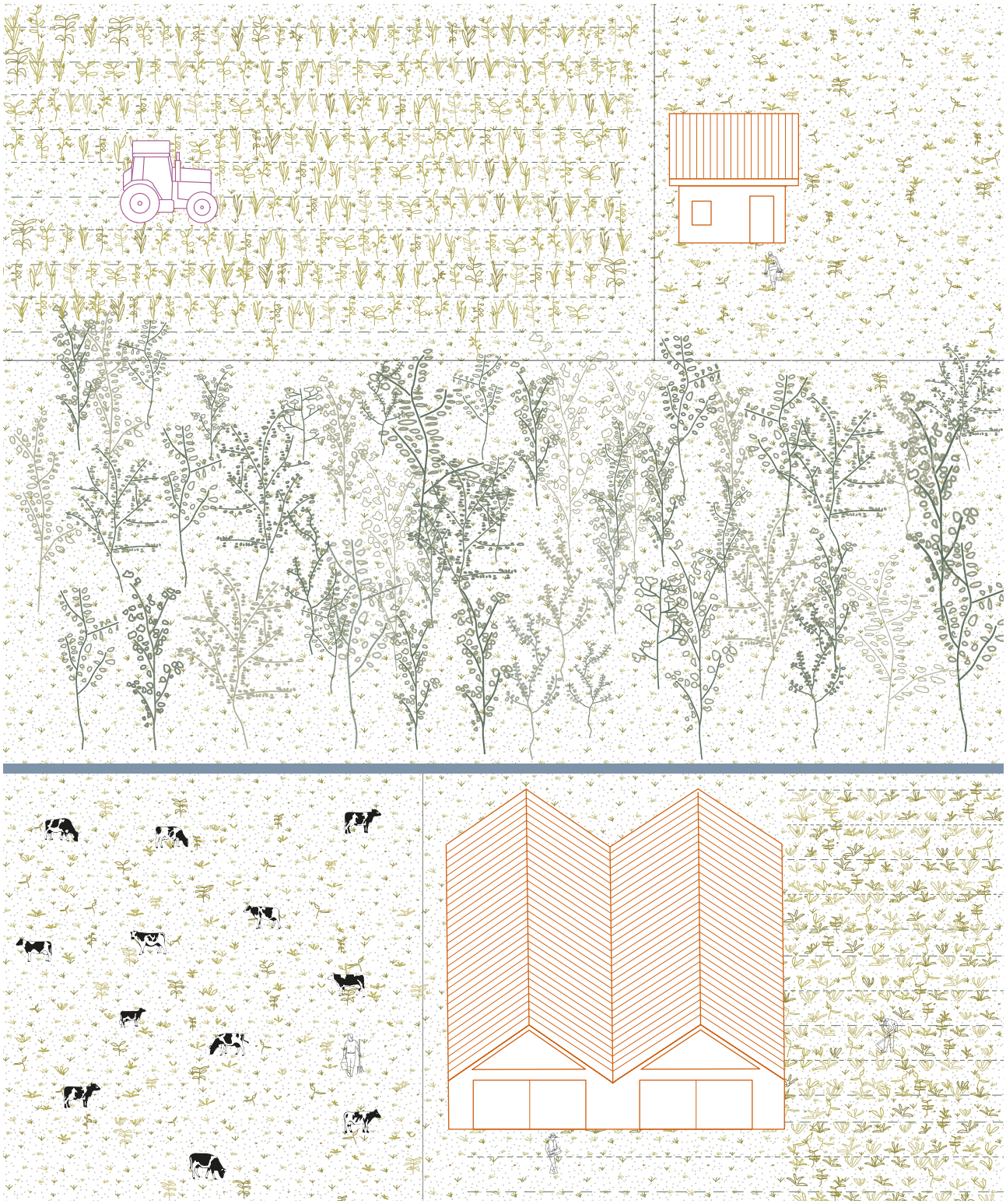
TRAJECTING TERRITORIES

A SPATIAL RECONFIGURATION TOWARDS MULTIPURPOSE FOODSCAPES



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FOREWORD

Gouda, Edam, Holsteiner, Nieheimer, Stilton, Cheddar, Camembert, Tiroler. Europe is a continent of cheese. Cheese made from the milk of goats, sheep and cows is one of the most beloved and versatile food preservation productions in the world. This popularity comes at a cost. Contributions to global emissions are massive: there is a high need to reduce greenhouse gas emissions within the dairy industry. In addition to its ecological impact, the spatial impact of the dairy industry takes up enormous amounts of land all across Europe . In the Netherlands alone a quarter of land area is taken up for feeding the cattle.

This report analyses the relation pasture land has to the rest of the surrounding functions of other agriculture, living, nature and industry, while proposing a new configuration of how farming and livestock farming can be transformed into an integrated regenerative system.

Cheese became the guide that led us from the small singular object scale from the farms where they are produced to finally the European and global scale at which it is distributed. We found out that in the usual large-scale field of Urbanism the narrative device of objects and personal relations goes a long way in understanding a region. This report therefore follows a specific structure. Instead of beginning at the continental scale and moving down, we start at the object scale to diverge and see its commodity flow going up from the field to the province, national and transnational. After this we will jump back down through the scales using tools found along the way such as regional cooperative planning, soil, crop and livestock management and sustainable technologies. These tools will be used to create a provincial and municipal design which through communal learning can then be exported to the rest of the province, nation and continental.

With this research, we contribute to the future development of strategies within the field of regenerative agriculture and environmental sciences. Our evidence based recommendations can inform policy discussions, and potentially influence farming management practises. For this, we want to express our appreciation to dr. Caroline Newton and Lukas Höller for their guidance during this project.

ABSTRACT

With an average cheese production of 947 mln kg/year, the dairy industry (in the Netherlands) is responsible for 6.3 % of agricultural/dairy/commodity greenhouse gas (GHG) emissions in Northwestern (NW) Europe. This report brings the production of dairy and its effects on the spatio-temporal and environmental footprints into view. By performing a material analysis flow of an everyday consumption product-cheese, a by-product from the milk produced by cattle raised on the vast flat pasture lands in the Netherlands, we determine the harmful role it plays in GHG emissions. Using a mixed-method approach, this study combines qualitative and quantitative analysis methodologies, extensive literature reviews, group discussions, available QGIS datasets, farmers sharing their experiences and knowledge on YouTube channels, case studies and a stakeholder interview. This led us to the formulation of a sustainable polyculture agriculture catalogue and toolbox where the dairy sector shifts from a core polluter and extractor role to a regenerative one. A future for farming is formulated where healthy soil is at the core of agricultural thinking. We outline a cow reduction spectrum resulting in opportunities for NW Europe leading to ecological improvements of the soil. Applying this toolbox to the South-Holland scale led to a multipurpose foodscape using an Integrated Crop-Livestock System (ICLS), where cows play the primary role of fertilisers of the land and secondarily, the role of milk producers. In conclusion, the research proves that the adoption of ICLS can significantly reduce GHG emissions in dairy production territories and optimise the existing land use. Implementing this system requires a shift in mindset and has significant implications for the dairy industry, policymakers and society at large. The strategy and action plan in this research seeks to inform policymakers, urban planners and other stakeholders in the dairy farming industry on how to transition towards a more regenerative and sustainable system that benefits the environment, society and the economy in the long duree. It suggests a socially just transition to the groups of farmers via a symbiotic approach.

Keywords: *ICLS, GHG emissions, monoculture, polyculture, farmers cooperatives, biodiversity, soil recovery, policymakers, pastureland, arable land, crops, Netherlands*

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Biokaas farm Kinderdijk, Alblasserdam

1. INTRODUCTION

1.1 START POINT: MATERIAL FLOW ANALYSIS

To break down the complexity and regional scale of this R&D studio, we set off with the intention to trace the trajecting territories of a specific product within the NW European context. Cheese, one of the commodities that best captures and influences the economic, spatial and political aspects of the region. It is culturally recognisable and a valuable economic export product. Their names carry weight, so much that many of them are protected by EU law, making the origin valuable around the world for export. For the Dutch context, dairy already consists of the third highest export product with a 7% portion of total export. Underlying the production of cheese is the creator - milk that carries with it environmental, land use, consumption and feed implications. Environmentally milk occupies 30% of the Dutch agricultural sector with 1 kg of milk producing 1.15kg of CO_2 eq. GHG, the main waste coming from sludge from the wastewater purification process. Dutch cheese production takes up 60% of the milk produced/year creating 947 million kg of cheese.
A material flow analysis of this production chain led us to realise that the problem is embedded in the larger context of cheese production. An astonishing number of livestock farms are distributed throughout the territorial boundaries of the Netherlands and NW Europe. The primary purpose of these farmlands is to export dairy products like cheese and milk to neighbouring countries and beyond. An existing monoculture of vast expanses of farmlands and pastures has led to economically efficient livestock grazing systems. In The Netherlands, cluster farming techniques are adopted as compared to diffused farming in neighbouring regions. It is environmentally and socially inefficacious. These landscapes are speculated for sustainable future development. We start from cheese, pastures, Netherlands, NW Europe coming back to the region of South Holland, Hoekse Ward and cheese. We diverge initially to eventually converge back to cheese. This report is a catalyst for conclusions drawn after speculations.
The reduction of these pastures and monocultures opens up the possibility of new symbiotic systems between resource oriented local land management, natural restoration, food production and social justice.

1.2 HISTORICAL CONTEXTUALIZATION

The history of Dutch milk starts with water as its first ingredient. To prevent flooding in the low-lying pastures, those who wanted to keep cows had to dig ditches and build dikes. Eventually, the water, soil and climate proved favourable for raising cattle. During the agricultural crisis, which lasted from about 1880 to 1900, agriculture went through rapid economic development. All these innovations determined the structure of agriculture, which still forms an important part of the Dutch economy in the 21st century.
The first important shift in the dairy industry occurred when new processing methods were adopted in the second half of the 19th century. Both condensed milk and milk powder were exported in large quantities by then. In 1882 Hollandia was founded as the first predecessor of today's colossal FrieslandCampina industry. The Dutch Dairy Bureau, a project of the industry itself, continued the collective promotion of milk that had begun in the 1930s as part of the agricultural crisis policy. The bureau's campaigns were partly responsible for the success of Dutch cheese in European markets but it was in 1957 with the almost fascist prints of large children holding glasses of milk, that dairy campaigns really broke through. 12 years after World War II, the Netherlands was a nation under construction, in need of symbols and national values. A key figure for this major change was Sicco Mansholt. He created a production-enhancing agricultural policy to avert another famine to ensure that a Hunger Winter like the one in 1944 would never happen again. His efforts allowed Dutch agriculture to be mechanised, rationalised and scaled up to unprecedented levels. The landscape was clearly affected by the modernisation of agriculture and the required expansion in scale. The Netherlands developed into a world leader in agricultural innovation.
Several decades later, in the 1980s, the sector's focus shifted from expansion to maximising efficiency. By focusing on fewer, larger farms, adopting new breeding techniques and using advanced technologies, notably the milking robot developed in the Netherlands.
Today, these experiments continue but environmental issues are holding them back.

