At the moment, there are 173,500 ha of agricultural land for dairy farming. Half of this amount is more than enough to implement good grazing. Therefore, agricultural land from dairy farms can easily be used to produce enough rough protein locally in Friesland to feed

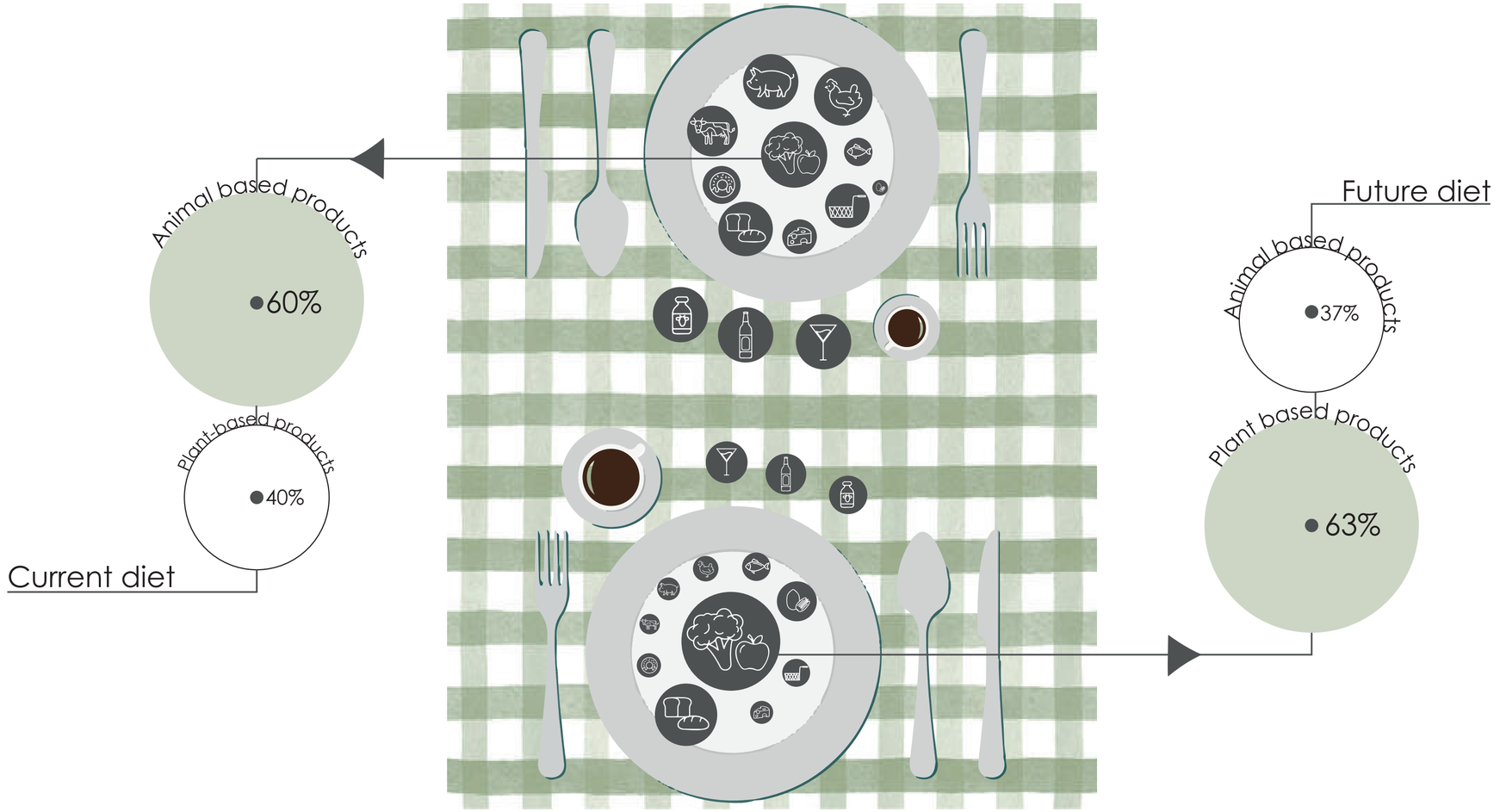
Therefore, it is necessary to increase the agricultural area of arable land compared to the current situation. Additionally, the future diet, as discussed earlier in the report, is taken into account. With this new diet, the demand for vegetables and fruits, grain products, and legumes is expected to increase by 34% (PBL Netherlands Environmental Assessment Agency, 2020).

On this arable land, protein-rich crops can be grown to meet the increasing demand for local protein-rich feed, such as soybeans or alfalfa. Alfalfa is a good candidate because it grows well in Dutch soil and contains a lot of protein (Prosu Media Productions, 2017). "An alfalfa field enriches the landscape with biodiversity as it provides food and shelter for various types of insects (including bees), mammals, and birds."

173,500 - 57,465 = 116,035 ha left for grazing for dairy cattle, the incorporation of new nature, and recreational opportunities.
Intensive livestock farming disappears due to the extensification of the dairy industry. This is done through regenerative agriculture. Therefore, an additional 4,800 ha of space becomes available. Greenhouse horticulture remains as it is and accounts for 0.5% of the available agricultural land.
The agricultural area of the current livestock farms is halved. The remaining land area is divided between the realization of additional nature and recreation. A ratio of 80/20 is mentioned for this purpose and is also applied here. The additional nature is now part of the reinforced nature network.

Additionally, it improves the soil and is a nitrogen-fixing crop. (ZLTO and CLM, 2017). It is known that 15% of a cow's diet consists of soybeans (NZO Dutch Dairy Organization, 2019). This can also be replaced by alfalfa. If this is the case, the following calculation can be made for the whole of Friesland:
On average, 12 tons of alfalfa per hectare can be produced per year.
A cow eats a total of 55kg of food, of which 15% is soybeans (in this calculation, alfalfa) (NZO Dutch Dairy Organization, 2019). The number of cows in Friesland is 458,000 (Agricola, 2023). Reducing this with 50% gives 229,000 cows. 15% of 55 kg is 8.25 kg of alfalfa per day. Alfalfa requirement in kilograms for all the dairy cows in Friesland is: 8.25 * 229,000 (number of cows after reduction) * 365 (days in a year) = 689,576,250 kg of alfalfa per year required for all dairy cows in

CONSUMPTION



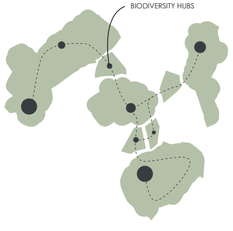
The future diet
In this project, the decision has been made to adopt the "sustainable and healthy" dietary pattern as the reference diet for the future in the Netherlands. This reference diet consists of 37% animal products and 63% plant products. This represents a reduction of 23% in animal products. This has significant positive consequences for the footprint of the Dutch consumer and simultaneously for health. It reduces both the land footprint and greenhouse gas emissions per person by approximately 40%. This diet still includes meat and dairy, but to a much lesser extent (Westhoek, 2019).

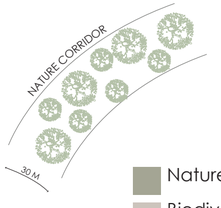
In addition to this reference diet, consideration has been given to the overproduction/self-sufficiency rate of some products from the livestock industry. It appears that the self-sufficiency rate of milk is 217% and cheese is 277% (Westhoek, 2019). This represents a significant overproduction. "If it were up to the environmental organization Nature & Environment, the Netherlands would have about 40% fewer cows and pigs by 2030 than it does now" (Kennisnet, 2017). The agricultural agreement assumes that the livestock population will decrease by 25-30% by 2035 (Kalden, 2023).

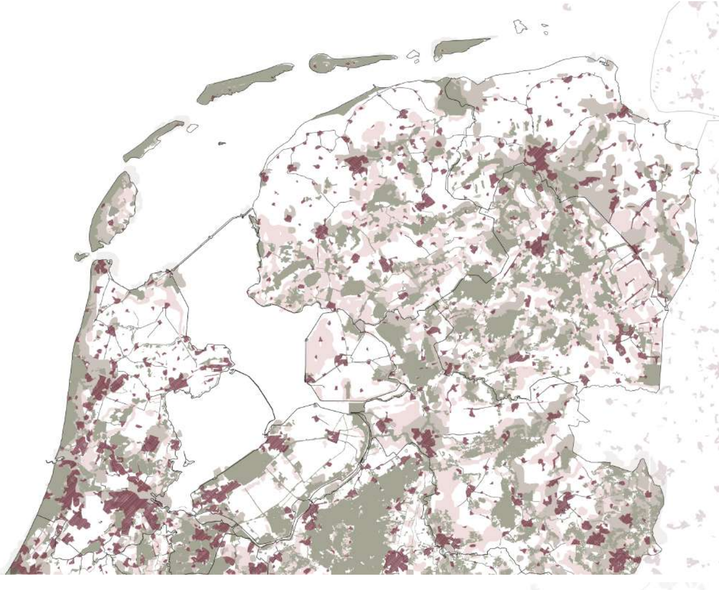
However, this agricultural agreement has not been finalized (NOS, 2023). The overproduction contrasts with this reduction in the livestock population, and therefore, these are two interesting components to consider in the vision.

The aforementioned numbers for reducing the livestock population vary considerably, but they all focus on a timeframe of 10 years. This vision outlines a perspective for a tight 30 years. It is necessary to take into account a healthy and sustainable diet, the aforementioned overproduction, and the desire to reduce the livestock population when forming a new vision for the dairy industry in Southwest Friesland.

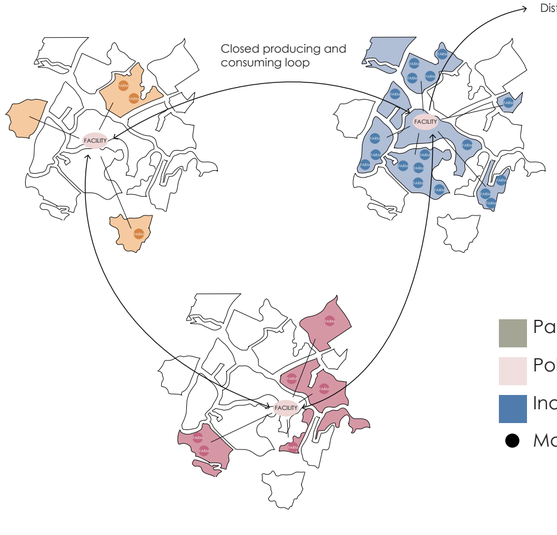
ON THE REGIONAL SCALE

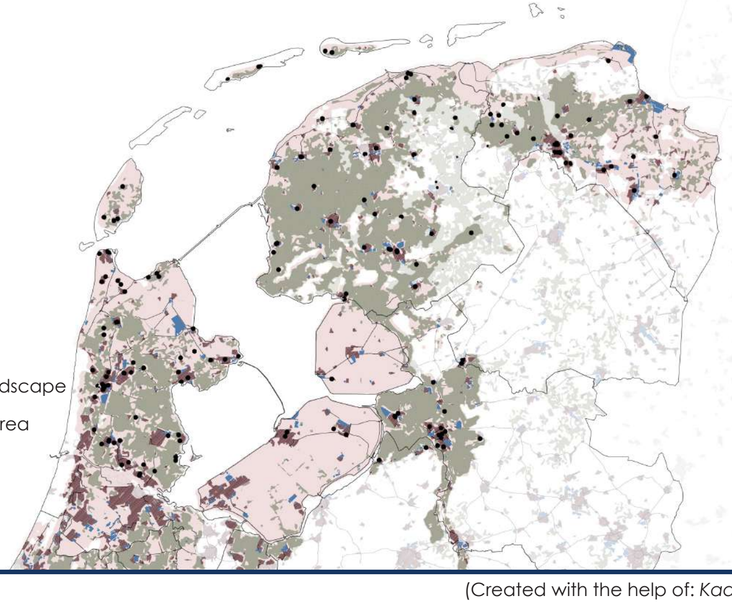






Nature Network
Biodiversity Network
Ammonia reduction zones





Pastures
Polder Landscape
Industrial area
Market

Green Network

The green network visualized in the Netherlands is structured around three key layers: the National Ecological Network (NEN), biodiversity hubs, and high ammonia reduction zones.
The primary layer of the National Ecological Network is prioritized for preservation as the highest priority. Following this, the biodiversity hubs, which are strategically located throughout the Netherlands with the objective of preserving their ecological richness. Lastly, the third layer consists of vulnerable zones with a mandatory 47-58% reduction requirement, which are essential to maintain in their green state. Implementation of the green network is mainly in the Type 1 polder and involves the introduction of regenerative and self-restoring nature-oriented functions to polder cooperatives. This approach envisions a dynamic green network evolving through local initiatives, with a focus on fostering personal connections to the land at a local level, polder by polder.