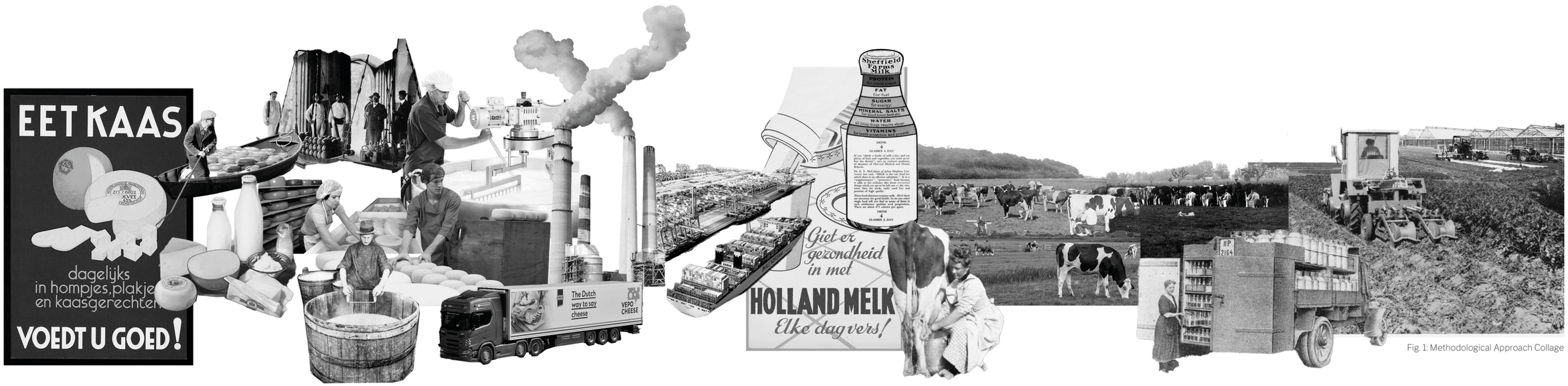


Fig. 1: Methodological Approach Collage

1.3 POLICIES CONTEXTUALIZATION

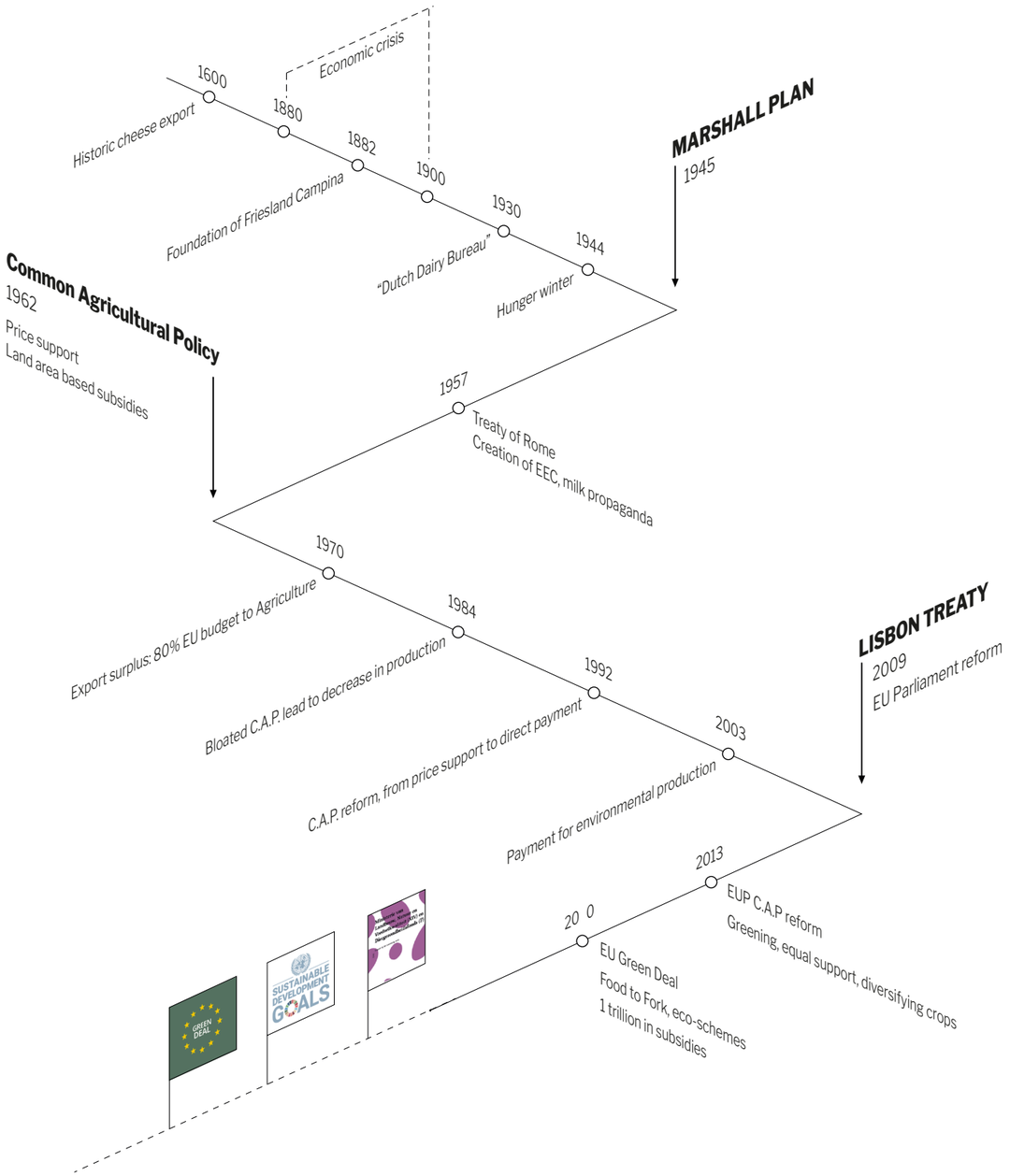


Fig. 2: History and Policy Timeline

This history of Dutch cheese production as an export product goes as far back as the 1600s. Low-lying subsiding land in the province of Holland was much more favourable to livestock raising than crop production. The simultaneous economic expansion of the colonial period and the heightened demand for animal products laid the foundation for the cultural significance of cheese in the Netherlands. We skip to the 1880s, right after the start of the industrial revolution when an economic crisis broke out which lasted until 1900. This crisis forced the dairy sector to industrialise and expand. This shift in dairy production resulted in the formation of the Campina dairy corporation which still exists to this day being the largest dairy processor in NL and the 5th largest in the world. In 1930 the largest dairy producers founded the Dutch Dairy Bureau to further standardise and consolidate their position within the agricultural sector.

There cannot be an analysis of Dutch agricultural history without the consequences of the Hunger Winter of 1944 during WW2. This traumatic event in Dutch society led to 20,000 deaths. The famine, partly due to the relatively low production of agricultural produce and years of occupation, established the sentiment “This, never again”. NL would be food secure from now on.

The post-war reconstruction period and the implementation of the Marshall Plan streamlined and industrialised the entire agricultural sector based on mass production practices from the USA. The consolidation of Western Europe, directed by the USA paved the way for European integration with the European Coal and Steel Community (ECSC) in 1952 and the European Economic Community (EEC) in 1957 with the Treaty of Rome. At this time Dutch milk production had become so large that ‘milk propaganda’ was invented to drive up consumption. The second large influence on the sector in NL and the EU at large was the Common Agricultural Policy (CAP). The CAP, an agricultural version of the ECSC, has as its goal to increase productivity with technology and labour. The two set-mark policies within the CAP are setting a price floor by buying European produce and placing tariffs on foreign food. Secondly, the more acres a farmer owns and toils, the more subsidies they receive. This resulted in favoured large farmers over smaller ones leading to the decrease of the amount over time and a powerful agribusiness. The EEC at this time could be seen as an agricultural community, in 1969 80% of the EEC budget went towards the CAP. This still had the desired effect of becoming food secure, exporting more in 1970 than it exported. The bloated subsidy budget however could not be sustained. Reforms in 1992 shifted the price sealing to direct payment to farmers to sell at global market prices. An effect of this was the decrease in global food prices due to overproduction, hampering agricultural development in the global south. A second reform during this time was the shift to more environmentally friendly ways of agriculture with subsidies for green production in 2003.

The last major shift in agricultural policy was the Lisbon Treaty of 2009 which gave the EU parliament more power over agricultural legislation. This led to further CAP reform in 2013 to promote greening, equal farmer support and diversifying crops. The policy of paying for land and output stayed the same, keeping the unevenness between small and large farmers in place. In 2016, 20% of farmers received 85% of subsidies.

Now the introduction of the European Green Deal to achieve Net-Zero by 2050 works alongside the CAP. These 2 policies however are not yet in line with each other, the CAP being the one that is lacking behind. The 25% of so-called eco-schemes built into the CAP budget however is promising.

1.4 DAIRY INDUSTRY FRAMEWORK

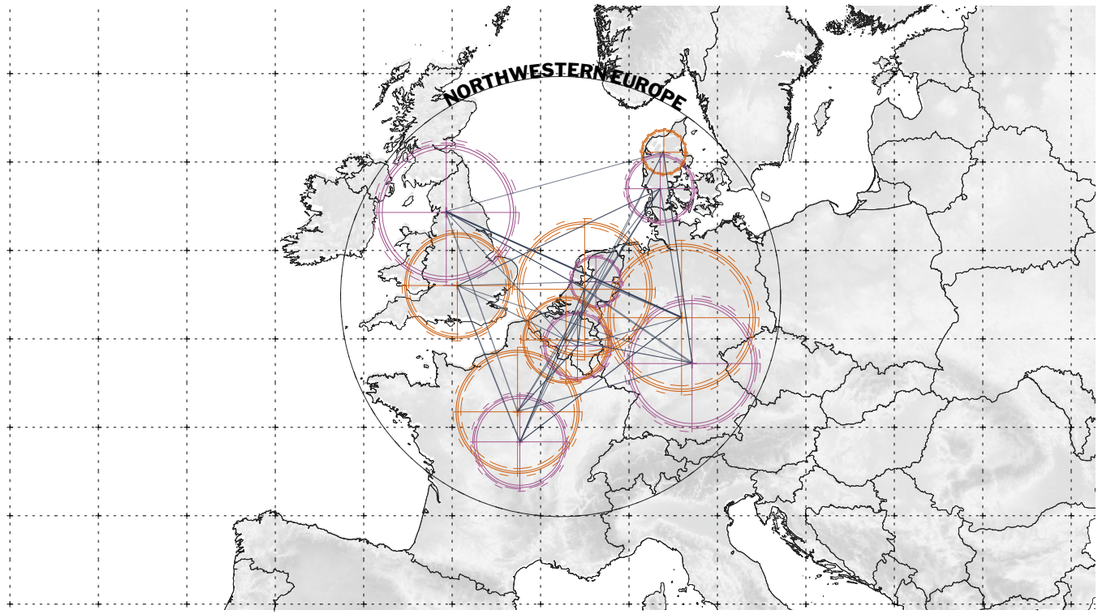


Fig. 3: NW Imports and Exports

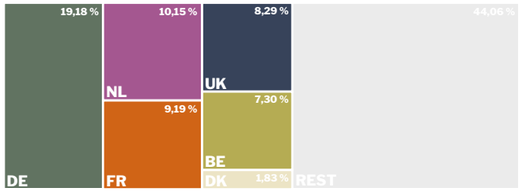


Fig. 4

IMPORTS

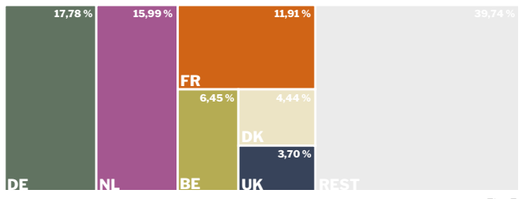
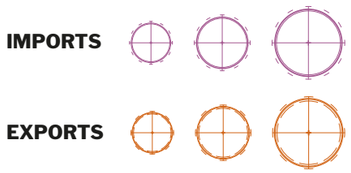


Fig. 5

EXPORTS

Imports and exports form an integral part of this problem. Currently, 1.59 million Dutch cows contribute to 13% of the world's milk production. The most bred cow breeds are the Holstein Friesian,



Meuse-Rhine-Ijssel, Holstein Crossbreds and Jersey Cows. The NW European dairy sector sees the strong cross-country import-export network of cheese. The largest dairy-processing company in the Netherlands is FrieslandCampina, which processed around 11.8 billion kilograms of milk in 2018. The company is the 6th largest dairy-processing company in the world, generating a turnover of EUR 11.55 billion in 2018 (FrieslandCampina, 2019a). The top ten largest dairy-processing industries in the world include five of them in NW Europe itself. Cheese, of course, being a regional product raises the demand for different flavours. The import-export network engenders major trade for NL between its European neighbours and the rest of the world exporting 4.12 billion dollars in 2020 accounting for 13% of global cheese export. Germany being its main trading partner takes the largest share of this, importing 17% of Dutch cheese. Within the Dutch agricultural sector, cheese is the second largest export product with 3.8% of the sum total. An average Dutch person consumes 35g of cheese every day of the week, it plays an important role in the daily diet and the heart.

The overall land the agricultural sector occupies in NW Europe is substantial. The animals that inhabit this space are responsible for 9% of all EU GHG emissions. The relation between pastureland and cropland is not evenly distributed. On opposite sides of the spectrum are the UK having the largest land mass dedicated to agriculture with 71% mainly for the herding of sheep (Gov. UK, 2022) and Denmark with 65% while being focused on cropland. In sheer numbers is Germany, being the largest EU country but maintaining their agricultural land below 50%.

In NL 53% of the land mass is agricultural but half of that is pasture land. One quarter of usable land area in the NL is used by pasturelands and is dedicated to the raising and feeding of animals. And it contributes to almost 6% of GHG emissions in the Dutch context. Of the total number of animals, 3.8 million are cows of which around half are dairy cows. The major polluting effect cows have is their CH4 production, being 38.9 kg CO2 eq. These cows are spread across over little less than 16000 dairy farms, an average number of 99 cows per farm. As will be discussed further in the stakeholder analysis, farmers are not a monolith. The average small Dutch farmer has 62 cows while a large one has 144 cows. An interesting historical trend has also peaked our attention that the sharp decline of dairy farms stands in contrast to the lower amount of cows overall while productivity has increased. Fig. 10 illustrates how the number of dairy farms has drastically reduced from 1960 until now but the density and productivity have increased over this period. The pasturelands as well as the factories generate GHG issues. In total, an amount of 1.48 kg CO2 eq is emitted per kg of Dutch milk delivered to the factory (Dolfing, 2017).

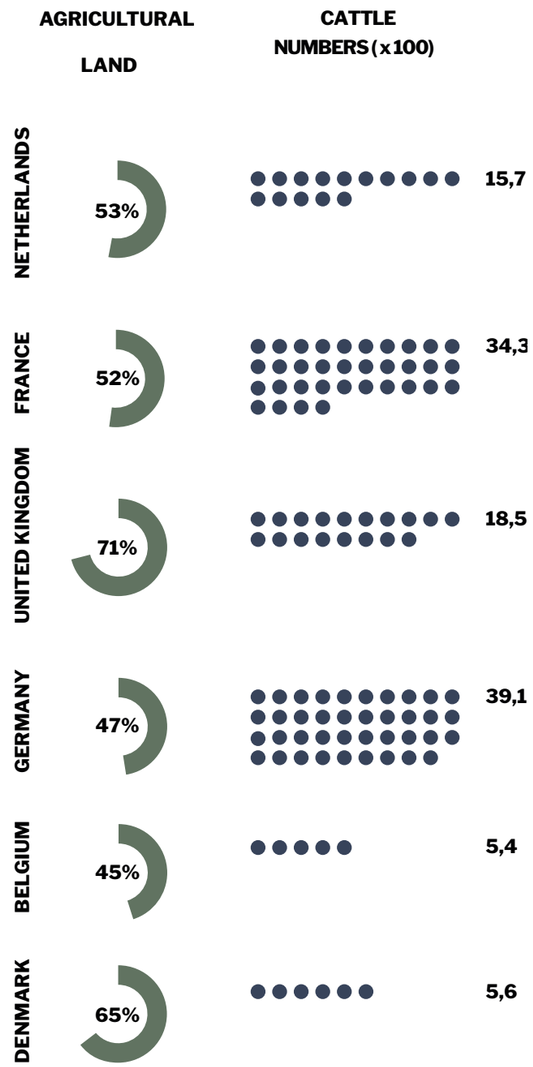


Fig. 6

1/4 LANDUSE IS PASTURES
1 569 000 COWS
15 872 DAIRY FARMS
6 % ALL GHG EMISSIONS
38.9 kg METHANE

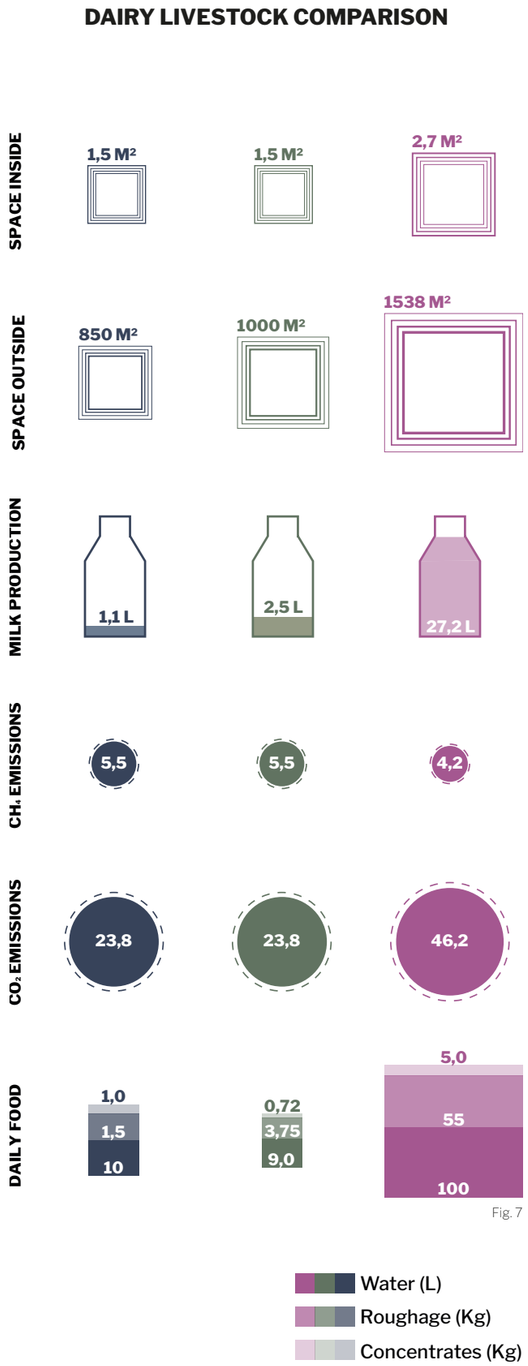


Fig. 7

Milk production is not limited to cows or cattle. Different milk-producing animals take up vastly different areas as seen in Fig. 7. This is also the case for the amount of food they eat, the milk they produce and GHG they emit. Sheep and goats take up the same space inside with 1.5m^2 while cows take up 2.7m^2, 80% higher. This difference becomes less outside for goats relative to cows at 50% more but stays the same for sheep. Cows stand head and shoulder above sheeps and goats in GHG emissions being around double of both individually. This can be seen as a trade-off for the higher amount of milk a cow produces compared to the others, giving between 300% for sheep and 100% for goats. The amount of food that is needed to feed these animals is not the same and again cows need way more water, roughage and concentrates per day than sheep or goats. For each 1 liter of cow milk, it needs around 2kg of roughage, while for goats this is 1.5kg and 1.3kg for sheep.