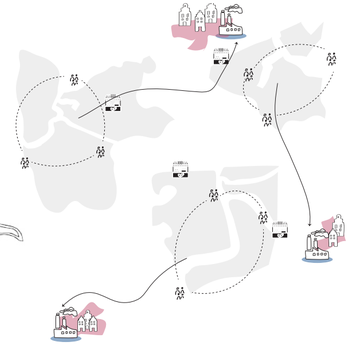
Local Network

The local network impacts circularity on two levels: ecological circularity and circularity in distribution and trade.
At the distribution level in the vision, circularity is affected because there is generally less need for importing goods and raw materials, as different types of polder cooperatives exchange these with each other. For example, the manure from a type 3 polder can be distributed to a type 2 or type 1 polder to enhance soil nutrients. Conversely, a type 3 polder with an overproduction of grain or corn can distribute these to another type 3 polder for cattle feed. The local production and sale of goods and services contribute to the circularity of goods flows in South-West Friesland, but also indirectly in the Netherlands. As previously shown in this report, there is a huge overproduction of milk (217%) and cheese (277%) in the Netherlands, much of which is exported (Westhoek, 2019).

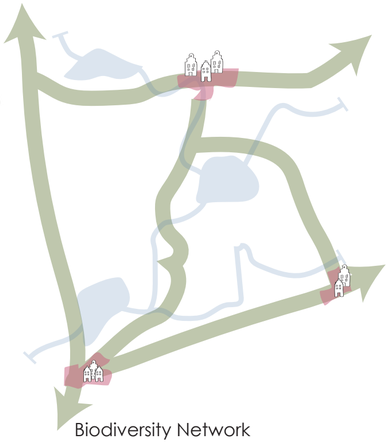
Since this project focuses on local and decentralized production and consumption, we have chosen to reduce this overproduction, aiming for a 50% reduction in cows by 2050. However, the option to export is still available to create more economically viable business models. Nevertheless, the rule is to first meet local demand. This way, the consumption flow remains as local as possible.
Additionally, it also impacts ecological circularity because the raw materials and goods produced locally are also used locally. The produced goods are kept within the local network as much as possible, thereby reducing the need for goods from other parts of the world. This also contributes to mitigating externalities outside the Netherlands.

(Created with the help of: *Kaarten | Atlas Leefomgeving*, n.d.; Steffen Nijhuis & Michiel Pouderoijen, 2013)

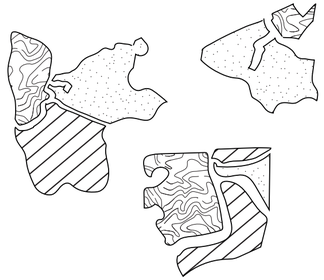
VISION



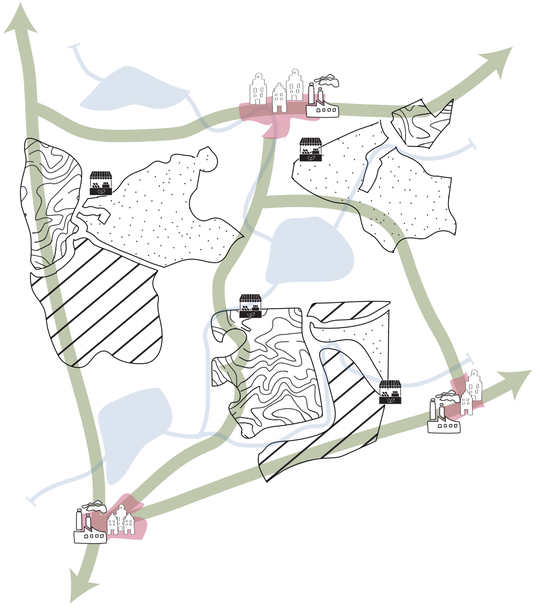
Cooperative Structure



Biodiversity Network



Polder Mosaic



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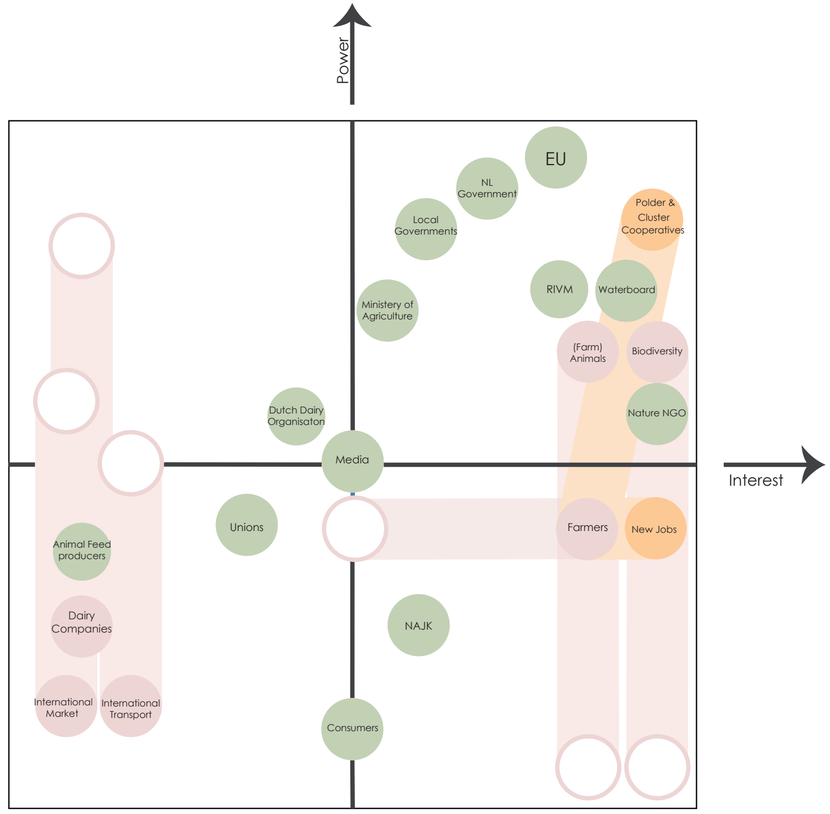
07 PolderWideWeb

Stakeholders
Phasing
X-curve
Farmbiz
Pilot

Stakeholders after implementation of the polyculture polder



Stakeholders in status quo

Stakeholders that move interest and/or power

Newly acquired stakeholders

Stakeholderanalysis | The stakeholders
STAKEHOLDERS

The Shift in Stakeholders

It is important while making a strategy to make clear which stakeholder supports your vision and which does not. Supporting stakeholders can help with realising the vision, while blockers should be convinced. A strategy should include how to implement the vision despite the blockers' opposing views. Earlier in this report, a stakeholder analysis is made to show the most important actors within our scope. In this new stakeholderanalysis, we included new stakeholders that came up while creating the vision. In this new stakeholderanalysis we see some change in the amount of interest or power of the stakeholder. This gives clarity on what can be included in the strategy.

One of the main goals of the strategy is convincing farmers who are against the transition towards sustainable, regenerative agriculture. We expect they will change their interest towards the project. This could be done through including them intensely, giving them compensation and giving a clear structural plan of what is going to happen. So, the strategy will have to include policies, compensation and legislation to convince and support farmers in their transition.

Farmers will also have to transition towards newly acquired jobs. This creates an extra group of stakeholders. The cooperatives are also newly acquired actors after the implementation of the vision. They are a new stakeholder that holds power to make decisions on their own scale. The polder cooperatives have the power to decide on the spatial plan of their own polders. Cluster cooperatives have the power to make decisions on the shared facilities and they are the ones responsible for the financial plan.

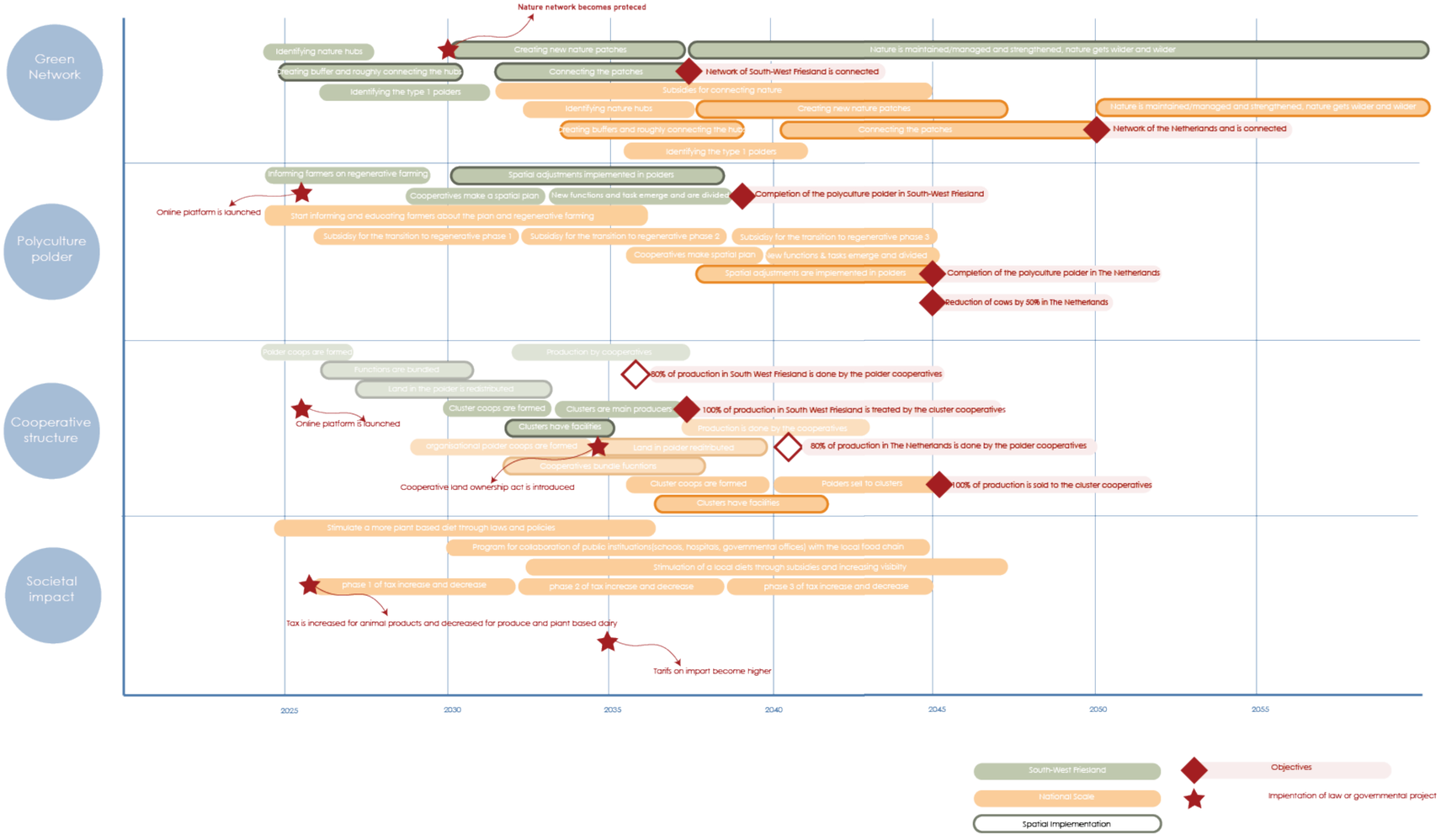
Another goal of the strategy is giving more power to nature. Animals and biodiversity have too little power, even though they are impacted with the negative externalities the most. That is why the strategy should include how they are protected and included just like other stakeholders.

There are a few stakeholders that already have a low interest in implementing our problem and after implementation. We foresee them not changing their opinion. These stakeholders are mostly related to the current industry. Big dairy companies, including production, treatment and distribution facilities, will not be as needed in the polycultural polder, and therefore have less power in the new system.

Next to that, our vision includes less import and export and therefore, international companies will also feel a decreased power. The strategy will have to include how we see their new role in the future.

Governmental institutions have a high interest in changing the status quo and meeting climate targets (Ministerie van Economische Zaken en Klimaat, 2023). Our project gives them a strategy for achieving those goals. Since they also have a lot of power, our strategy should use and include the different layers of government, using, for example, subsidies and legislation that help us achieve the vision.

Stakeholderanalysis | Phasing | Farmbiz
https://Phasing.com/PartII
Process | Working with the time
PHASING | X-CURVE
Part I
Part II



The Phasing shows you what will happen when, on what scale and what goals we want to achieve.

Green corridor

The implementation of the green network starts with the pilot project in SouthWest Friesland. The idea is to identify and strengthen the already existing nature patches and where necessary, create connections. Provincial governments will plan for where the nature networks will be localised. After that, it is possible to identify the type of polder and to see which polders are going to be type 1 polder, focused on nature. When polders start being transformed into polycultural, mixed-use polders, new patches will be created and later connected.

Whilst the construction of the pilot project is taking place in the South-West Friesland, the identification process of nature hubs and nature networks can start in the rest of The Netherlands. The next step; building the connections and allocating typologies to polders will only start on this scale after the pilot project has been tested and found to be successful. To incentivise transformation to nature oriented polders, subsidies will be appointed from the start of the pilot project, slowly decreasing in funding over time to stimulate early adaptation.

Once finished, the new network will be managed and maintained in similar manner as current Natura-2000 areas, emphasising the importance of the greenery and biodiversity. Managing this will fall under the supervision of the polder cooperative.

Polyculture polder

The implementation of the polycultural polder is mainly focused on the transition from the current dairy farming system towards a mixed-use, regenerative polder. The process starts with educational projects towards informing farmers about regenerative farming. This happens on both the national level as the pilot project at the same time. Shortly after, subsidies for transitioning towards the new mixed-use system will be implemented. These subsidies will be issued in three phases and decreasing in support over time, aiming to facilitate quick usage and transformation. To stimulate farmers to transition towards regenerative farming rather sooner than later, the subsidising will be done in phases and the first phase of subsidies will be the highest.

Besides the financial incentive, an educational program, in the form of an online platform, is introduced to help the cooperatives, farmers and local governments. This will consist of practical tips and roadmaps that facilitate a smooth redistribution of land and tasks. With the help of this online platform, the polder cooperatives can make a spatial plan and divide tasks within the polder, which will result in a polycultural landscape. After the first implementation in the pilot project and the first tests of effectiveness, this educational program will be rolled out over The Netherlands. By 2045, the polder cooperatives will need to have a complete spatial plan present.

Lastly, policiesare introduced to the dairy industry to reduce the linearity of this process. These aim to reduce the amount of cows by controlling the amount of cows per hectare. At the same time, these policies should contain rules on the origin of animal feed and self-organisation of farms. As Commissie Grondgebnonenheid (2018) reports, these policies can be conceptualised through groundedness. Their concept is therefore used as a guiding direction.

Cooperatives

As reported in the vision, certain laws are used to promote the formation of cooperatives and their functioning. This starts with a clear legal guideline to create the cooperatives, provided by the government. Stimulating policies such as tax reductions accessible loans to start cooperative structures should incentivise farmers to come together in cooperatives. This starts in the national scale and pilot project at the same time, but promoting this change will first be targeted on the pilot project.

The land consolidation law will nationally take effect after a majority of the cooperatives initiated.This law will however already have been in effect in the pilot project, in a similar manner as happened in Walcheren, which was a pilot project to experiment with a new consolidation act in 1954 (Blom et al., 2016). This law will share a lot of similarities as the former law, however the restructuring will now be focussed on collective ownership rather than redistribution.

This means that this consolidation will take effect even if not all agree to. If it turns out that desired effectiveness is not met, a reform of the law can take place where a government can legally incentivise such a consolidation.

Society and community impact

With our project comes a large impact on the current way society approaches consumption of animal products and the origin of their food. This part of the phasing is based around policies, laws and projects that incentivise people to eat more plant based and to buy more locally. First of all, just like the subsidising for the transition to regenerative farming, tax increase and decrease will be done in multiple phases. The impact of transition to regenerative farming is already high, so increasing prices too suddenly will create a high risk for dairy farmers. The tax increase in animal products and the tax decrease in alternatives, will stimulate people to eat more plant based, but the phasing will “soften the blow” for farmers making the transition towards a mixed-use regenerative agricultural system feasible.

Another aim of our project is creating a more local food chain. As explained on page 48 and 49. The Netherlands imports and exports a lot of their animal feed and exports lots of their dairy production. Therefore, we will increase the tariffs on import and export. With this rise in price, the transformation to a local food chain is incentivised.

Stakeholderanalysis | Phasing | Farmbiz
https://Phasing.com/PartII
Process | Working with the time
PHASING X-CURVE
Part I
Part II

For the stimulation to eat a more plant based and local diet, we also see the need to change the visibility of the impact that buying certain products has on the climate. There are multiple options that could be implemented. The current “nutriscore” or “beter leven” hallmark, which are used to indicate the healthiness and animal wellness on food products in The Netherlands, are considered as examples of good practice. Temmerman et al. (2021) describes that the nutriscore does help people to assess the healthiness of a product, which also impacts the decisions people make in the supermarket. Therefore, a similar visual indication will be used and obligatory to put on products, informing consumers on the climate impact of products through, stimulating purchasing plant based alternatives. Likewise, dairy and animal products could more clearly state the location of production in a location label, unique to every region. This could even be used as a marketing tool for the cooperatives to promote their own brand.

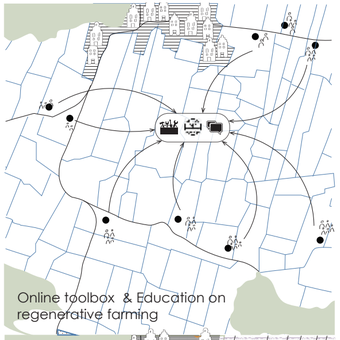
Another option could be to go for a similar strategy as dutch supermarkets have used with alcoholic drinks. Reduction of the max 25% in offers of animal products, or to stop allowing advertisements containing animal products that are created in a mass-production setting. Making big offers on dairy and meat not possible, or not seeing as much publicity on meat and dairy, could make the meat and dairy alternatives more competitive.

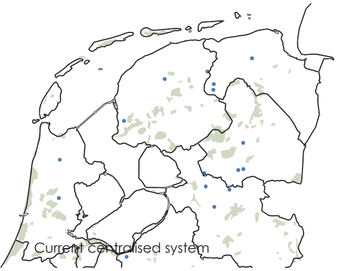
Lastly we will educate people on a local food chain, by creating programs where public organisations collaborate with local producers. Schools, hospitals and governmental offices could cooperate with their local chain to get local food in canteens, cafeterias, cafés and lunch rooms. Since these institutions are governmental, the transition can start from the inside out and educate children as well as health and governmental professionals on where their food comes from.