Lastly, the major issue is the concentration of these densities of cows on these pasturelands which leads to a higher amount of GHG emissions coming out of cluster farming practices. Fig. 9 shows a clear difference in which countries made cattle their main focus of the livestock sector. NL is at the top with 4 cows per hectare with Belgium close behind at 3. The low-lying western mainland European countries of Denmark, NL and Belgium are the cattle capital of Europe. The overall drive for higher efficiency and state subsidy support for large farms is clear from these facts and figures.

In NL, the province of Friesland has the highest concentration of livestock farms. This northern province along with central and eastern provinces has a huge number of livestock farms ranging from 1744-3000 farms (Maarten Schouten, Wim J. M. Heijman, 2012). Dairy cattle herds range from 0-700/km^2 with these provinces having about 200-700/km^2 dairy cattle herds (A.R.W.Elbers et al, 2012). From this, we believe the excessive consumption of this product would require a shift in mindset to enable a shift in this massive interconnected global system.

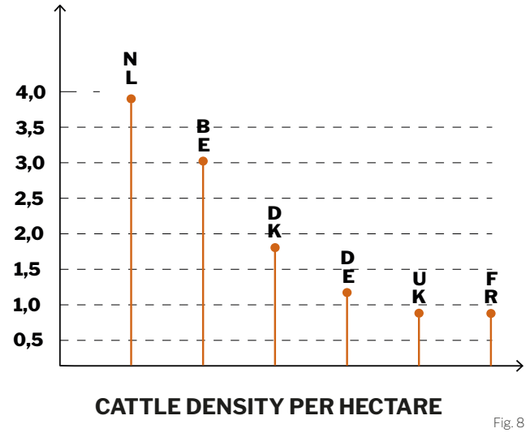


Fig. 8

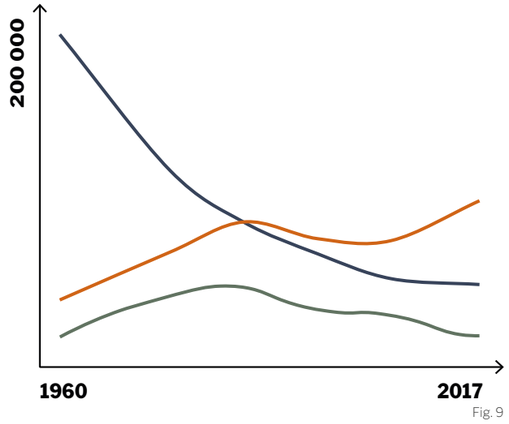


Fig. 9

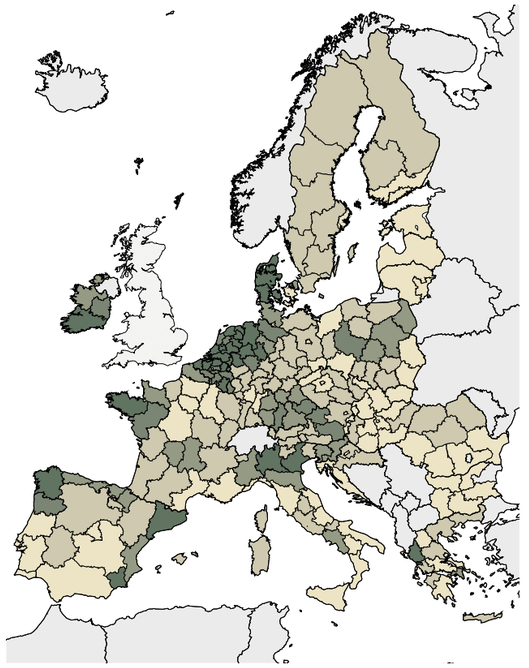


Fig. 10

1.5 PRODUCTION CHAIN

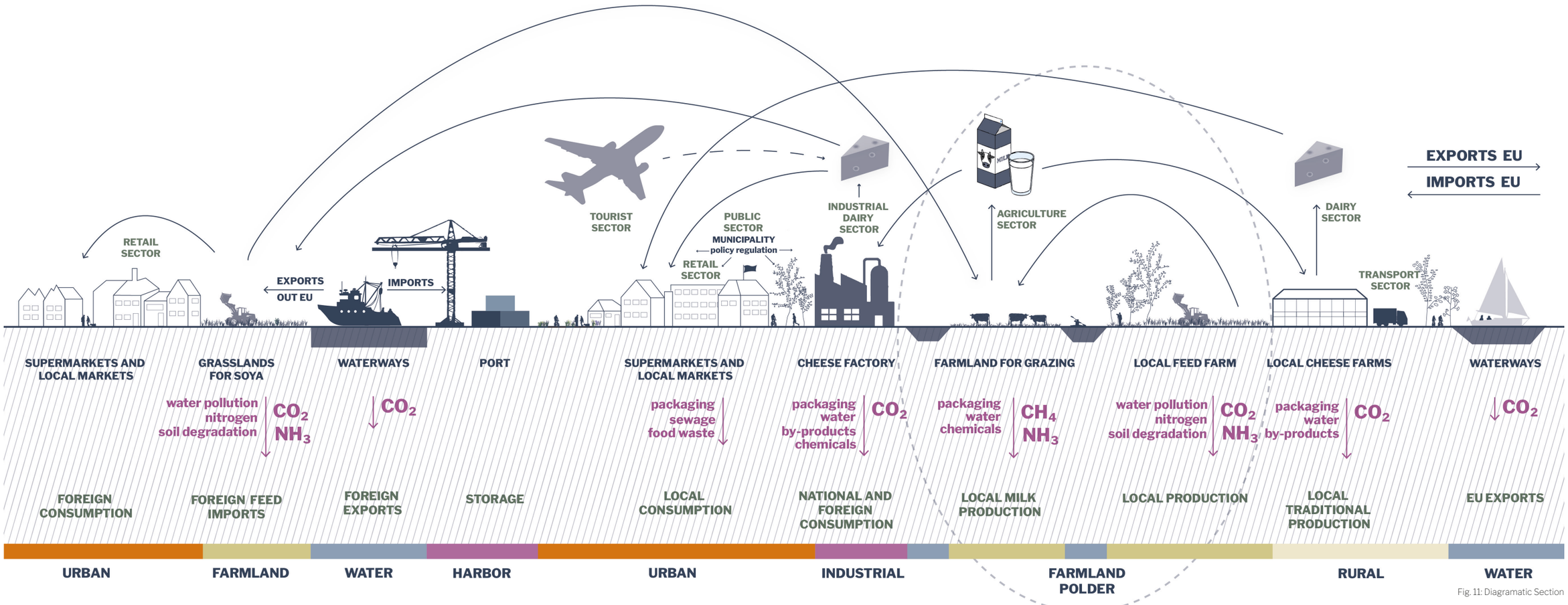
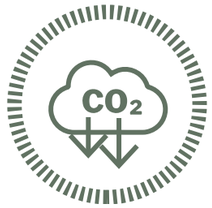


Fig. 11: Diagramatic Section

Placing the chosen commodity of cheese on the landscape at large was our first step to understanding its impact (GHG, resources, etc), relevant connections and reach. We conducted preliminary research into each aspect of the chain allowing us to decide on the direction we want to head in for our eventual strategy. The systematic chain of cheese in the middle is farmland for grazing and feed production (local and international) for cattle, milk production, cheese production (local cheese farms and industrial), local domestic distribution towards supermarkets and international (non-EU) exports. Within this system, CO2 and CH4 get emitted at various steps along the way along each land use of farmland, water, urban, rural and industrial. Specifically, in the farmland, extra N2 in the form of NH3 is emitted damaging local flora. On the regional scale, transportation emits the most GHG. The global scale should not be forgotten, especially foreign farmland being used to produce cattle feed such as soya in Brazil, causing deforestation. The cheese markets of Gouda, Edam and Alkmaar or the touristy cheese shops in Amsterdam are favoured by many from all over the world. It is clear that a commodity can touch on large interconnected global connections. This report heads towards the domestic and international commodity flows, tourist infrastructure and the effect on the urban, citizen spatial relations to production processes, etc. With each of these factors briefly analysed we decided to take up the largest spatial and ecological player out of this material flow process - the unending agricultural landscapes and scale of its livestock and dairy sector. The emissions aspect of the dairy industry is substantial due to deforestation to make pastures, manure management releasing CH4 and N2, enteric fermentation releasing 44% of the total methane output, deforestation for animal feed, transportation emissions and large energy consumption, to name a few. The ecological impact of fertilisers and pesticides on biodiversity and soil health is concerning. This determines the historical land value the organisation of pastureland has in the Netherlands and NW Europe.

1.6 ALIGNMENT OF GOALS

PROJECT SPECIFIC GOALS



ELIMINATING GREENHOUSE GASES

SOCIAL COHESION AND FOOD SECURITY

INCREASE REWILDING AND NATURAL SUPPORT SYSTEM

INCREASE IN SUSTAINABLE FARMING

Out of this preliminary overview, we have made clear that the spatial, environmental and socio-economic impact of the use of cows is a major part of European production, consumption, culture, emissions and spatial arrangement. This made it evident to us to outline our goals. To eliminate GHG to reach the EU Net-Zero target of 2050. Increase Rewilding, enabling the natural support systems of water and climate regulation, biodiversity, pollination, nutrient cycling, soil health, etc. These goals can only be realised with a strong social basis from the consumer population with social cohesion and food security and by the producers who will increase sustainable farming practices. Our goals are a response to the proclamations of the Social Development Goals of the UN and the Green Deal by the EU. We look up to the social SDGs of 2-Zero hunger, 3-Good Health and Wellbeing, 10-Reduced Inequalities and the EU's Farm to Fork in ensuring a just transition for all.
The environmental SDGs of 6-Clean Water and sanitation, 7-Affordable and Clean Energy and 13-Climate action and EU's preserving and restoring of ecosystems and biodiversity and zero pollution for a toxic-free environment.
The economy of 8-Decent Work and Economic Growth, 9-Industry, Innovation and Infrastructure and 12-Responsible Consumption and Production and the EU's industry mobilisation for a clean and circular economy.
To get more concrete in actions we also include the 10 key solutions of the recent IPCC report. Especially points 2, 6, 8, 9 and 10. The challenges of climate change and spatial planning can only be resolved by the union of the social, environmental and economic:
1. RETIRE coal plants.
2. INVEST in clean energy and efficiency.
3. RETROFIT and DECARBONIZE buildings.
4. DECARBONIZE cement, steel and plastics.
5. SHIFT to electric vehicles.
6. INCREASE public transport, biking and walking.
7. DECARBONIZE aviation and shipping.
8. HALT deforestation and RESTORE degraded lands.
9. REDUCE food loss and waste and IMPROVE agricultural practices.
10. EAT more plants and less meat.
(IPCC Report, World Resources Institute)
We propose viewing SDGs for the large-scale and longue duree goals as compared to the IPCC report which suggests goals at a smaller scale and can be achieved urgently. Especially, 8-HALT deforestation and RESTORE degraded lands and 9-REDUCE food loss and waste and IMPROVE agricultural practices which are included in our design visions.

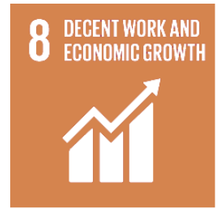
17 SUSTAINABLE DEVELOPMENT GOALS

- promote sustainable agriculture
- achieve food security
- improved nutrition
- soil quality improvement
- from mono- to multiculture food production

- eliminate antibiotics in food production
- higher quality of the natural environment

- precision agriculture to maximize productivity and minimizing the use of water
- reducing groundwater pollution

- Generate energy from manure
- Promote agricultural careers as aspirational
- Create a market for local farmers
- Pursue investments in agriculture and agricultural markets, including storage and logistics



- Promote agricultural careers as aspirational

- Pursue investments in agriculture and agricultural markets, including storage and logistics

- Adapt business strategy to make products more affordable for consumers on low incomes

- Food production near and within urban areas

- Increase energy efficiency within the value chain
- Reduce water consumption

- Mitigating greenhouse gas emissions
- Support farmers for the development of climate resilient agriculture

EUROPEAN GREEN DEAL

Industry mobilization for a clean and circular economy

'Farm to fork': designing a fair, healthy and environmentally friendly food system

Preserving and restoring ecosystems and biodiversity

Ensuring a Just Transition to all

A zero pollution ambition for a toxic-free environment

Biokaas farm Kinderdijk, Alblasserdam

2. METHODOLOGY

2.1 RESEARCH QUESTION

HOW CAN WE REDUCE GREENHOUSE GASES

THROUGH A SPATIO-TEMPORAL APPROACH FOR

DAIRY PRODUCTION IN NW EUROPE?

RE-DEFINING

What is the spatial/environmental impact of the dairy sector?

What is the commodity flow and supply chain of cheese?

How much cows need to be reduced?

How much cheese consumption is sustainable?

BLURRED FRONTIERS

What are sustainable land use functions?

How can we build codependent relationships between land uses?

GOVERNANCE

How do policies affect the role of the NL dairy sector and (agricultural) land use?

How does change in policy making influence land reform?

SPATIAL CONFIGURATION

What are the major agricultural/pasturelands in NW Europe?

What are the land typologies adjacent to agricultural land?

SOCIO-SPATIAL JUSTICE

What are the social conditions of rural areas?

How should farmers be organised in regenerative farming systems?

How does shift in mindsets contribute to social justice?

TEMPORALITIES

What is the importance of seasonal farming?

How do land use changes occur over time?

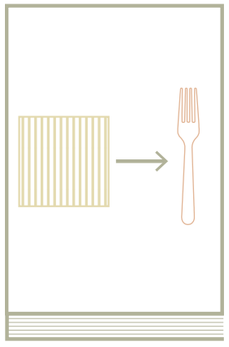
ENVIRONMENTAL AND TRANSITION

How can soil health and climate change play a positive role in this process?

2.2 THEORETICAL FRAMEWORK

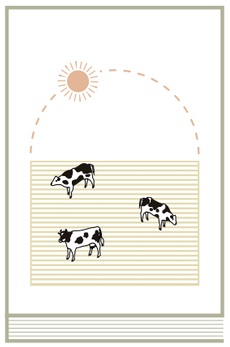
“REGENERATIVE AGRICULTURE IN EUROPE”. (2022). EASAC - Science Advice for the Benefit of Europe.