Process | Working with the time

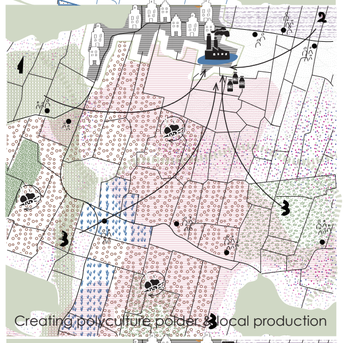
Phasing diagrams

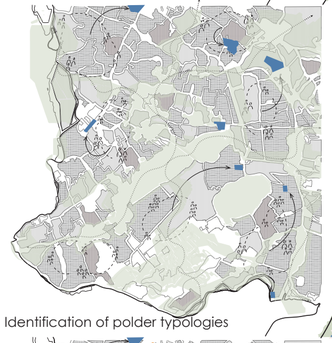
2025 - 2030

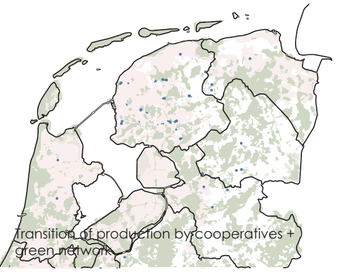




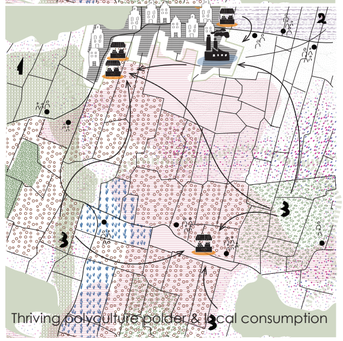
2030 - 2035

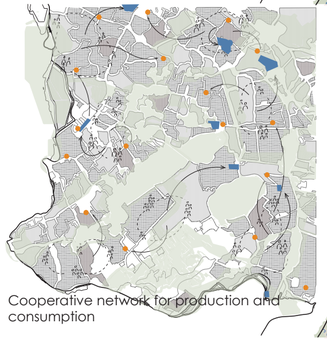


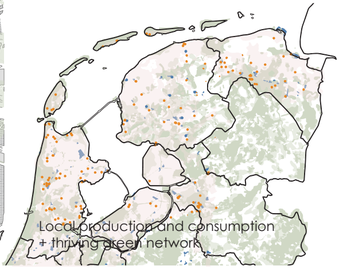




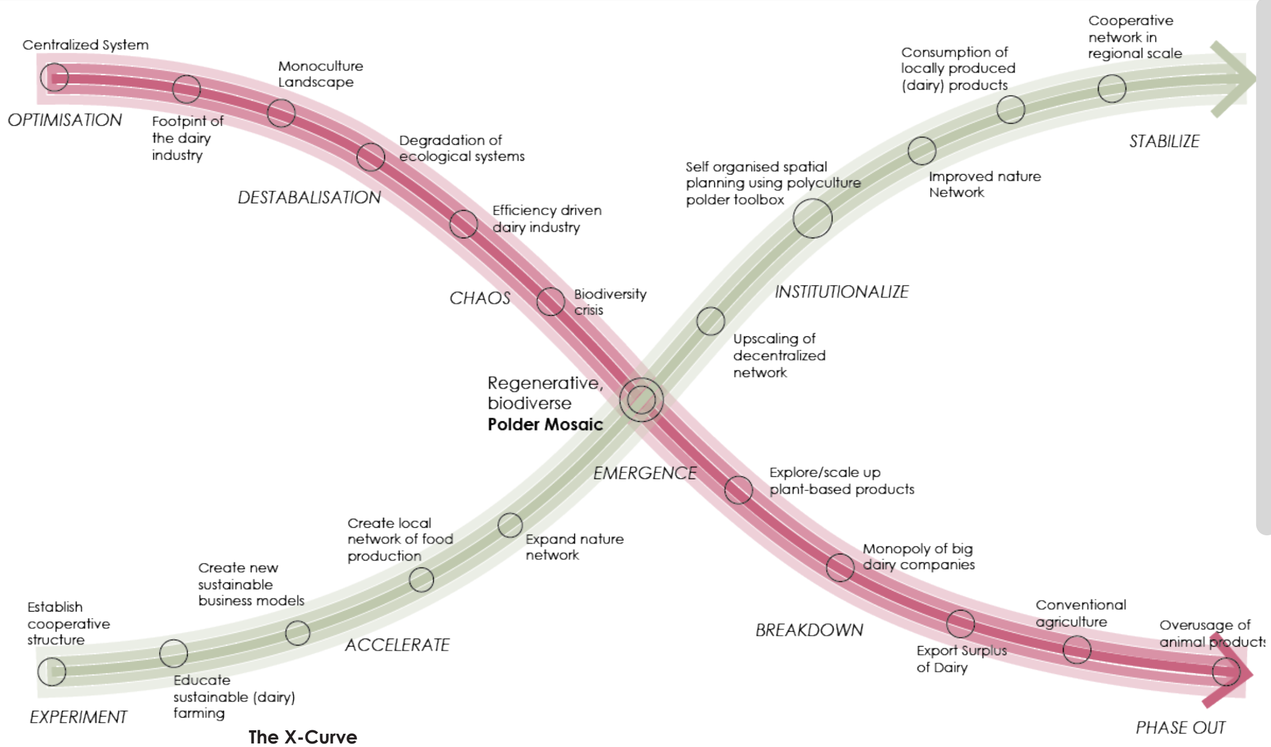
2035 - 2050







Phasing | What is going to happen when



The X-Curve

The X-curve envisions the emergence of a decentralised, regenerative agriculture network, as the current centralized dairy system is phased out. As a preliminary step, an experimental pilot cooperative structure is established for polders and their clusters, with a focus on educating about sustainable farming methods. The nature network is then expanded. Here, emphasis on the regenerative and biodiverse polder mosaic serves as the catalyst for transitioning the system away from the old monocultural landscape of the unethically optimized dairy industry.

To foster a spatially just future, the regenerative polderscape is expanded from the bottom-up, utilising a toolbox through the cooperative network. Consequently, the influence of major dairy companies is weakened, prompting them to pivot their business strategies towards scaling up plant-based alternatives and facilitating the decentralised network. The excessive use of animal products together with conventional agriculture is gradually phased out.

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https://Phasing.com/XCurve

Phasing | What is going to happen when

PHASING | X-CURVE

The future of Friesland Campina

Friesland Campina announced several years ago that they are developing a new corporate strategy called Expedition 2030. They anticipate that milk production will remain stable due to increased efficiency in cow farming. Despite this, they aim to save a significant amount of money, around 400 to 500 million euros, primarily in support services (Friesland Campina, 2024). The strategy is still in progress but is likely to focus on seven business groups. From these business groups, it is evident that Friesland Campina maintains an international focus. It appears that they do not intend to transition to local production and consumption or shift towards a more plant-based industry.

With the introduction of new business models in Southwest Friesland and the reduction of dairy production in this vision, questions arise regarding the role of Friesland Campina and its associated treatment plants. The large linear chain of importing animal feed and exporting dairy does not align with this vision. In this perspective, Friesland Campina, including the treatment plants, transitions to local and more plant-based distribution and sales. This transition will be guided by the new ratio of plant-based to animal-based products (63%/37%). This signifies a significant shift in the business model since the current market share of plant-based dairy is only 4% for yogurt and milk (Stevens, 2023).

With a greater emphasis on arable farming, there is also increased demand for efficient distribution and processing of these products. As all animal feed is produced as locally as possible, more protein-rich crops such as soybeans or alfalfa are cultivated in Southwest Friesland. The treatment plants can focus on processing not only dairy products but also plant-based dairy or animal feed. Currently, much of the animal feed is imported, creating a market gap if local production is required. The new plant-based dairy products can leverage existing efficient production processes and Friesland Campina's established market position. Some facilities are also capable of producing plant-based protein-rich ingredients (Stevens, 2023).
Lastly, Friesland Campina can still facilitate reduced exports, including the increased production of plant-based products. Scaling down to smaller production scales is part of this vision, as there is a focus on reducing exports. It is acknowledged that the company will generate less revenue both domestically and internationally as a result.

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Farmbiz | Exchanging Knowledge and expertise

HOME | ABOUT US | FARMER | POLDER COOPERATIVE | CLUSTER COOPERATIVE | CONVENTION | CONTACT

FARMBIZ: to help you specialise in the future

Welcome to our website ''FarmBiz''. This is our all-in-one platform for agricultural innovation and business development, specially made for you. As a farmer, you are faced with challenges and opportunities, especially in a time like this when traditional practices are evolving and new possibilities are emerging. At FarmBiz, we provide advice and fun activities to do in your polder and/or cluster to ensure a smooth and just transition and get the most out of your land. We're here to help you discover what's possible and how to get there.

Whether you're seeking ideas to change your land in new ways, diversify your business model, or simply want to know how to thrive in a changing landscape, we have got it all for you.

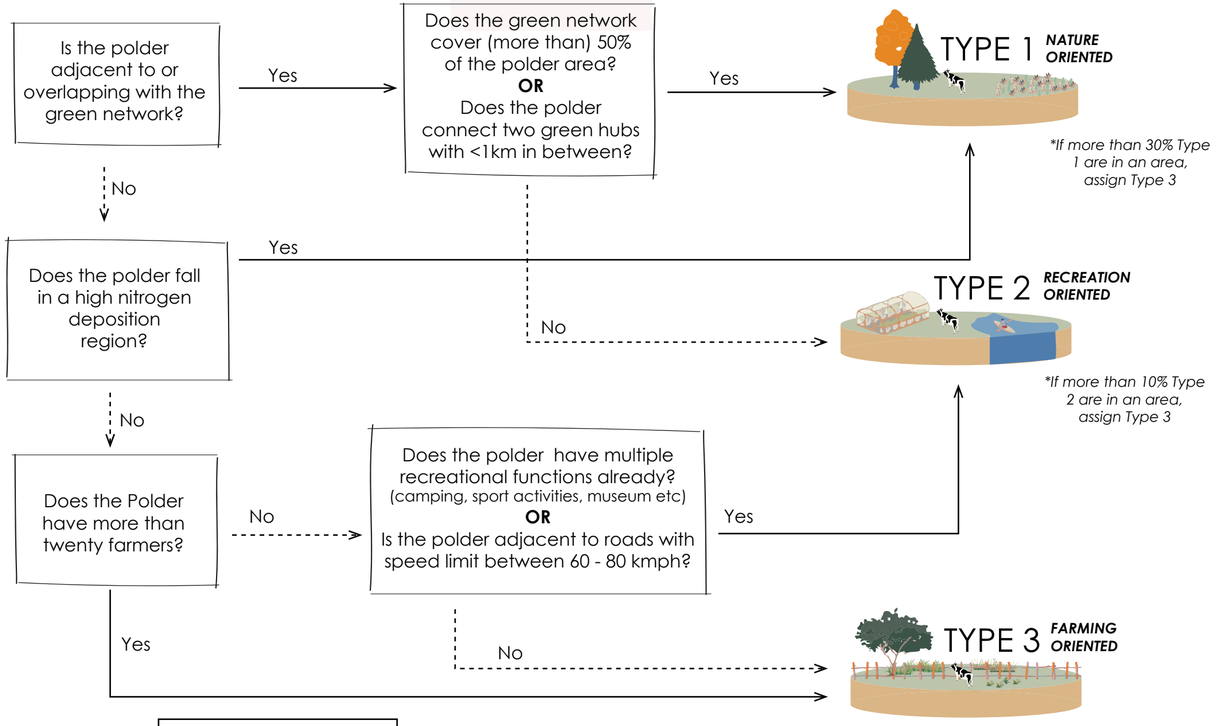
Our platform is packed with tips, tricks, and inspiration to support you in developing new businesses that align with your vision and capabilities. However, FarmBiz is more than just an online website, we are a community. We serve as a toolbox where everyone, from transformed dairyfarmers to seasoned agricultural entrepreneurs, can meet and learn from each other. Our forums and chat features provide a space to ask questions for experts, share experiences, and collaborate on innovative solutions.

And that's not all! Several times a year, we host large fairs all over the Netherlands where farmers from across the country can come together to discover the latest trends, network with like-minded individuals, and receive direct advice from experts in various fields.

Whether it's sustainable farming practices, technological advancements, or business strategies, our events offer a valuable opportunity to gain knowledge and grow as a farmer. At FarmBiz, it's all about your success and well-being. So what are you waiting for? Look around and see what could be in it for you.

We hope to see you soon at one of our conventions. In the meantime, look around on our website, we have catalogs, toolboxes and roadmaps for your polder / cluster cooperative on this website. If you want to look at tips of experts or just ask a question, you can find it on this website.

We created this website with love, for you!
Big Love, the Farmbiz



DECISION CHART FOR POLDER TYPE

Methods:

- Co-designing sessions
- Surveys/ questionnaire about preference
- Gatherings to have transparent discussions

Facilitators and Actors:

- Province + residents in participatory session

General conditions:

If a polder is adjacent to an urban area, accomodate buffer of at least 30m around urban border.

If the polder lies between two nature hubs, make a green connection of minimum 30m width.

Decision Flowchart

In this decision flowchart, you can see how your polder got its type. The province uses this chart to re-assign every polder one of the three types: nature, recreation or farming oriented. The flowchart is on this website to keep the process as transparent as possible. If you have any questions regarding the typologies, don't hesistate to contact the province.

How to make a spatial plan with your polder cooperative?

1 What is your polder type?

Divide functions based on the guidelines

		Guideline for ratio
Type 1: nature oriented	Nature oriented functions	50%
	Human oriented functions	15%
	Agricultural functions	35%
Type 2: Human and nature	Nature oriented functions	20%
	Human oriented functions	60%
	Agricultural functions	20%
Type 3: Agricultural focus	Nature oriented functions	20%
	Human oriented functions	10%
	Agricultural functions	70%

2 What functions can you choose for your new business?

See catalog of functions

3 Educate about incentives and subsidies

Where can one find this information?

Which subsidies can be applied for as a cluster?

Which subsidies are accessible to individual business owners?

Refer catalog for advantages of each function

4 Refer to checklist for each function:

Example:

Managed grazing

- [x] ~~Organise boundaries for managed grazing~~
- [x] ~~Locally sources cattle feed~~
- [x] ~~Buy tools for no-till farming~~
- [ ] .....
- [ ] .....
- [ ] .....
- [ ] .....
- [ ] .....
- [ ] .....
- [ ] .....
- [ ] .....
- [ ] .....

STEPS FOR SPATIAL PLANNING OF POLDER COOPERATION

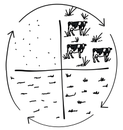
Methods:

- Co-designing sessions using models/storyboards and drawings
- Survey/questionnaire about preference
- Gatherings to have transparent discussions
- Farm visits
- Education days

Facilitators and Actors:

- Province + Members of polder cooperative

Managed grazing



- Least transition necessary from a current dairy farm

Orchard

- Long term investment: trees poduce year after year
- High amount of carbon capturing

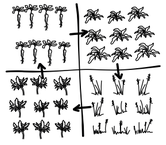
Silvopasture

- High grade of biodiversity
- Diverse production possibilities including dairy production
- High amount of carbon capturing

Wet cultivation

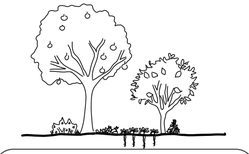
- Good for flood mitigation
- Water filtering
- Counters subsidence

Crop Rotation



- Food procuction for humans and local feed production for the farm animals
- Possibility for intensive agriculture without harming soil

Food Forest



- Wide variety of food production
- Permaculture is low in maintaince after planting

The Catalog

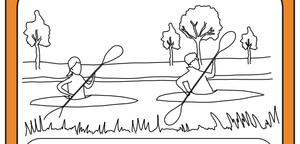
Welcome to the Catalog! We have gathered several functions that you can use in your polder. However, don't be shy to think of one yourself. This page is to give you some ideas. Pick a few cards and see how you can make them yours. We have agricultural, recreational and nature ones. However, keep in mind that the agricultural functions have to be regenerative. It is important that you keep to the guidelines in relation to percentages of ratio's, to assure a diverse mix of functions. The scales can be adjusted to keep the ratio's, enjoy!

Agriculturally focused functions:

These are the functions that focussed on agricultural production. Since the polder region is still a producing region, this can be a large part of the function in the polder region.
All these functions are based on regenerative farming (see page 74 & 75), which focusses on a more sustainable, self-restoring type of food production.

Ratio guidelines:
To make sure that the we create a diverse polycultural polder, there should not be not much of one production type per polder. Every production type should have max ratio of 60% of kind of agricultral function.

(Water)sports Facilities



- Facilitating oppurtunities for healthy habits
- Many different options to choose from
- Creating a new business

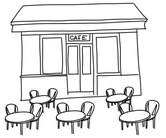
Tourism Facility (E.G. Campsite)

- Posibilities for cultural exchange
- Creating a new business

Playground

- Family friendly
- Focused on creating recreational for children

Hospitality



- Posibilities to cook with local specialties
- Possibility to create new business

Park

- Adds to biodiversity
- Easily combinable with other functions
  - Like hospitality or playgrounds

Farm Shop

- Center for the community to buy their food
- Creating a new business around the local products

Community Garden

- Educational purposes for healthy eating
- Getting community involved in growing food
- Generating income through rent

Recreationally focused functions:

- These functions are based on recreational activities for the polyculture podler. The highest amount of these functions will be placed within type 2 polders. These functions are supposed to create social hubs for the community. They should be creating places for excersice,
- relaxation, places to meet and to spend quality time with friends and family.

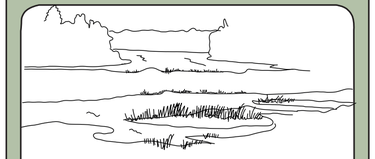
Ratio guidelines:
To create an economically viable, and diverse polder, polders should aim not to have the same recreational functions in the same polder.

Nature focused functions:

These functions are based on nature functions that will create wild patches of nature within the nature network. They are focused on adding biodiversity, attracting more diverse species and creating a resilient, future-proof polder landscape.

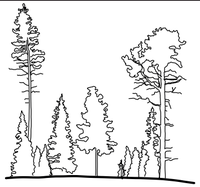
Ratio guidlines:
The ratio for the different nature patches is not set. All functions will add a great amount of biodiversity to the polder.

Wetland



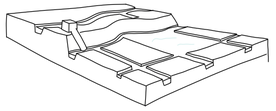
- Good for flood mitigation
- Filtering water

Forest

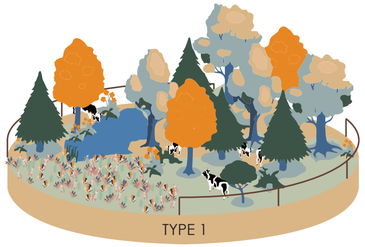


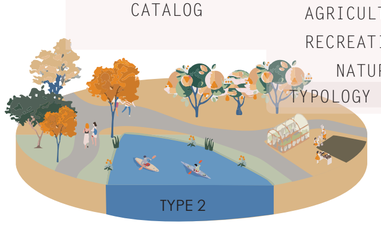
- High amount of carbon capturing
- Cooling effects

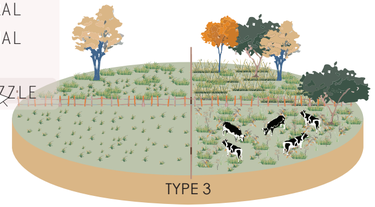
Waterbuffer

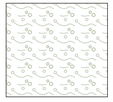


- Flood protection in wet seasons
- Sypplying water in periods of draught
- Has recreational opportunities



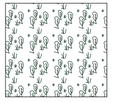




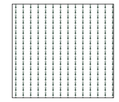


Nature strips priority to flora and fauna

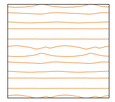
Silvopasture



Food forest production oriented small scale

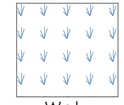


Food forest recreational oriented

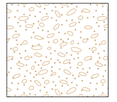


Park

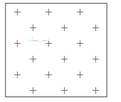
Community garden



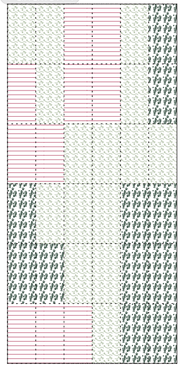
Wet cultivation

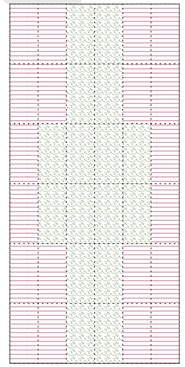


Crop rotation /diversity

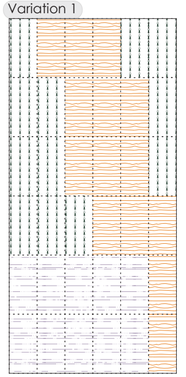


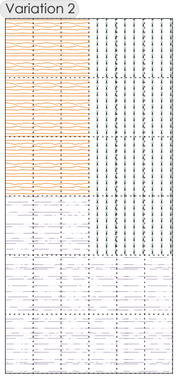
Managed grazing



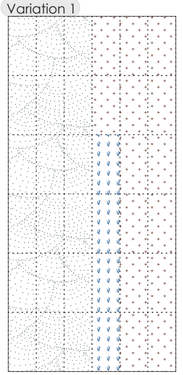


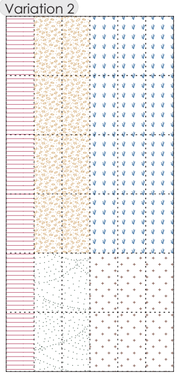
Possible variations of Type 1





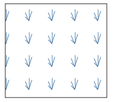
Possible variations of Type 2

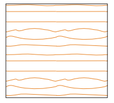




Possible variations of Type 3

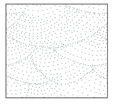

= Silvopasture

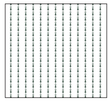

= Wet cultivation

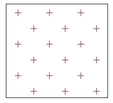

= Park

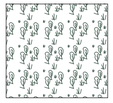

= Crop rotation/diversity

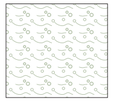

= Community garden


= Food forest - production oriented big scale


= Food forest - recreational oriented


= Managed grazing


= Food forest - production oriented small scale


= Nature strips - priority to flora and fauna

Typology Puzzle

As you now know, we have three different typologies for the polder landscape. You have first followed the roadmap and picked your cards from the catalog in the categories ''Agricultural'', ''Recreational'' and ''Nature''.

On this page, you can find how to implement these cards. There are multiple functions for your polder and you can fit them like a puzzle, as is shown when you scroll down.

Stakeholderanalysis × Phasing × Farmbiz +
https://Farmbiz.com/PolderCooperative/Catalog/Nature

Farmbiz | Exchanging Knowledge and expertise

HOME ABOUT US FARMER POLDER COOPERATIVE CLUSTER COOPERATIVE CONVENTION CONTACT

INSPIRATION
ORGANISATION AND SIZE
FACILITIES
BUSINESS MODELS

(CONO Kaasmakers, n.d.;Hamilton, 2023; Beemsterkaas, n.d.)

Inspiration for your cluster cooperative

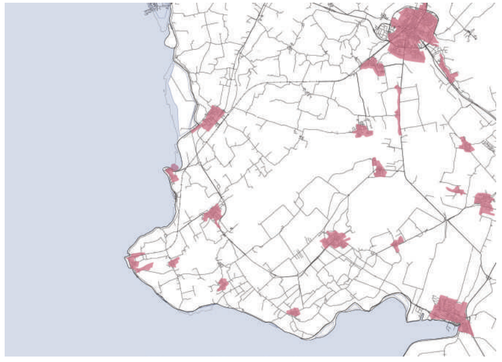
CONO is a cooperation of farmers and a cheesemaker in the Beemster, a polder just above Amsterdam and has over 120 years of experience in the business. The aim of this cluster cooperation is to pay their affiliated farmers a fair price, up to 25% more than the national average. In return, they ask their farmers to maintain high standards for the treatment of both their animals and land. This includes ensuring a minimum number of grazing days per year, allowing natural vegetation on their meadows, and installing animal friendly cowsheds. Farmers are incentivised to reserve land for nature through subsidies. For example, farmers that participate in "bijenlint", a highway of flowers and plants through the polder that mimics natural habitats for bees receive a benefit (CONO, 2022).

CONO is associated with about 400 famers, and sells their cheese both abroad and in the Netherlands. You can buy their cheese in special cheese shops, local markets and national grocery stores. They have turned the beemstercheese into a household name, resulting in a strong regional identity and put the area on the map.