“The TYFA Project explored the possibility of of generalising agroecology at the european level by analysing the uses and requirements of agricultural reduction, both now and in the future”



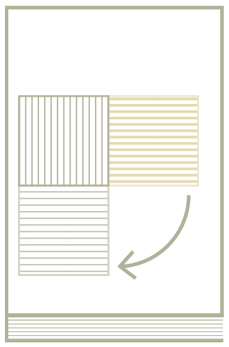
“FROM FARM TO FORK” in EU Green Deal (2019) European Commission

“The Farm to Fork Strategy is at the heart of the Green Deal. It addresses comprehensively the challenges of sustainable food systems and recognises the inextricable links between healthy people, healthy societies and a healthy planet” P.4



“CLIMATE-SENSIBLE DAIRY SECTOR IN THE NETHERLANDS” (2018). Dutch Federation of Agriculture and Horticolture

“This action plan describes how the dairy sector wants to actualise its contribution to this mission in coo peration with governments, chain parties, retail, trade and industry, and social organisations.” P.2



“USING ECO-SCHEMES IN THE NEW CAP” (2020). IFOAM EU, FIBL and IEEP.

“This guide has been developed primarily for policy makers and Member State officials involved in the national and regional programming processes of the Common Agricultural Policy Strategic Plans” P.9

Having performed the preliminary analysis to become familiar with the subject matter made the general variables for this project clear. The environmental and spatial impact of the commodity flow of cheese made us consider technical solutions. Moving away from an initial theory approach, we chose a material flow analysis which later informed us of theories related to this subject of matter. The historic to contemporary influence of policy created a longue durée perspective of the place our research would take place in. Lastly, the choice to take cheese as the starting point made the research take on an ontological character in how we related to the objects we analysed and designed. To back up the initial visions of the findings, the following theoretical framework helped us ground ourselves.

Regenerative agriculture in Europe:
This report highlights the need for urgent action to reduce greenhouse gas emissions from agriculture. The report analyses the potential synergies and trade-offs that may occur when implementing regenerative agriculture practices to meet the goals and targets of both Farm to Fork and Biodiversity Strategies. The report provides evidence-based policy recommendations for meeting Green Deal targets and highlights practices that show synergies between carbon capture and storage and enhancing biodiversity. Among the agricultural practices suggested are: increased diversification within and among crops, introduction of permanent and perennial crops, and keeping cover crops on all available farm fields during all seasons.

Climate-sensible dairy sector in the Netherlands:
The second report outlines the views of the dairy sector of NL. To have a perception of the ways the industry sees itself moving forward towards a sustainable agricultural system is illuminating as a baseline for our research, placing our research in relation to the actual goals of the sector. The report argues the need for self-supporting farms with local cycles, sufficient grazing space and a decrease in importing animal feed. Just as with agroecology, this gave the project a starting point to develop ideas and concepts which go further. The nature of the private sector however is one of reluctant change. To only rely on them would not be enough for a just and shift transition.

Farm to Fork:
Having stated the governance and policy nature of the agricultural sector in Chapter 1, it was evident to see the stance and goals of the different municipal, provincial, national and transnational institutions. This we found in the policy outline of the Farm to Fork strategy.
Its goals are:

- Ensuring sustainable food production
- Ensuring food security
- Simulating sustainable food processing, wholesale, retail, hospitality and food service practices
- Sustainable consumption and healthy diets
- Reducing food waste
- Combating food fraud
- Supporting these efforts are the initiatives for research, innovation and knowledge sharing to become a global agricultural pioneer.

This policy document advises being worked into CAP. policy but does not specify how. Only it must be done by the Eco-Scheme budget of the CAP.

Using Eco-Schemes in the new CAP:
Implementing our initial interventions should fit into an already existing governance and subsidy framework. This report outlines the potential to guide development for policy makers involved in regional programming processes for the CAP strategic plans. The budget of the CAP between 2021-27 is €386.6 billion (CAP Funds). Writing our vision in accordance with eco-schemes requirements allows our interventions to be taken seriously from a governance perspective.

2.3 CONCEPTUAL FRAMEWORK

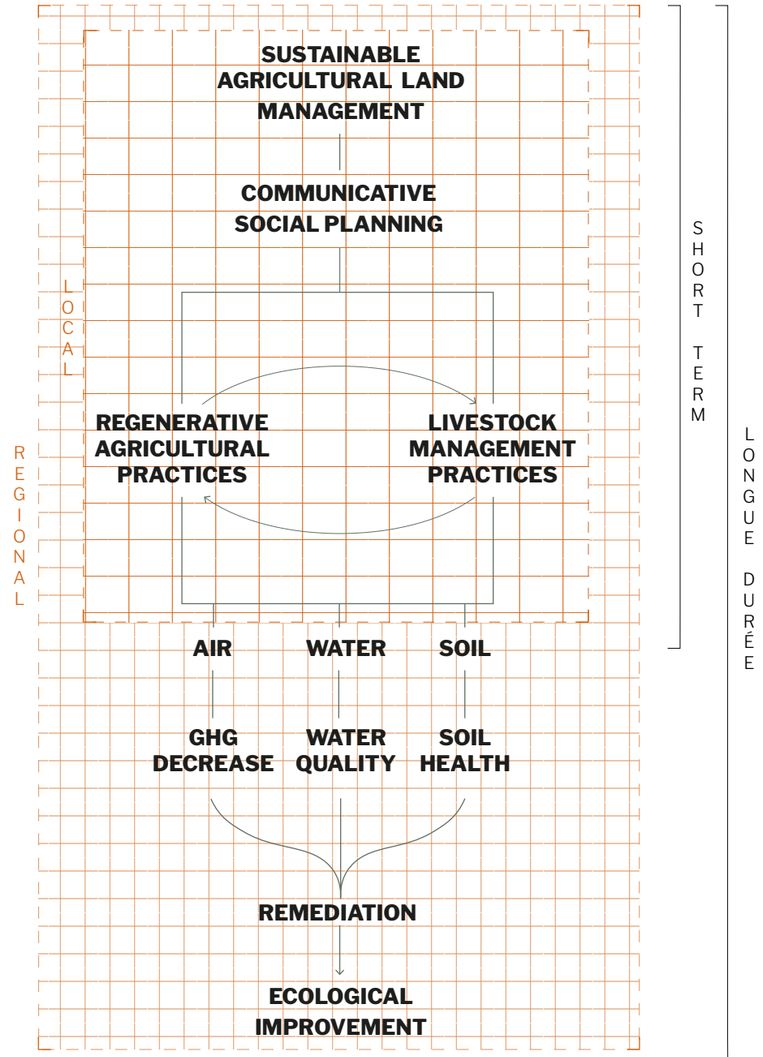


Fig. 12

To answer our research question, the development of a theoretical framework is pivotal. The development of this framework is based on the 4 main goals of our project. GHG decrease, rewilding, sustainable farming and social cohesion + food security. Our framework is divided in a spatial and a temporal dimension.

The conceptual framework outlines the structure of our report. Our ultimate goal on the longue durée is to achieve ecological improvement of the air, water and soil. As argued in the theoretical framework, the implementation of the environmental and technological can only succeed with community and farmer support. An interview with a farmer will be held to apply community planning from which we can receive feedback and reflection on our vision. On the local scale the vision for regenerative agricultural practices and livestock management system will be developed. The interactiveness between these 2 elements are that they reinforce each other, one benefiting the other. The result of these practices are the remediation of air, by reducing GHG, improving water quality and soil health. This remediation will occur on a regional scale if implemented broadly enough. A continued effort of these the proposed practices results in ecological improvement over the longue Durée

2.4 METHODOLOGY

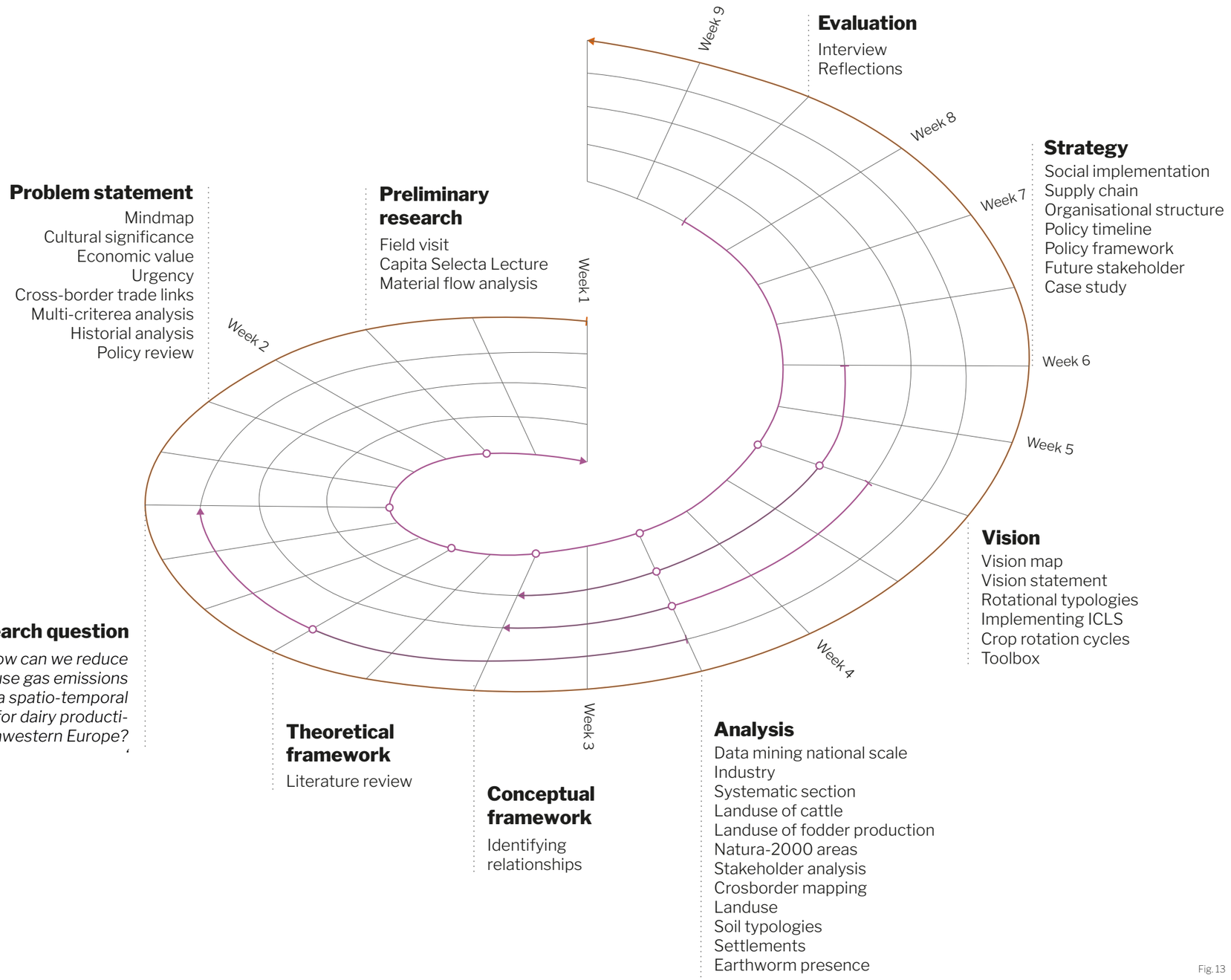


Fig. 13

Our process consists of nine phases, each with its own focus and applied research methods. As mentioned earlier, our initial process started with the material flow analysis of cheese. This divergent research led to a problem statement where the environmental impact of cheese stood central.

The problem statement is a large amount of pollution and land using cows in NL and NW Europe. NL consists of a quarter of land mass. This has caused a myriad of crises - ammonia pollution, soil degradation and animal cruelty. An explorative search for all the aspects related to this impact followed. Milk production was found to have both the greatest spatial and environmental impact, leading to the research question 'How can we reduce greenhouse gas emissions through a spatio-temporal approach for dairy production in NorthWestern Europe?'. A theoretical and conceptual framework as explained in the following pages formed the starting point for our analysis, which involved several research methods. Reviewing the literature, finding available QGIS datasets for collected geographical and statistical data of NL and NW Europe and then combining these maps led us to a synthesis map and vision map. The synthesis map is a collection of all the analysis maps helping us frame the larger scenario and overlapping data for a multi-layered approach to intervention. From here, we returned to the analysis phase to look specifically for possible elaborations of our vision which resulted in the vision map. The vision map helps us figure out the relationships between different landscapes and land uses in this region. The relationships were complementary and different in urbanised and non-urbanized areas. These then led to the proposed functions for these sites which led us to the rotational typologies, ICLS catalogue and toolbox. With the feedback from our midterm presentation, we continued working on our strategy, focussing on the social implementation, spatial justice and consequences of the design. A case study is used to explain the concept and demonstrate feasibility. Finally, we conducted an interview with a farmer not acquainted with our process but vision, to check practicalities and missing links and get honest opinions.

Biokaas farm Kinderdijk, Alblasserdam

3. ANALYSIS

3.1 STAKEHOLDERS ANALYSIS

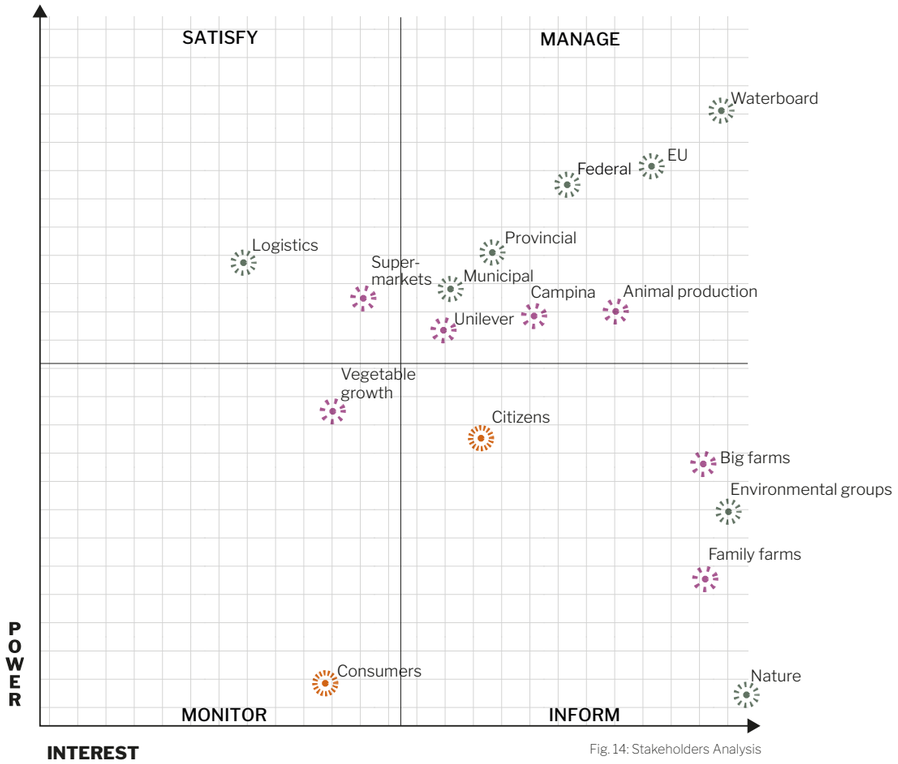


Fig. 14: Stakeholders Analysis

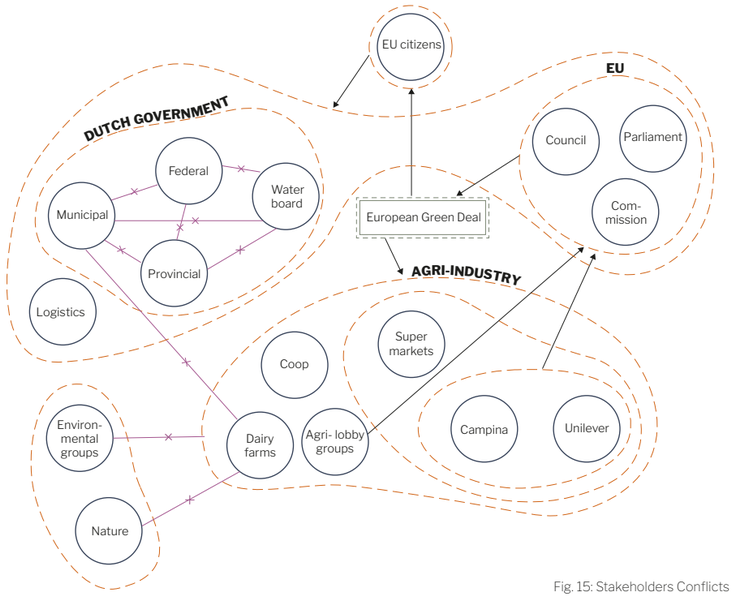
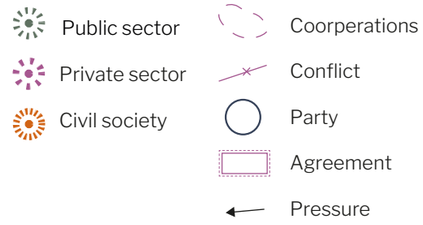


Fig. 15: Stakeholders Conflicts

The Stakeholder's Analysis holds within our values but also considers the world as is within the current system. For our project to alter the way agriculture functions will bring out major conflicts between the different levels of governance and industry. These conflicts will only heighten due to the ongoing climate crisis.

The stakeholders are divided into 3 groups with subgroups within those. The public sector includes different governmental hierarchies. On the NW European scale, these are the EU at the top with its many agencies under the EU Commission (EC) and the Parliament (EP) with its committees. Due to the legislative role the EU plays the various national governments still have considerable sovereignty but are subservient to EU laws being proposed by the EU Commission and approved/rejected by the European Council (also known as the Council of Ministers) (EUCO). The national governments make policies at their own discretion, which will be explored in depth later. For the national government scale, we chose to analyse the Dutch government, due to the focus area. These government structures function generally the same way with power varying between the government hierarchies of federal, provincial and municipal. The federal level consists of the executive ministries, related to agriculture and public environment are the Ministry of Agriculture (LNV), the Ministry of Infrastructure and Water Management (Rijkswaterstaat) (IenW) and the Ministry of the Interior and Kingdom Relations (BZK). These ministries apply the laws passed by the Dutch parliament and the ministry then works at the provincial and municipal levels. The federal government has final judgement over the policies of the provincial and municipal levels. In the Dutch context are also the waterboards (waterschappen). Their tasks are the maintenance of dikes, managing the water level, wastewater treatment, water quality and nature management. The last governmental level, partly overlapping with the private sector, is logistics.



The public sector is the main spatial occupant of our report's focus. The main ones are the pasture and non-arable land, covering 54% (CBS, 2020) of NL. To perceive the agricultural sector as a monolith would be reductive. The trend of the last 7 decades of higher productivity on fewer larger farms at the cost of small farms that get bought out because they cannot compete anymore. This difference in income levels is extreme, 1/5 of Dutch millionaires work in agribusiness while 36% of Dutch farmers income is below the statutory minimum wage. The Dutch market leader in the dairy sector is FrieslandCampina, processing 69% of milk produced in NL (CBS, 2022). This de facto monopoly in the Dutch dairy sector shows the discrepancies within the overall agricultural sector. Supermarkets also play an oppressive role in negotiations with farmers. For the striking example of milk is where the farmer has a -2% net margin while the supermarket makes an 8% net margin. For bio-milk, this is -9% and for the supermarket 0%. Lastly, the company Unilever has a Dutch market share of 53% (Veb,net, 2020) and a global market share between 40-50% (Food Navigator, 2023).

The last group is a civil society with a dual role of consumer and citizen. These groups are split since not every citizen participates as a consumer in each market. The more important distinction is how they are perceived by the public and private sectors. The private view a person as a consumer, performing the role of the buyer, exchanging the universal commodity money, for a perishable consumable commodity, food. The state ideally sees a person as a citizen, to be engaged with and serve. In both cases, however, the person has little influence over the process.

3.2 DUTCH CONTEXT ANALYSIS

Fig. 16

Fig. 17

Fig.18 0 10 50 Km

CROPS PRODUCTION

- Horticultural production for food
- Crop production of roughage

SOIL FERTILITY

- Agricultural areas - Fertile soil
- Agricultural areas - Less fertile soil
- Natural areas - Fertile soil
- Natural areas - Less fertile soil
- Other - Construction and other areas

NATURAL AREAS

- < 10 % Trees cover
- 100
- Natura 2000 Areas
- Natura 2000 Sea
- Rivers

CROP PRODUCTION SPACE

As discussed before in the historical contextulisation section. NL and the rest of the EU scaled up their agricultural production over the last 7 decades with fewer but larger farms. Where NL switched to the system of cluster farming for efficiency in economic and logistical systems. They went a step further by strictly separating farming practices into these clusters of horticultural produce and crop roughage production for livestock grazing. The peat soil lands of South Holland and Friesland mainly dedicated to crop roughage production (pasturelands) while the provinces of Zeeland, Brabant and Flevoland went predominantly towards the production of crops for humans (horticulture).

SOIL FERTILITY MAP OF THE NETHERLANDS

NL, being a delta region, of course, has plenty of fertile soil. Almost all the areas which are in the fertile soil agricultural areas category have been under water for long periodic amounts of time throughout history. This was due to flooding from both directions - the sea and the rivers. These floodplains would create wetlands where large amounts of flora can grow, building up slowly in the soil for hundreds of years. In some places, it is becoming so dense that it is not considered soil at all but peat. Peat soil is deposited on the banks of these water bodies making it suitable for crop growth. There are vast fertile soils available in the provinces in the NL making it suitable for current agricultural practices.

NATURAL AREAS (NATURA 2000)

The one place NL is sorely lacking in its biodiversity health is limited nature. Being a highly urbanised country throughout its history has taken its toll on the pre-human natural condition. Even though biodiversity exists in the fertile soil, above-ground biodiversity is limited. Former wetlands and floodplains have been diked in due to the water defense systems. Old-growth forests have been chopped down. The only natural area left relatively wild throughout history is the North Sea around the Wadden Islands.

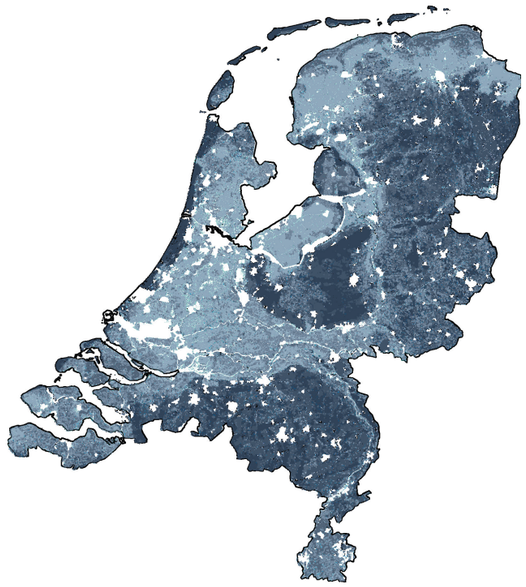


Fig. 19

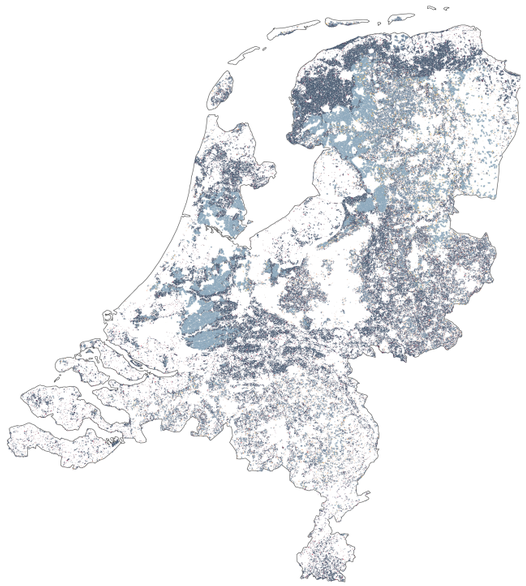
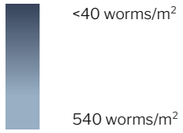


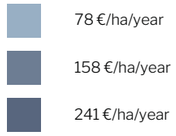
Fig. 20

Fig. 21 0 10 50 Km

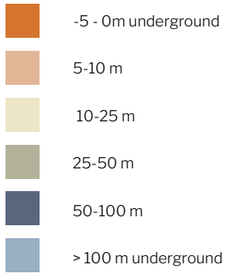
EARTHWORMS TAXONOMY



LAND WITH SUBSIDIES



SURFACE WATER SALINATION



EARTHWORMS TAXONOMY

Earthworms belong to the giants of soil life, the so-called macrofauna. In the Netherlands about 25 species are known, but most of them are rarely observed. (European Commission, 2018) To back up the evidence of the soil fertility map, earthworms turned out to be a good indicator of healthy soil. Mostly existing in the low-lying former underwater areas of NL of Zeeland, North and South Holland, Flevoland and Friesland. The number of worms in the ground makes it airy and very suitable for crop and roughage growth.

LAND WITH SUBSIDIES

As stated in the history and policy contextualization section of this report, agriculture is a large recipient of subsidies. Farmers and farming methods depend mainly on these subsidies. This map shows the value of the land to produce grass without subsidies €/HA/year. It is important to note that land that is designated as pastureland in regions with a high level of soil subsidence has the lowest value out of any agricultural land. Subsidies are regulated by governmental bodies based on soil subsidence, accessibilities and other geographical criteria.

SURFACE WATER SALINATION

The increase in salt levels of surface and groundwater is increasingly becoming a problem for coastal regions. This problem is even greater at the end of river deltas with rising sea levels and decreased river flow resulting in brackish water infiltrating further inland. Surface water salination has been a persistent problem in NL making it a long-duree strategy point of intervention.

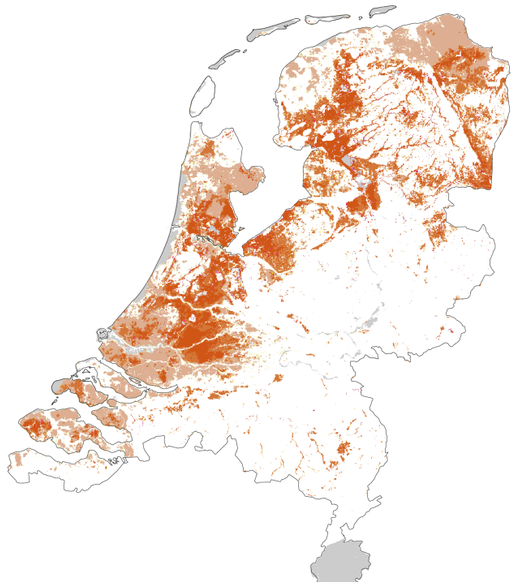


Fig. 22

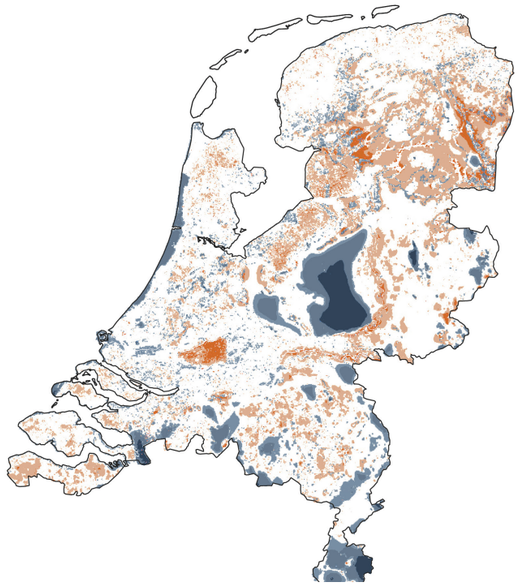


Fig. 23

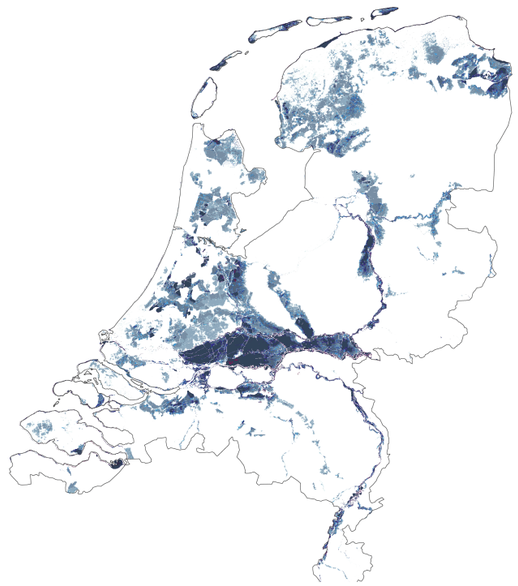


Fig. 24

FLOOD RISKS HIGH-MEDIUM PROBABILITY

The last analysis map shows the risk of floods, a serious concern for NL of which 26% lies below sea level (IPCC, 2007), the percentage of this below-sea level area will increase with the constant threat of rising sea levels and climate change. The spaces directly neighbouring below-sea-level areas are also at risk, with that category it extends to 55% which is at the risk of flooding. Also along rivers in the South and East of NL, well above sea level, floods may occur due to excessive rainfall.

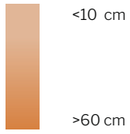
LOWEST GROUNDWATER LEVEL 2100

The groundwater table in NL sees a lot of regional variation in changes in water level over the course of this century. Sandy and silty based soils tend to decrease in groundwater level while peat and clay soils increase. Additional factors are the amount of rainfall, river flow and
water management of the specific areas.

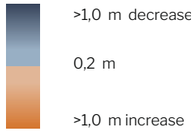
SUBSIDENCE 2100

These 3 maps show the relation of water with the soil. The subsidence of land by 2100 is worrisome and in need of urgent action for the West and North of NL. Subsidence is the process of sinking land due to low groundwater levels, drought and resource extraction. It is important to maintain healthy soil to mitigate this risk and the current threat of soil subsidence. All these reasons are based on soil type, peat soil being the most sensitive to the salinisation process.