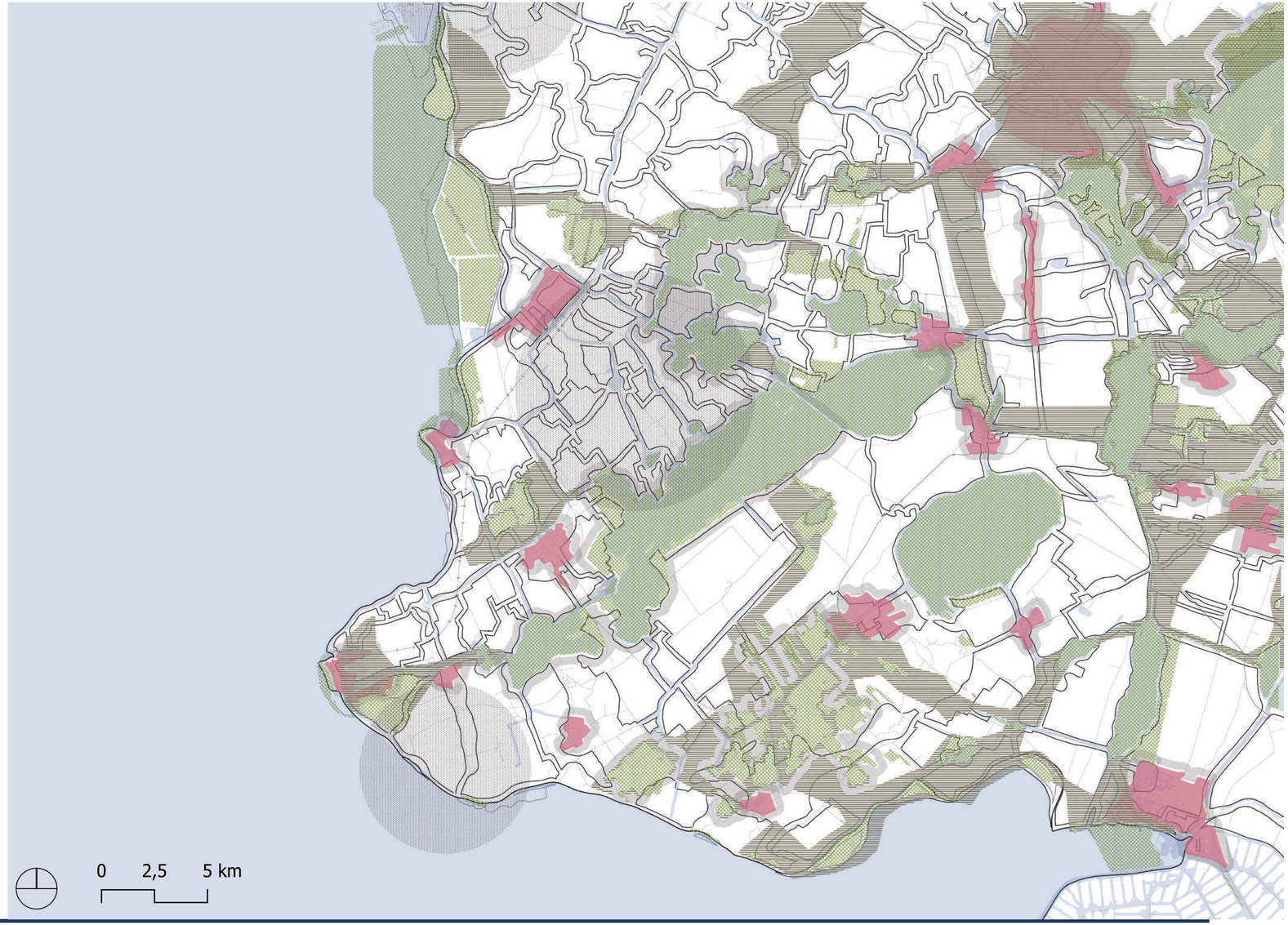
PILOT

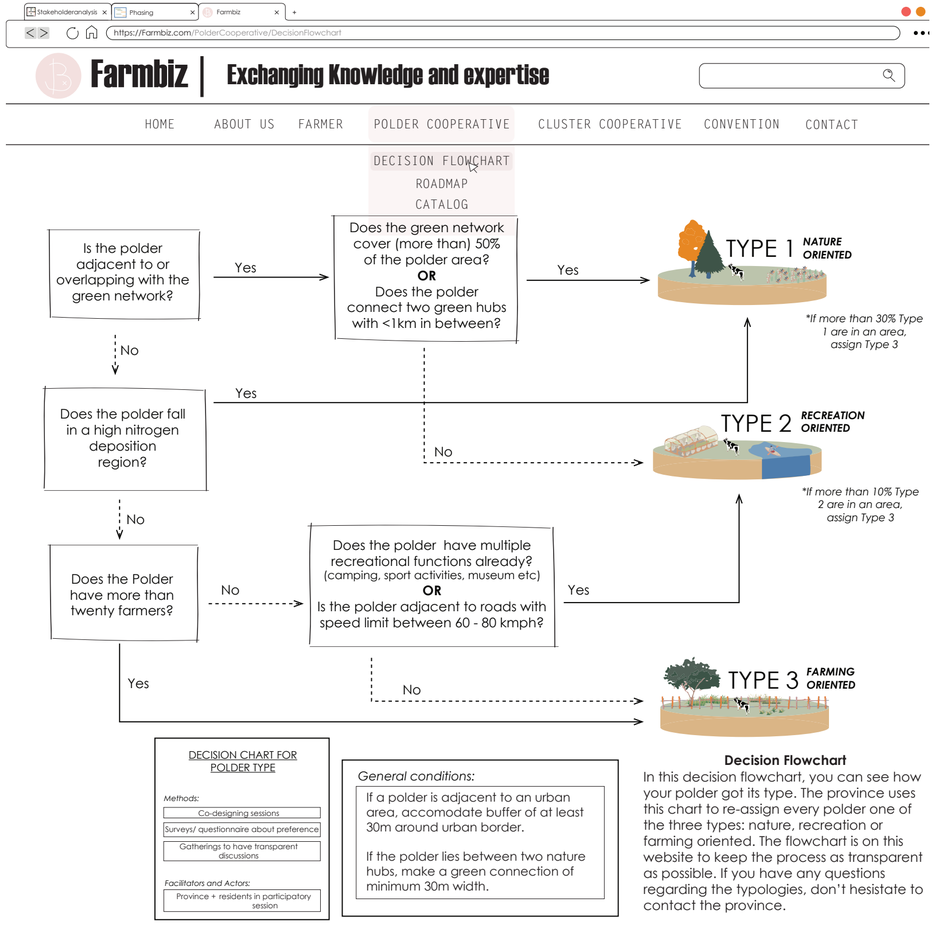
To test the effectiveness of the project, the concept is implemented first in the polder landscape of the focus area, the South-West of Friesland. This pilot uses the tools that can be found on FarmBiz, the online platform.

POLDERS
BIODIVERSITY
NATURE NETWORK
NATURA 2000
NITROGEN



Urban city
Pastures
Biodiversity hotspots
Green corridor
Natura 2000
Ammonia



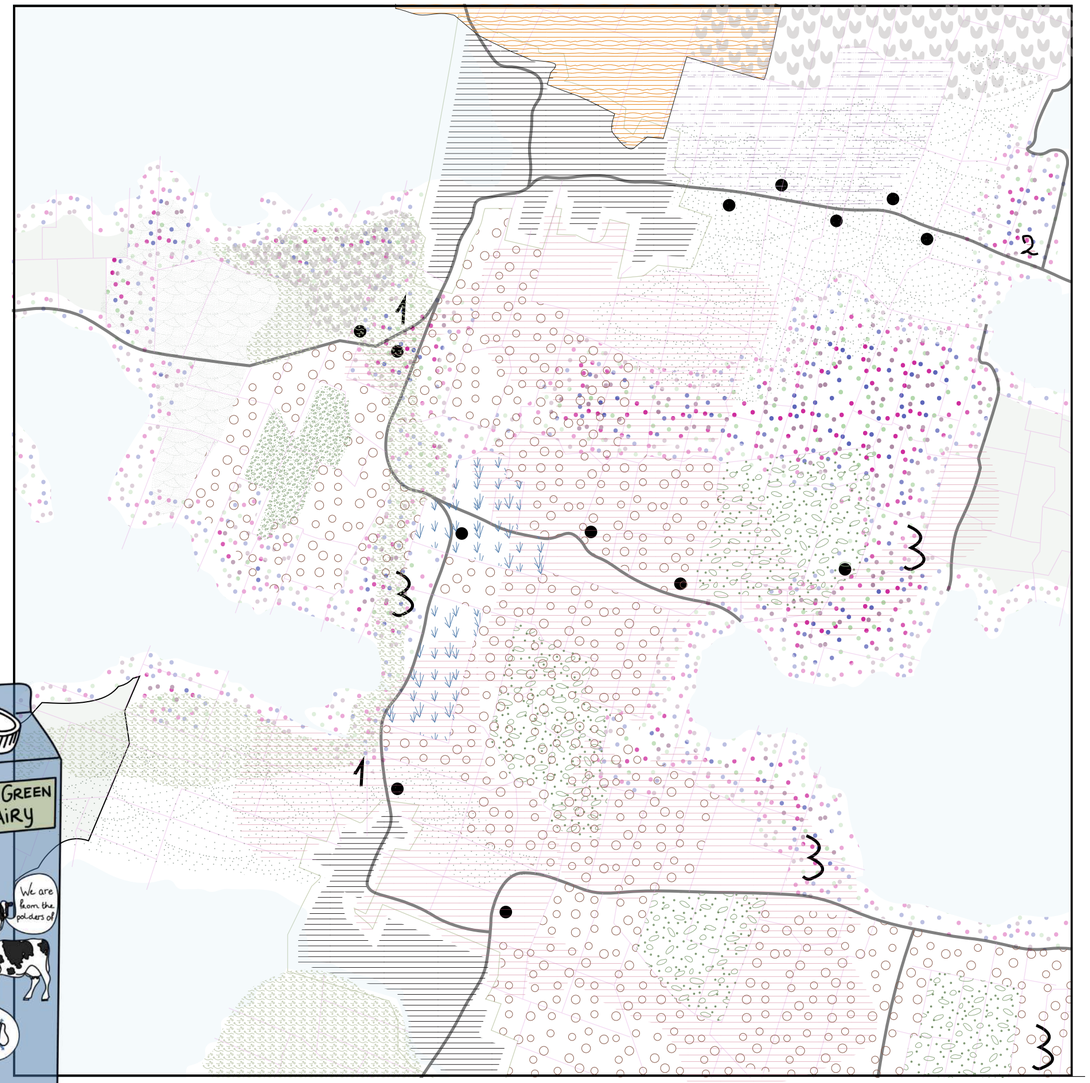


Decision Flowchart
In this decision flowchart, you can see how your polder got its type. The province uses this chart to re-assign every polder one of the three types: nature, recreation or farming oriented. The flowchart is on this website to keep the process as transparent as possible. If you have any questions regarding the typologies, don't hesistate to contact the province.

The Distribution of the Typologies in South-West Friesland
With the help of the decision flow-chart, the typologies can be determined in South-West Friesland.

The Polder Patchwork
This shows an overview of X polders of different typologies. It visualises that although they are of different typologies, specific functions do overlap. At the same time, some areas are both used as nature areas but do remain other functions, such as temporarily managed grazing. There are no hard borders between functions, illustrating a gradual transition in the landscape.

Like the CONO, newly formed cluster cooperatives can create a strong regional identity through branding their products. If done collectively by all the clusters, a regional identity structure, just like the wine industry in France, will emerge.



= Silvopasture

= Wet cultivation

= park

= Community garden

= Food forest - production oriented big scale

= Food forest - production oriented small scale

= Food forest - recreational oriented

= Nature strips - priority to flora and fauna

= Managed grazing

= Crop rotation/diversity

= Cattle area

= Farmer

07 CONCLUSIONS

Conclusions
Ethical reflection

CONCLUSION

This Nitrogen crisis in the Netherlands has aggravated over the last decade. This is largely due to the dairy industry. An efficiency driven model and boosted production steered by a narrative supporting dairy consumption, has brought the industry to its current status. Occupying up to 30% of the land cover in the country, the dairy industry is also responsible for large amounts of monocultural landscapes - hence making the nitrogen emission worse.

The research identifies three main problems in the dairy chain- monocultural landscape, centralised production and linear system. Ecologically, the landscape is exhausted and biodiversity is severely lacking in the pastures, conversely more in cities. Further, the centralised system creates a monopoly of big dairy companies, like FrieslandCampina, detaching the farmer further from his produce and land. Overall, the system has a linear composition that is pushed by the need to maintain trade surpluses in export. This overproduction and a lack of insight on sustainable farming is the main cause for methane, phosphorus and nitrogen problems. It is made clear that many of these problems accumulate in a specific area: South-West Friesland.
In this project we tried to answer the following question: "How can we transform the polluting dairy industry into a circular system and make a shift towards a local, diverse and self-restoring agricultural network in South-West Friesland by 2055?"

We first answered the sub questions before answering the research question.

1. How can we rearrange the dairy industry in such a way that we minimise the negative externalities?
With this vision, these externalities are minimised by restructuring the polder landscape to a mixed use polder landscape. By diversifying production to include not only dairy but also other enterprises, pressure on ecological systems is reduced. Meanwhile, the conventional agricultural method will be replaced with only regenerative farming methods that include nature networks and restore the local circular ecosystem. Furthermore, the percentage of dairy farming is halved, which means a big reduction of, among other things, ammonia. Simultaneously, fostering more localised supply chains minimises transport-related externalities.

2. How can we create a spatial and social just system for the farmers?
A spatial and social just transition for the farmers is achieved through different strategies. At first, we facilitated a balance between a bottom-up and top-down approach while designing the strategy. Moreover, a broader vision for farmers, beyond mere reduction of externalities, forms the foundation of this just transition. Setting up the cooperatives provides more economic certainty for the farmers, while restoring and improving the biodiversity of South-West Friesland. With these strategies, we create a spatially and socially just transition.