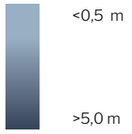
SUBSIDENCE 2100



LOWEST GROUNDWATER LEVEL 2100



FLOOD RISKS HIGH-MEDIUM PROBABILITY



3.3 NORTHWESTERN EUROPEAN ANALYSIS

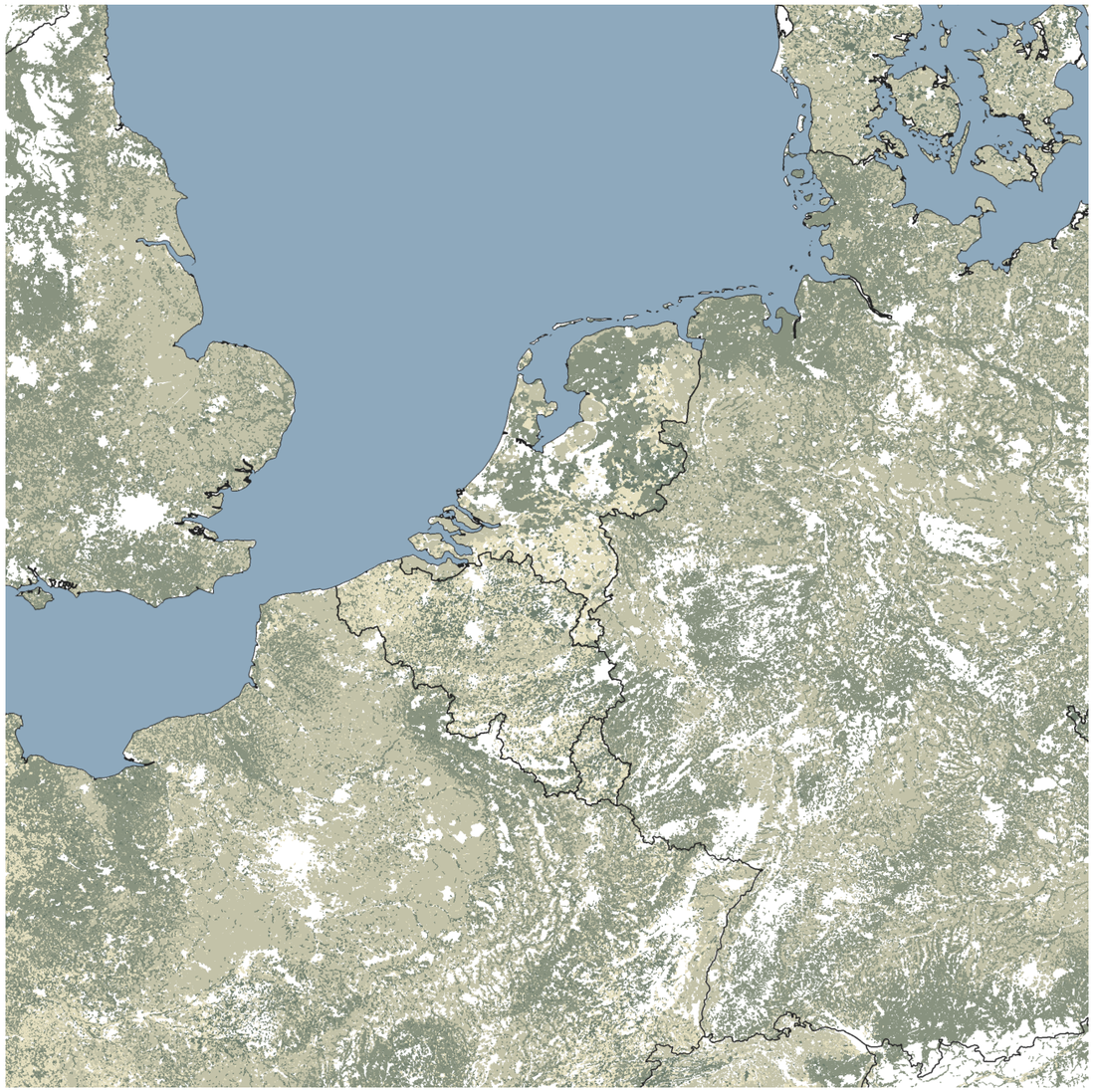


Fig. 25 0 175 250 Km

LAND USE

- Complex cultivation patterns
- Non irrigated atable land
- Pastures, meadows and other grasslands
- Land Principally used for agriculture

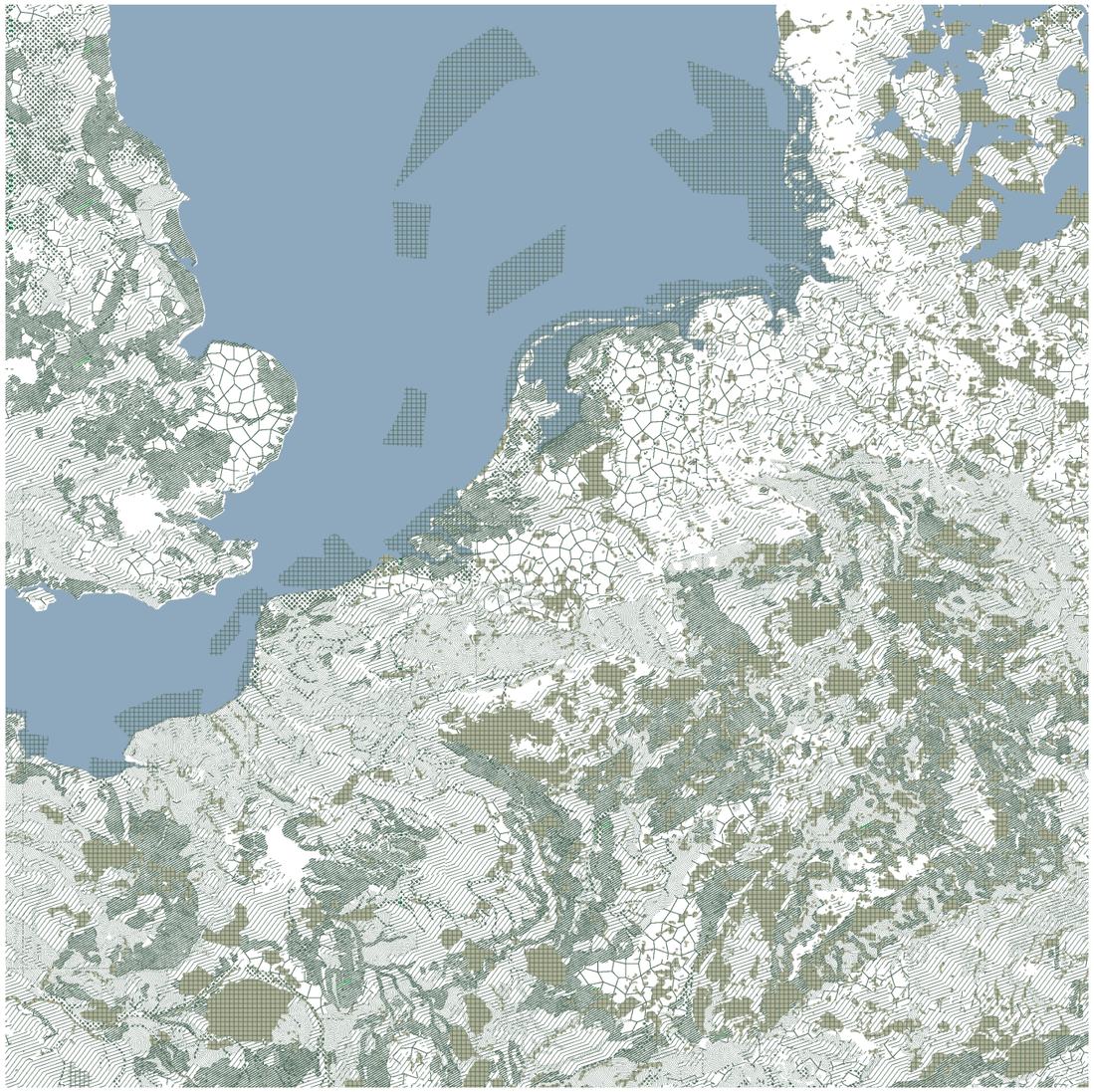


Fig. 26 0 175 250 Km

SOIL TYPOLOGY

- Coarse soil - Sandy loam
- Medium soil - Sandy clay loam
- Medium fine soil - Silty clay loam
- Fine soil - Clay loam
- Very fine soil - Clay
- Peat soil - No mineral teyture
- Peat soil - No mineral teyture
- Natura 2000 Areas

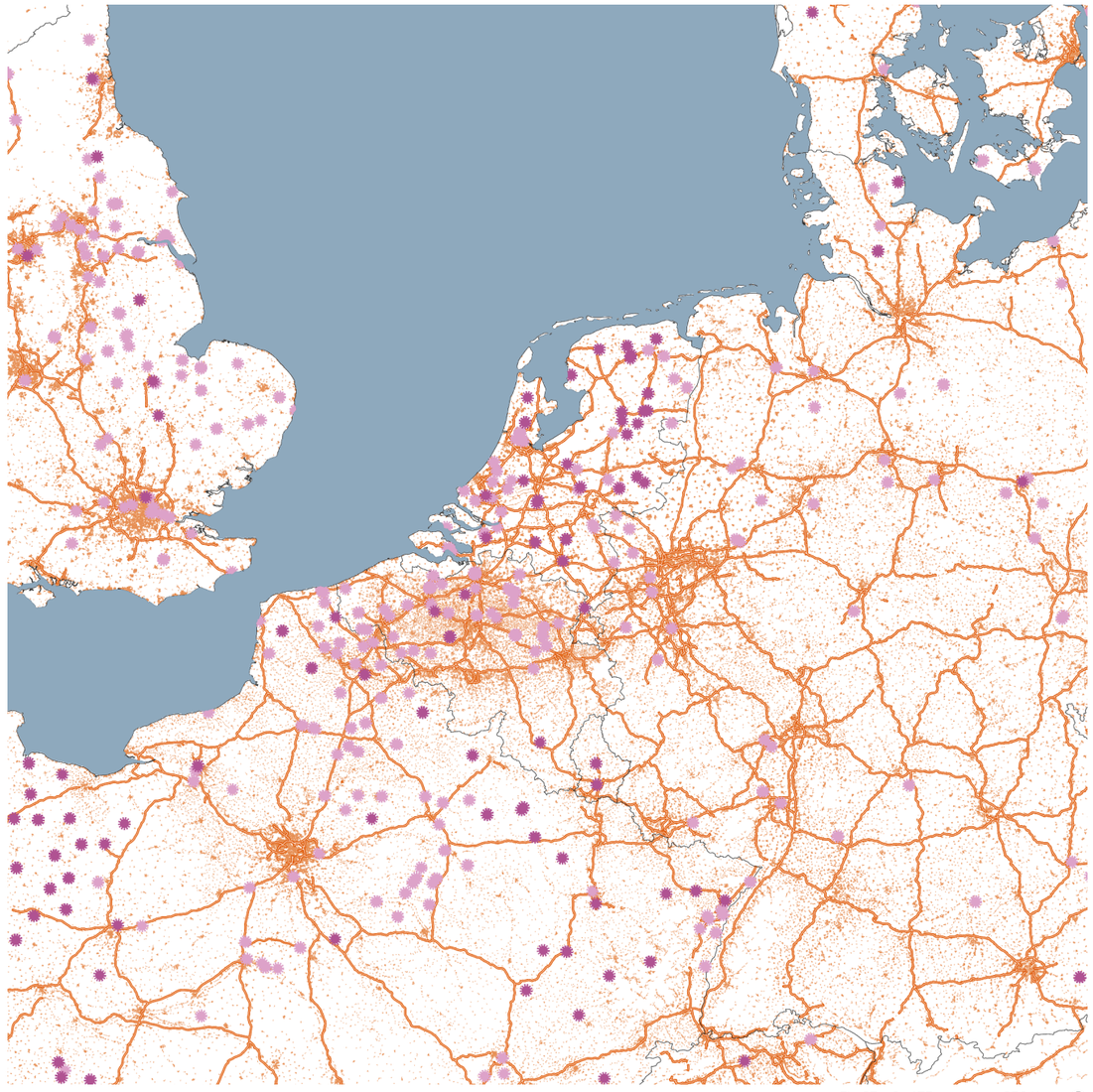


Fig. 27 0 175 250 Km

INFRASTRUCTURE AND INDUSTRY

Slaughterhouses, milk, animal and vegetable raw materials

Treatment and processing of milk

Infrastructure

Urbanised Areas

AGRICULTURAL LAND USE OF NORTHWESTERN EUROPE

Our analysis uses agricultural land in 4 categories. From biggest to smallest area size are:

Non-irrigated arable land: Cultivated land parcels under rainfed agricultural use for annually harvested non-permanent crops, normally under a crop rotation system, including fallow lands within such crop rotation. Fields with sporadic sprinkler irrigation with non-permanent devices to support dominant rainfed cultivation are included.

Pastures, meadows and other grasslands: Permanent grassland characterized by agricultural use or strong human disturbance. Floral composition is dominated by graminacea and influenced by human activity. Typically used for grazing pastures or mechanical harvesting of grass–meadows.

Complex cultivation patterns: Mosaic of small, cultivated land parcels with different cultivation types -annual crops, pasture and/or permanent crops-, eventually with scattered houses or gardens.

Land principally used for agriculture: Areas principally occupied by agriculture, interspersed with significant natural or semi-natural areas (including forests, shrubs, wetlands, water bodies, mineral outcrops) in a mosaic pattern.

(Based on the dataset from Copernicus EU, Corine Land Cover)

Although this map leaves out the urban and forestry sections.

SOIL TEXTURES

This is an analysed map of the soil typologies present in Europe based on soil texture which is the percentile makeup of sand, clay and silt that make up the mineral fraction of the soil. We have further explored this based on the USDA Soil Texture Triangle. In addition to this is the peat soil type which consists of mostly decomposed organic matter. The last part of this map shows the Natura 2000 areas. These are mostly located in areas unfit for human occupation, agriculture or production such as hill regions, swamps, infertile land and non-fossil fuel deposits.

INFRASTRUCTURE AND INDUSTRIES

Europe, being the most connected and urbanised continent with respect to its land mass, has been affected and changed in nearly every corner. All old-growth forests have disappeared by human hands from our frame of analysis. Only some North Sea areas can be considered untouched, but only due to the difficulty with its geography. Within this space, one of the highest productive regions on the globe resides. Also called the ‘Blue Banana’ along the Rhine to the mouth of the Dutch/Belgium delta across the North Sea toward England, home to over 100 million people. The processing of animal products such as milk and animal meat in slaughterhouses itself happens within this region except for the French region. We have included the industries necessary for our task of analysing our vision.

These maps altogether help in putting together the synthesis map of the problem at hand.