3. In what manner can a biodiverse landscape be structured to sustain employment opportunities for its inhabitant?
The mixed use polder landscape establishes new businesses and creates alternative job opportunities. By re-appreciating natural areas and reserving capital to maintain them, new forms of employment arise. Human-oriented polders, drawing people from urban areas into the landscape, will create employment with them. At the same time, the cooperative structure realises a fairer capital flow in the dairy industry towards the farmers.

4. In what way can this new combination (biodiverse and new business) be implemented in the polder landscape?
Through implementing a mosaic of polder typologies, a mixed and biodiverse rich landscape is realised. A decision-making process prioritises green networks and results in determining which polders become which typology.

5. Which tools and policies can be used to realise this vision?
To make our vision reality, FarmBiz, an online platform is created to provide guidance for stakeholders to make the transition. The platform provides advice, tips, roadmaps and reference projects to help all layers of the system.

"How can we transform the polluting dairy industry into a circular one and make a shift towards a local, diverse and self-restoring agricultural network in South-West Friesland by 2055?"

The newly created vision "grazing towards a greener future" aims to create a diverse, fair and cooperative polder landscape. The dairy industry is transformed from a monocultural, central and linear system to a polycultural, decentral and circular agricultural system. The vision focuses on a polycultural landscape at the polder level, the main production unit of the dairy industry. However, the introduction of new functions in a regenerative model creates a new problem of unjust division of space between the existing dairy farms. This is further resolved by the introduction of a cooperative system within polders. These self-organised, knowledge sharing and joint decision making clusters facilitate a new future for their land.

ETHICAL REFLECTION

A just transition

We all aimed for a social and just project. After reading about the dairy industry and the associated communities, our project kept the farmer as a major actor. The farmer's well-being was on our mind a lot. Especially considering the lack of transparency and vision in the communication from government to farmers. We all thought that they should get a clear idea on what would happen to their landscape.

We noticed that the governmental organisations really focused on reducing, without giving a broader vision of the future to the farmers and the corresponding stakeholders. Also, the changing of policies in recent years didn't give them a clear perspective of the future. We think this is a lack of good governance, because it doesn't meet the needs of (a part of the) society. With this in our mind, we wanted to create a broader vision, in which everyone is included. We wanted to foster self organisation within this broader vision. Our goal was to prevent the dominance of an efficiency-driven model and create a model where self-organisation is the standard. With both creating a broader future vision and fostering self-organisation, we created a just project.

The introduction of new functions in a regenerative model creates a new problem of unjust division of space between the existing dairy farms. This is further resolved by the introduction of a cooperative system within polders.

Limitations of the project

There are some limitations of this created vision and strategy. At first, the polder types are really abstract and research about how the mentioned functions really could be implemented is absent in our vision. Research about soil types, for example, is not integrated in our vision, as well as other differentiating aspects related to polders.
Furthermore, the research on the social structure of the framed polder landscape is limited. We didn't talk to any real stakeholder, but only used desk research to examine the roles of the actors. Blocking mechanisms, like economical difficulties among farmers, are not highlighted in this vision.

Finally, important to mention is the scope of the project. We mainly focused on reducing the ammonia emissions by creating a broader vision for the farmers. However, other sectors contributing to the nitrogen crisis - such as mobility sectors and other farms like pig farms - are left out in this vision. These sectors do also influence the nitrogen deposition greatly. This vision alone could not solve the nitrogen crisis on its own. It needs to be combined with other measures for other sectors as well.
Further research

The vision stops at the territory of the polder landscape. But, the dairy industry and its externalities are a problem all over the Netherlands. It is therefore interesting to do further research on how the vision can be implemented in different polderareas and non - polderareas. This, of course, is a local and regional oriented task, because every landscape and social structure is different from another. It is also needed to do more research about cooperative structures, because it is not common in the Netherlands.

Moreover, the vision is limited to only 3 types of polders. However, we believe there could be many more types created that satisfy the needs of the farmers and society.

At last, we only focused on the ecological circularity and the import and export, while there are many other forms of linearity in the dairy industry. An example is the food packaging or the food waste of the industry. It is mentioned very little in this vision, so further research on these parts of circularity is needed to complete a total circular flow.

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The vision stops at the territory of the polder landscape. But, the dairy industry and its externalities are a problem all over the Netherlands. It is therefore interesting to do further research on how the vision can be implemented in different polderareas and non - polderareas. This, of course, is a local and regional oriented task, because every landscape and social structure is different from another. It is also needed to do more research about cooperative structures, because it is not common in the Netherlands.

Moreover, the vision is limited to only 3 types of polders. However, we believe there could be many more types created that satisfy the needs of the farmers and society.

At last, we only focused on the ecological circularity and the import and export, while there are many other forms of linearity in the dairy industry. An example is the food packaging or the food waste of the industry. It is mentioned very little in this vision, so further research on these parts of circularity is needed to complete a total circular flow.

08 REFLECTIONS

Group Reflection
Individual Reflection

Group Reflection

Working on this scale with five people was something none of us ever really did. However, we all agree that our group was a good combination of different expertises. We have had a lot of fun and we really got to know each other. It became clear we were all intrigued by the farmers in the Netherlands and the reasons why we chose nitrogen.

At first, the group process was a little chaotic. Due to the fact it was quite fun within our group, which sometimes made it hard to really focus. Moreover, our way of working varied greatly. We eventually chose to make more structure in our group process by choosing roles within our group. Juliette and Jonas were chosen to be the chairs and would switch this role during the days. They created agendas and led the group discussions. The other team members took minutes during the group discussions and the tutoring. In this way, the process got more structured and we worked more efficiently. Our research and drawing styles vary greatly. Also, some of us are better at logical thinking, while others are better at creative thinking. This only benefited the project in providing a variety of ideas, drawings, diagrams, maps and research. It also resulted in all of us learning something new from others. We must say we are all pleasantly surprised and endlessly grateful we have a group we can collaborate well with. The project is really a bit of each of us.

Next to the working part, we also did fun things to build trust and to get to know each other. We brought a lot of (self-made) food and this resulted in group bonding. This helped us to get more motivated for the project and to bring it to a good end.

Melanie Mary Marshal

Since the beginning of the academic year, I have looked forward to working on the Q3 project, a regional-scale project aimed at understanding the spatial impact of processes that transcend boundaries.

Initially, my interest lay in the food production system and comprehending global-scale flows, alongside its ecological dimension. I have had an interest in understanding the role of people in shaping urban scenarios. The drive to implement interventions from a people-centric and bottom-up perspective has been key to the process. I also had a significant interest in comprehending global justice within these food chains, which, unfortunately, lagged slightly behind as the project developed.

The SDS series served as a guide, introducing the various possibilities for a territorial-scale project. Carola Heins' lecture on Oil-Scapes particularly resonated with me, especially in understanding the narrative's role in framing the development of an entire industry. Upon reflection, I realized the parallels with the milk industry in the Netherlands, and that our project also focuses on changing the narrative.

The initial steps of the project were framed by understanding the current processes of the dairy industry. These material flows and externalities were framed in the systemic section, with the guidance of Alexander Wandl's lecture on Territorial Metabolism. The section formed the basis for identifying problems in the dairy chain: monoculture, the linearity of flows, and a decentralized system. As we researched these issues further, they also pointed to spatial aspects (polder landscape), the process (linear flows), and the socio-economic setting (cooperatives). However, while the project addresses these flows on a smaller scale and provides a basis for integration at a territorial scale, it doesn't directly address them.

The lecture on representational challenges by Nikos Katsikis, gave insights into tackling the project at various scales and differentiating between process, elements, and their synthesis. In a world inundated with information, this understanding also helped me grasp the importance of minimizing information on maps. As we moved to the strategy phase, our design zoned in on a highly productive and ecologically vulnerable area, the South-West of Friesland, that we envision as a future regenerative landscape. However, this would not suffice for spatially just future and so local cooperative hubs facilitate this transition from the bottom-up. The regional scale encapsulates our ambitions for the future of the Netherlands, utilizing a toolbox to scale up the design through cooperatives rather than creating a top-down solution.

Although from a vastly different perspective of the global south, I often referenced urbanist Abdoumaliq Simone from their paper 'People as Infrastructure, which emphasises the agency of people in a shaping a city relating to the socio-economic scenario. Through this project I was able tot contextualise this idea within the concept of 'in -between cities' and 'Zwischenstadt' which I explored last quarter. Though the project does not reference these theories, it helps further my understanding of metabolic flows of a territory, aiming for a balance between rural-urban nexus, which is often proportional to production and consumption.

Laetitia Ruiter

Group process
The group process started a bit chaotic. This was partly due to having many lectures and assignments involving QGIS, which provided us with several tools for our project. Consequently, we found it difficult to focus on the project's content. After a while, we introduced more structure into our group activities, allowing us to have a better overview of tasks and work more efficiently.

My role within the group
My role within the group was primarily analytical, investigative and critical. I provided substantial support and arguments to establish our vision. Additionally, I took on a planning role, which served as a good refresher of my knowledge in urban planning. However, I encountered a familiar issue of promising too many deliverables in a short time. To address this, I sought help in time, particularly during QGIS workshops, where I struggled to keep up. I also occasionally fount it challenging to maintain focus and was sometimes chaotic during meetings. This improved as our meetings became more structured. I learned to communicate my need to work independently for a better focus, enabling me to deliver sufficient products.

Peer-review
During the peer-review, I received the lowest rating on focus, which was the major discrepancy between my self-assessment and the peer review. It turned out other group members experienced this too. This discussion revealed that we sometimes got too comfortable, leading to lower focus levels. It also highlighted that within the group, I was perceived as someone who laid the theoretical foundation for our vision, aligning with my own insights.

Learning objectives
My first learning objective was to understand how nitrogen is integrated into policy and regulations across all scales. I extensively reviewed policies and regulations and I now understand how nitrogen is addressed at these scales, including the integration of de Nieuwe Omgevingswet (New Environmental Planning Act). In that regard, my learning objective is achieved.

Another objective focused on participation and the complexity of different stakeholders. I believe I could have learned more by, for example, conducting interviews with real life stakeholders. However, I gained valuable insights from workshops, such as creating a power and interest matrix, which provided a better understanding of involved parties and the relationships between them. Lastly, I aimed to take a more prominent role during the tutoring sessions and presentations. While not fully achieved, I partially succeeded. Particularly in the beginning, when it was too chaotic, I felt unsure about reporting our progress and structure. However, I did present the final presentation and sometimes took a more prominent role during group discussions.

I think working in this group worked out very well. I had a lot of fun and learned more about my own role within a group, although I already had quite some experience working in (big) groups. The big scale was challenging but has interested me very much. It is a scale I would like to work more with. Next time I would like to learn more about the possibilities and reality of implementing the vision and learn about which problems come forward with this. I also would like to learn how to practically set up a participation session when creating a vision (and strategy). This is including learning to speak the language of the target audience.

Myrthe de Reus

This project is about a social and just transformation shifting away from the dairy industry that we know today. We all started on this subject because of our mutual interest in Nitrogen. The reason why I am interested in Nitrogen was actually because I was less acquianted with this subject than with carbon. I wanted to challenge myself with the lesser known subject, to see how I would handle this and if I could understand the side of the farmers and or government better. We always talk about sustainability, but now the social and just transformation for the farmer was taking the overhand. I loved how we used the concepts cooperative and new business oppertunities to meet the farmers need as well. Which would all deduce the Nitrogen pollution at the same time. The way that we created this project could also attract non-farmers which I hope, would reduce the distance between the farmer and non-farmer. To create some understanding towards each other and to have a more local community, moving towards an increased social environment.

The subject that stuck with me the most out of the SDS lectures is about the ''Thinking of the Future''. We used to do this in quarter two and one as well, but with this project we made a phasing. We had to really think about what happens in the next 3, 5, 10, 15, 20, 40 years. This gave a whole new insight on really thinking about what the future holds for these farmers and how we could create a smooth transition as best as possible. There are topics that are possible and desirable, with combination of these two resulting in probable. This was also a returning subject in the group discussions. With five people, you get a whole lot of ideas, some are more dreaming / utopian leaning towards the desirable part. Where other teammates were more of the realistic and tangible ideas. However, deciding on compromis between these lead to some great ideas hovering between just and extreme.

Besides thinking about the timetable and ideas, we were also looking at the spatial coordination. Finding data and layering maps on top of each other to see what for information would be highlighted. Looking at exisiting connections and looking into spaces where we could create connections.

Creating this nature network, improving the biodiversity was something we all agreed on rather quickly. This network would mean that flora and fauna could florish better, especially in the polderlandscapes where there is, apparently, little biodiversity. This would improve the environment as well, there is space for vegetation to absorb Nitrogen, mitigating the crisis. And because this whole network runs throughout the Netherlands, because we will connect it to the existing one, the reduction in Ammonia should be feasible nationally. Besides connecting Natura2000 together with this network, we also create a common goal for the farmers, combined with other goals which are implemented in the typologies.

This would lead to community engagement within the cooperatives, we can create a better understanding of each other. While every cluster has different typologies, the income should not change that much while they will share their profits, together with amenitites and knowledge. We all agreed that this would mean that the dairy industry could not even be called the dairy industry anymore. Of course there would still be dairy products, but is much more decentralised, leading to, among other things, less transportation. Moreover creating a more localised production and consumption and creating new job opportunities and mix land-use. However, there will be variation in this new system, including more people than only farmers and creating a start towards a greener future!

Juliette Heeskens

This project, for me, was a first in a few different ways. It was the first regional design project, that discusses new topics, and the intense amount of group work is also unique. A more typical designing process, in an individual designing project, looks quite different than one we go through with more people that have different ways of working and communicating. So, this was an interesting learning process. We had to get to know the group and the way that everyone works best, individually and together. Our group was a diverse group of people, with each our own strengths, which I think really shows in the result. Everyone has brought their own expertise into the group, which lead to a strong group with many different roles and skills. Eventhough, sometimes we did tend to stay in our comfortzones, when producing work, everyone knew about all parts of the project, and offered help where needed.

Initially, I expressed that I was interested in learning about communication within a group. On how to create an open space for everyone to share their honest opinion. I feel like everyone in the group felt comfortable enough with each other to freely express, because we all valued each others opinion. So eventhough this was an intense course, and sometimes we challenged each others opinion, the environment was always comfortable and conflict did not arrise.

The topic that we designed around was Nitrogen. During the capita selecta lectures, a broad gave a good idea on multiple of the topics, and the one that mainly took my interest was the lecture about the dairy industry, since it points at a few current problem I knew little about.
Eventhough the main topic was nitrogen, when analysing, we quickly got to the dairy industry. During the initial analysis of the dairy industry, we found the three main problems of the dairy farming. These became a structural aspect for us in the story. We used to test ourselves throughout the project. These three problem were the main framework for the analysis, our vision, and then also for the presentation since it created a clear, easy to follow story for that too. One of these three topics was linearity, which we wanted to change to circularity and throughout multiple moments of the project we kept realising that this topic was lacking. Because we had set up this framework we could keep a focused, but complete result throughout the weeks.

Concluding this course, i feel like I learned a lot. I experienced a new scale of designing, that requires a different way of thinking, researching and visualising. I learned that my strengths lie more with strategising than visualising and that I really enjoy taking the lead in a group when it comes to planning and structurisin. This gives me insight into what I still need to learn and that there are valuable lessons I can take to my future courses.

Jonas Bottelier

Coming from civil engineering, my path towards design experiences has not been natural or plentiful. During this bachelor's, the focus was not often on design, but rather on arguing certain calculations. Now that I'm studying MADE, design plays a bigger part in my studies. However, the main focus is on holistic system changes, not necessarily spatially oriented.

This made me very excited to follow this course, as I was eager to experience a design and ideation process. I feel that I have gained this experience both from learning techniques in the lecture series and applying them in the project, as well as working with my group members.

One aspect that stands out as a learning objective to me is the way that concepts work as a bridge, structuring the analysis towards a design through a conceptual framework. This way of organising rather big concepts into a framework was something that I had never done before. Whilst the lecture Marcin Dąbrowski & Roberto Rocco was already telling, this process grew on me when doing it for our project. Hollistically thinking of our project and almost philosophically reviewing which concepts our project touches upon, whilst also debating how these concepts relate to each other structured the thought process of such a big project for me.

Research and design

Contrary to my prior belief, thinking that a design just follows up from a research/analysis, I think that design and research are more intertwined than this linear relationship, something that became clear to me during this project. I realize that in the first couple of weeks, we were just researching the nitrogen problem and agricultural system in general, not exactly knowing what we were looking for. With little to no system boundaries; a large focus area and a broad problem, it felt like searching in the dark.
It was only after we collaborated to sketch a rough vision that we gained clarity on our research direction. Once we started to design, it became clear what of our found research was usable, what was not, and what our knowledge gaps were.
We suddenly understood in which direction we were supposed to go, and how we could use that knowledge to improve our design. It made sense to use the tools learned during the SDS lecture series in visualizing te more relevant spatial patterns in Qgis.
It became clear to me that designing is a way of structuring knowledge, and to visualize knowledge gaps

Governance
The governance aspect is heavily embedded in our project. We see a big role in the unification of dairy farmers within their polders into cooperatives. This comes from a necessity to mitigate the changes in landscape equally over the farmers as well as to bring certain aspects of regenerative farming into reality. At the same time, we discovered that the dairy industry is heavily centralised and that dairy-producing stakeholders experience a rather big power imbalance.
To tackle this, we see a strong role for a cooperative structure. Especially taking the essence of governance in collective action into account, as we learned during the lecture of Simbarashe Chereni on governance.

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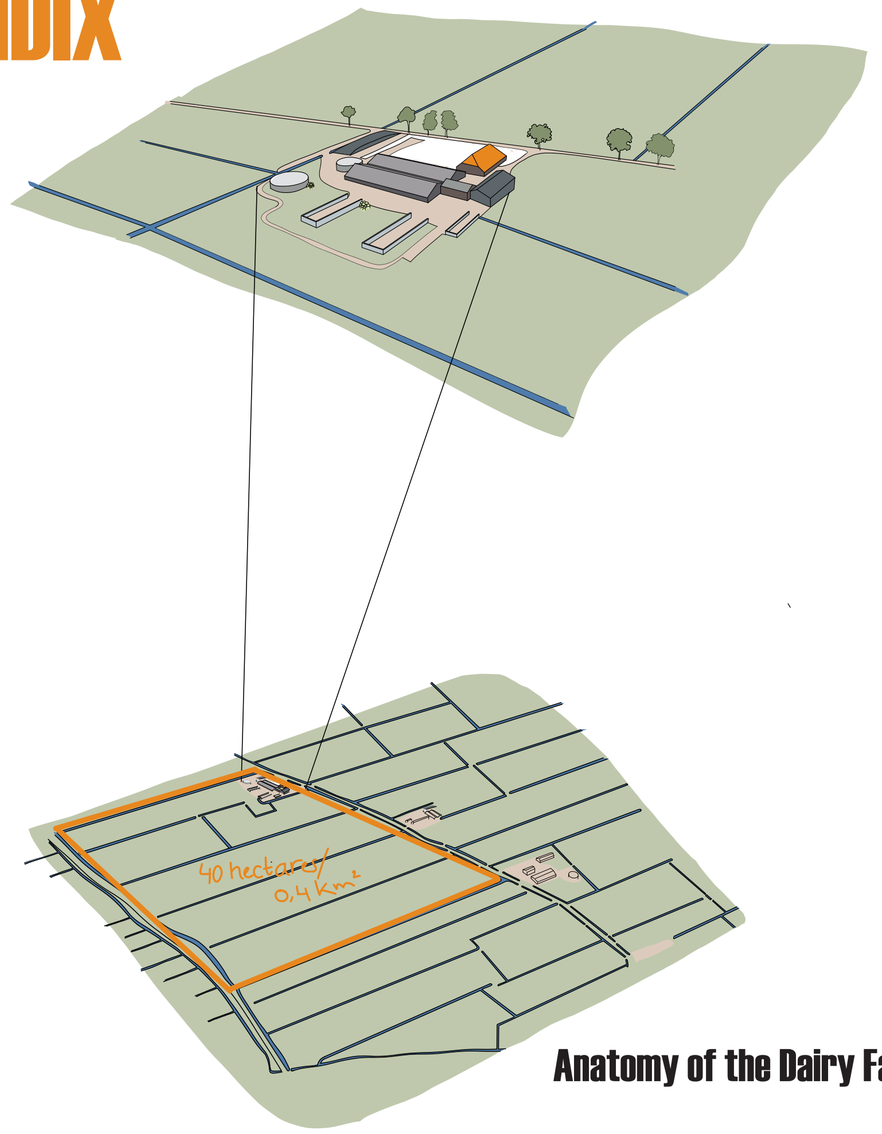
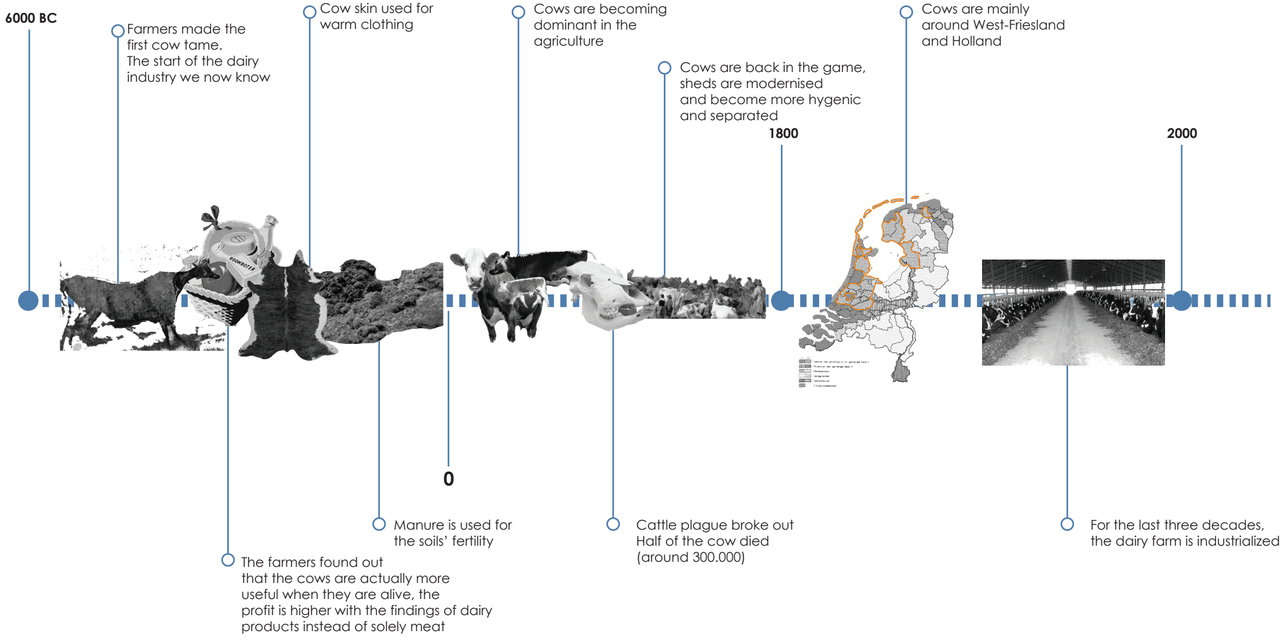
APPENDIX



Anatomy of the Dairy Farm



History of the cow