3.4 SYNTHESIS ANALYSIS

Fig. 28

This is the synthesis map, the combination of all the former analyses drawn. The combination of these maps gives us a hold on to the areas and their functions. The body of water allows the NW European production to reach a global scale through imports-exports. The Rotterdam Harbour is the most important link in this chain, transhipping 467,4 million tonnes in 2022 (Port of Rotterdam, 2021) making it the largest automated harbour in Europe and the gate towards German imports and exports. The land infrastructure and its good connectivity result in an efficient trade network on land. Stepping onto land, the soil make-up of NW Europe can essentially be seen in levels of fertile land and now established soil textures. The fertile land of mostly loam soils with a combination of clay, sand and silt is dedicated to crop agriculture, the less fertile land to pastureland and the least fertile or inhospitable land towards nature or Natura 2000 areas. Most important for our vision, designated pasture lands to dairy is home to the most milk processing facilities. Where there are more slaughterhouses, the pastureland is more dedicated to the production of meat. The clustered urban areas are dominant in the (relative) low-lying areas of The Netherlands and Belgium, extending towards the Ruhr region in Germany along the Rhine. We decided to separate clustered urban regions and concentrated monocentric structured cities based on the level of incorporation and fusion modes of development on the one hand and centrifugal modes of development (lecture by Cardoso on 27/02/2023). Besides these concentrations exist the largest dairy industries in the world, 5 of which are in NW Europe. Arla Foods on number 7 in Denmark, FrieslandCampina on number 5 in Northern NL, Danone on number 3 in Paris, Lactalis on number 2 in NW France and Nestle being number 1 in Switzerland. Not all their production happens in these places, but their headquarters or foundations and a portion of primary production do. Lastly, the locations of the Natura 2000 are scattered over the region. Because countries have the sovereignty to decide their location, they show different farming decision patterns by country. Germany and Belgium have many small and scattered patches while NL and France have few but large ones. Clustered farming versus diffused farming patterns are prevalent. The relationships between these urbanised areas and agricultural land parcels are now clear.

3.5 VISION STATEMENT

Fig. 29: Future Scenario Collage

TRAJECTING TERRITORIES ENVISIONS FUTURE AGRICULTURAL PRACTICES BEYOND CLUSTER FARMING: OPENING UP PASTURELAND ALLOWS FOR A SPATIAL RECONFIGURATION BASED ON SYNERGY OF ECOLOGICAL SYSTEMS.

Biokaas farm Kinderdijk, Alblasserdam

4. VISION

4.1 VISION MAP

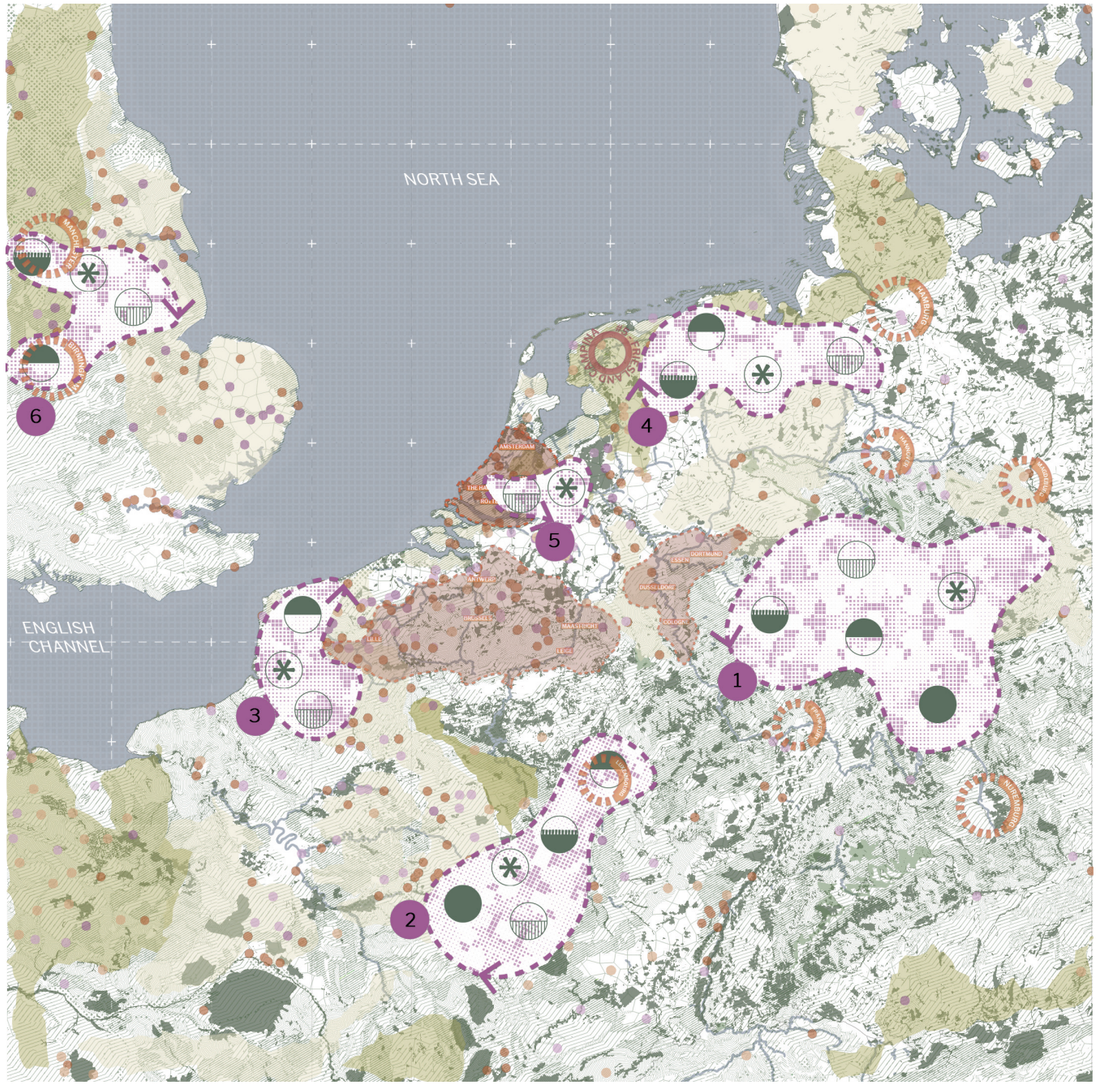


Fig. 30 0 10 200 Km

The synthesis map helped in understanding the relationship between urbanised areas and agricultural land - delimitation of possible clusters with different relations to urbanised areas. As part of our regional vision, we propose six areas of interest to analyse these sites at length. These clustered areas are designated to be new areas for our design strategy. These areas would have the following functions - crops for humans, crops for cattle fodder, grazing for cattle, rewilding and biomass energy production as mentioned in the legend. These are important functions we aim to cater to with our design proposal.

Cluster 1: The Ruhr to Leipzig urbanised cluster is the largest of the areas, only including one large city, Kassel. This area is defined by forestry and natural areas. Within this forested area are many pasture lands. Rheinland-Pfalz, Hessen, Thüringen, Sachsen, Baden-Württemberg and Bayern.
Cluster 2: The second area of interest which is in Luxemburg and the French provinces of Grand Est and Bourgogne-France-Comté is, relative to the others, the most inhospitable. This region is home to the Ardenne mountain range stretching from Eastern Belgium down into Luxembourg and Eastern France. Its mountainous character makes it most suitable for forestry. The slope of the hills determines where non-arable agriculture can take place. Pastureland is situated along the multitude of rivers and streams of the region.

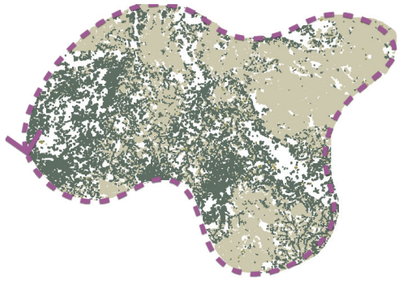
Cluster 3: In the French province of Hauts de France and Belgium West Flanders is characteristic of how close agricultural production happens to the shoreline. Overall, the province is focused on non-irrigated arable land with pockets of pastureland dotted over the core of the landscape, especially on the French side. The relation to the urban regions of Belgium is noteworthy. Where almost all of Belgium is urbanised, the West-Flanders province has been kept free of it for now.

Cluster 4: The fourth area of the provinces of Friesland, Overijssel, Groningen and Drenthe in The Netherlands and the Bundesleanden of Bremen and Niedersachsen in Germany is the second most heavily used pasture lands in NW Europe of the areas of interest. The region is divided along the border of NL and Germany with a belt of non-irrigated arable land. The pastureland in NL is almost entirely dedicated to pastureland for dairy production while the German side has a balance of dairy and poultry.
Cluster 5: The Randstad (“edge” or “border” city) is the smallest area of interest in this report. The region is in the heart of the largest urban population area of NL between the cities of Rotterdam, The Hague, Amsterdam and Utrecht. The space between these cities is also known as the Green Heart, not to be engulfed in urban sprawl. The term ‘Green Heart’ can be misleading, making it seem like a natural ‘Natura 2000’ space while it is mainly filled with pastureland for the dairy industry and non-irrigated arable land. The fields used for this purpose have been drained over the last 400 years, turning them into polders and exposing the nutrient-rich peat soil of the former wetlands. A consequence of the preservation of the ‘Green Heart’ is that the heavily urbanised Dutch provinces are still close to green open agricultural and natural spaces. Farmlands and urban centres are situated close to each other in this region.

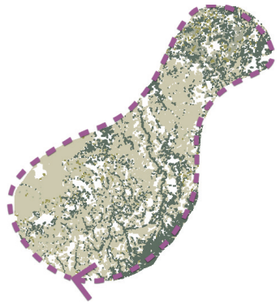
Cluster 6: The last region to the North of the most populous city in NW Europe, London is the Metropol area between Birmingham and Manchester stretching to the East coast. This area includes the regions of Yorkshire and the Humber and the West and East Midlands.

Through our vision map, we conclude that there is a codependent relationship between urbanised centres and farmlands connected through multi-scale infrastructures and networks. They share a demand-supply and a relationship of well-being. For this report, we will be delving further into the specifics of Cluster 5 and eventually proposing a design strategy and intervention for it.

4.2 AREAS OF INTERVENTION



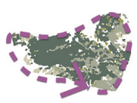
CLUSTER 1: RUHRLAND



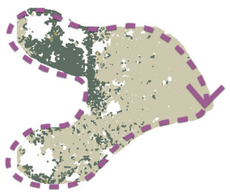
CLUSTER 2: CHAMPAGNE

CLUSTER 3: PAS DE CALAIS

CLUSTER 4: FRISIA



CLUSTER 5: RANDSTAD



CLUSTER 6: MIDLANDS

Fig. 31: Landuse in Areas of Interest

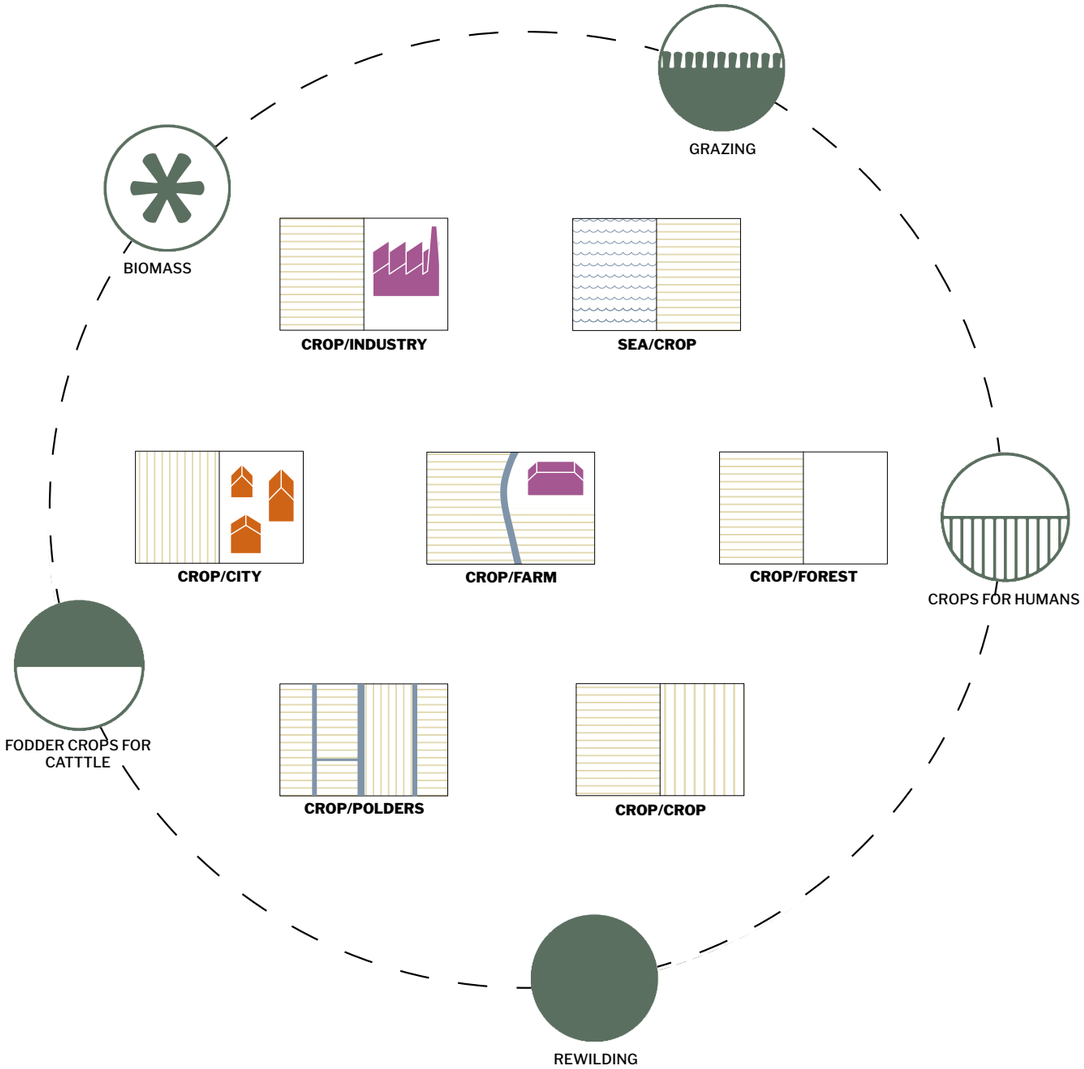
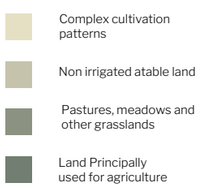


Fig. 32: Proposed Functions



Combining agricultural land uses with Vision Map.

Cluster 1: All types of productivity are considered for this area.

Cluster 2: The focus will be the redefinition of agricultural land according to regenerative standards.

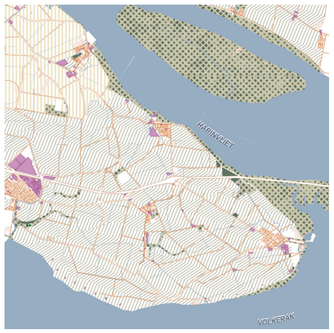
Cluster 3: The challenge will be focusing on food and energy production.

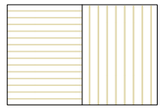
Cluster 4: The challenge is to regain soil quality. Cluster 5: Focus on biomass and crops for human consumption - decrease the number of pastures and feed production designated land.

Cluster 6: The challenge is to mix food and animal farms in the rotational system.

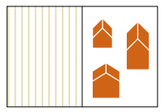
Further zooming into Cluster, these proposed functions are to be analysed with the existing land-use relational systems within the Randstad region in Netherlands.

4.3 LANDUSE TYPOLOGIES

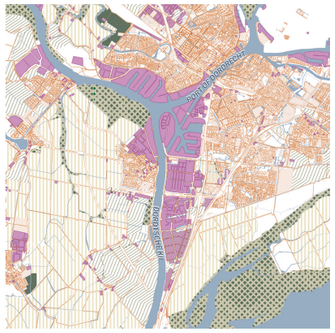




CROP - CROP



CROP - HOUSING



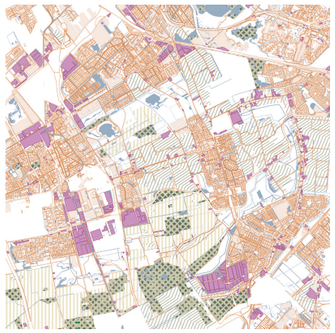
CROP - INDUSTRY

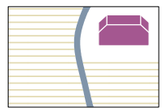
Urbanised areas
Natural Areas
Agricultural land
Agricultural land with value
Industrial areas
Water

Crop-Crop:
Crops are situated so close to each other on the land mass. It is surrounded by water but these vast paddocks of land are an answer to the current economic efficiency in the system. The scaling up of agriculture and the increase of production efficiency has made it isolated from other typologies, only relating to itself. This has solved hunger for a large percentage of the global population but has not eliminated it, still a quarter of people are food insecure (Max Roser and Hannah Richie, 2019). This monocultural form of agriculture needs to diversify to protect soil health and biodiversity for future generations.

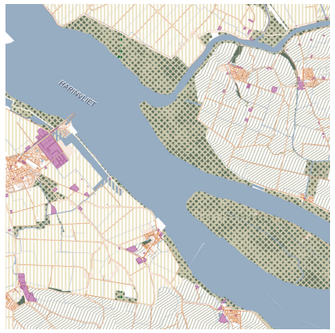
Crop-Housing (Urban):
An urban area provides the potential for harm to the farmland and soil due to the extensive use of harmful materials present in everyday human use and occupation. Before mass urbanisation humans lived most of history close to the place of food production for ease of access. Agricultural land should be feeding its local population. On this site, we're dealing with the proximity of this relationship.

Crop/Industry:
Industrial sites near agricultural land usually have a bad influence on the health of the soil. Especially, if they're in use by factories. Some industrial lands are warehouses and yards for storage. Continued emissions, the use of non-biodegradables and the potential accidental chemical spill introduce harmful elements into the food chain with negative health effects. Opportunities of this proximity are the available logistical infrastructure of rail and roads for ease of transport and away from the farm.

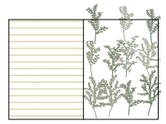




CROP - FARMS



CROP - WATER



CROP - FOREST

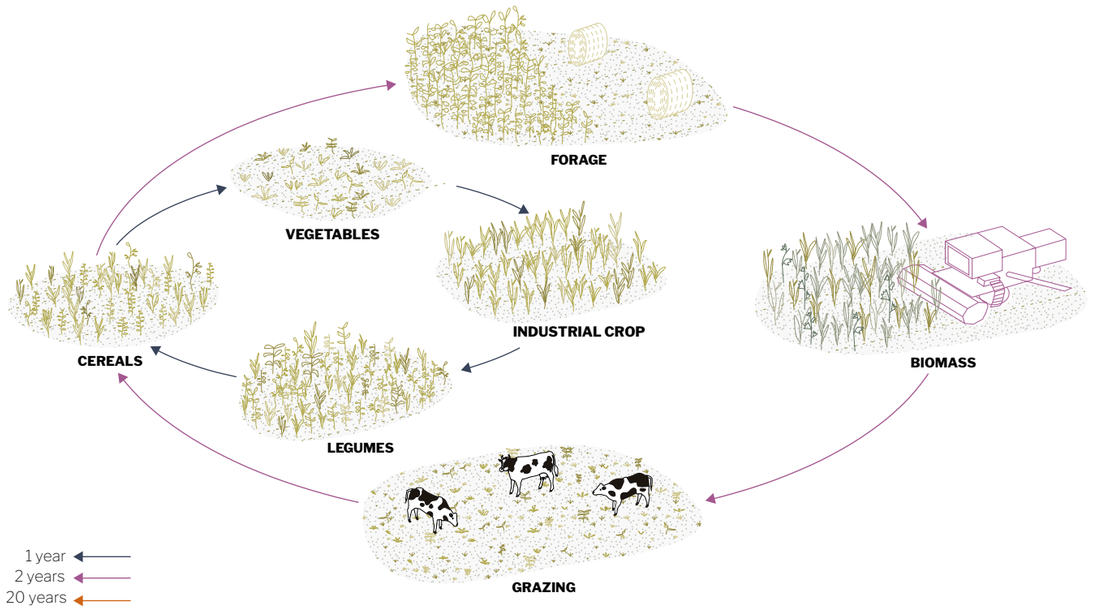
Fig. 33-38: 0 1 km 5 Km

Crop/Farm:
The farm in between the fields is the archetypal and favoured image of the countryside. Hamlets and farmhouses were since sedentary agriculture the main living place of the majority of humanity until the industrial revolution. The decrease of this typology over time has had negative effects on the social makeup of the rural landscape. The amount of space and existing low-density towns, however, can provide much-needed space for housing shortages.

Crop/Water:
Agriculture started close to water streams or in flood plains commonly the easiest to work lands. Agriculture and water share a strong relationship and are essential for crop productivity. The periodic flooding before human intervention made the soil fertile with organic material, in some cases becoming almost only organic material such as peat soil. This covers a large portion of the low-lying NL. The risk of flooding and salination with rising sea levels will make these places less reliable for food security.

Crop/Forest:
Agriculture by the fact of existing carves out space from natural areas. A farm, if it is not a monoculture, might have a multitude of biodiverse species present but can never sustain the biodiversity that was present in what it replaced. Agriculture close to natural areas does benefit from its presence, in form of pollination of crops by bees and pest suppressors such as birds and certain insects. Crops close to forests also give room for forest/nature expansions over the longue duree.

4.4 ROTATIONAL CYCLES



ROTATIONAL CROPS

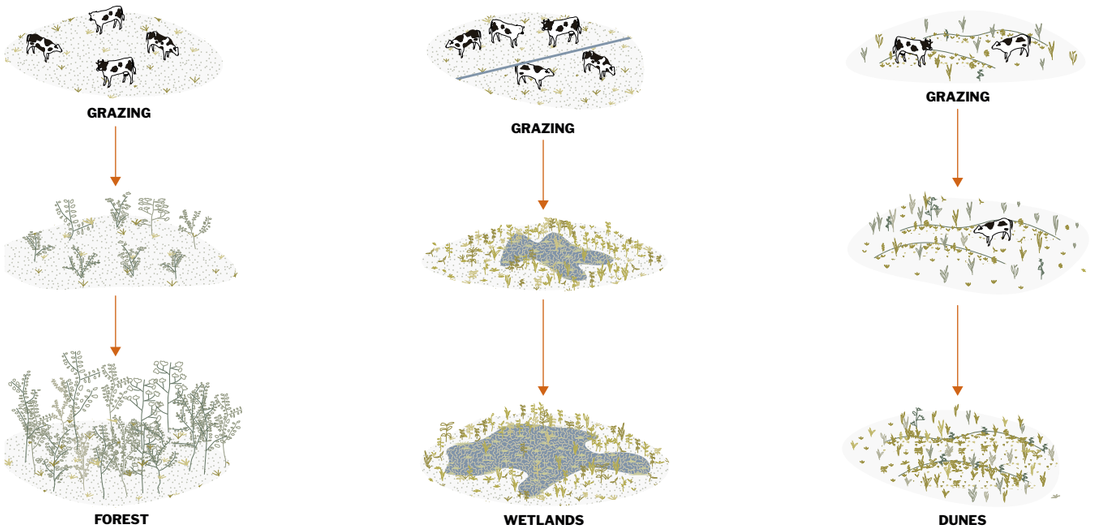


Fig. 39

REWILDING CROPLAND

We conclude that the problem lies in the vast expanses of monoculture farming that exists here. The large spatial occupation of livestock and dairy farming has polluted enormously increasing GHG emissions. The water quality and soil health are depleting at an alarming rate. Thus, to solve these issues, this report suggests a design proposal for rotational farming systems.

The goal is to keep the soil healthy and self-regulating by circular systems, embedded in short-term, mid-term and long-term (long duree) cycles. These cycles are embedded within each other and can cross-collaborate depending on the crop to be grown. It is here where we propose a different form of regenerative agriculture methods of land management adjacent to the other organisational typologies. The remediation of soil, air and water is needed for a sustainable human and natural environment. Our proposal continues the established practice of crop rotation by including livestock in these systems. As mentioned earlier, we have available land suitable for these purposes on our site under the name of Complex Cultivation Patterns and Non-irrigated Arable Land. Pastures and Land used principally for Agriculture will have to undergo some processes of recovery before they're fit for utilisation.

This expansion incorporates not only crops, switching yearly between cereals, vegetables and fruits, industrial crops and legumes but also the production of forage, biomass (biogas eventually) and fodder for livestock grazing. This may or may not be a continuous cycle, forever to work the land with different crops or grasses. A longue duree view of land management where typologies can change towards rewilded states of being. Such states, depending on the situation can assume original natural structures such as forests, wetlands and grasslands. Each offers a biodiversity-rich environment from which our human typologies will benefit. Due to the variation in place-based ecosystems, the choice between these 3 general categories will always require local knowledge and specific rewilding efforts. The EU has extensive catalogues of mapping ecosystems done by the European Environmental Agency. The EU Habitats committee that classifies has classified 234 different habitats to explore this in depth. (*https://lexparency.org/eu/31992L0043/ANX_I/#--27*) over 27000 Natura 2000 areas (*https://ec.europa.eu/environment/nature/natura2000/faq_nl.htm#:~:text=Het%20Natura%202000%2Dnetwerk%20van,deel%20van%20de%20omliggende%20zee%C3%ABn*). However, we open and limit our proposal based on our understanding of this system on our site.

We introduce the Integrated Crop and Livestock Systems (ICLS) which is an established system as our design proposal. Integrated crop–livestock systems are a form of sustainable intensification of agriculture that rely on synergistic relationships between plant and animal system elements to bolster critical agroecosystem processes, with potential impacts on resilience to weather anomalies (Peterson et al.,2020). We will further explore how this system can be worked out.

Biokaas farm Kinderdijk, Alblasserdam

5. STRATEGY

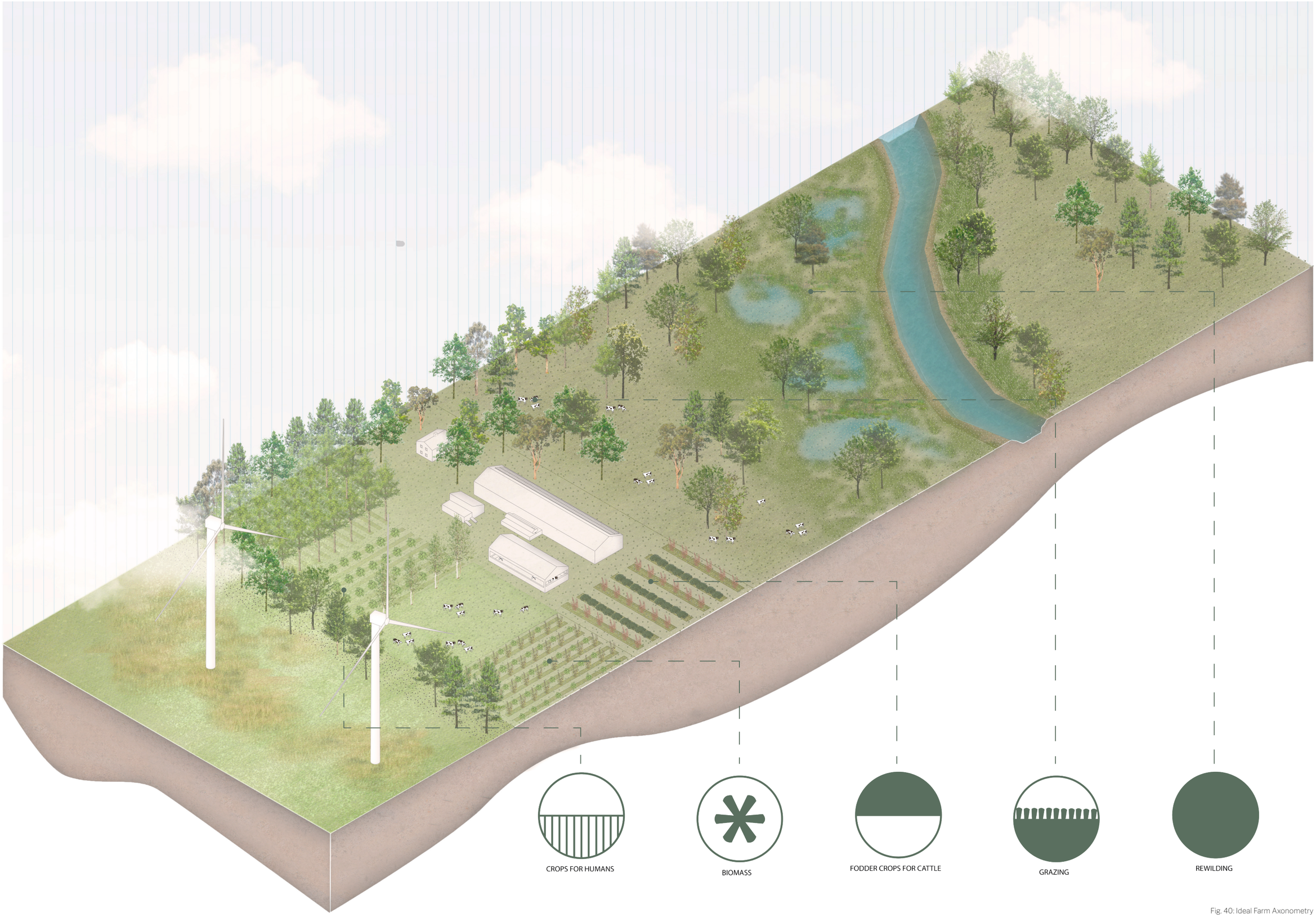


Fig. 40: Ideal Farm Axonometry

5.1 UNRAVELING SOIL TEXTURE DIVERSITY

Agricultural specialisation or monoculture farming does provide benefits of scale including lower production costs and ease and efficiency of management but it has resulted in widespread environmental issues. In order to cater to this, a switch from monoculture farming methods to polyculture farming methods is required. Monoculture is a type of farming where a single crop is cultivated/livestock grazing is done on a given piece of farmland. Polyculture includes a mixed farming method where land is parcelled to allow for different activities. Here, all the crops/products are produced in one location. It depends on many forms and scales depending on external and internal factors. External factors namely climate, weather, soil conditions, political stability and market prices. Internal factors namely land areas, land ownership, ingenuity between farmers, farm's economic structure and equipment availability. For the purpose of this report, we brush upon all these factors but delve deeper into social aspects and the environmental aspects of this system. Throughout agricultural history, animals have played a key role in the farming system, providing manure to fertilise cropped fields and converting residues, by-products and grazed biomass into animal products for food. (Schut et al., 2021)

This report is an exploration of these rotational food systems - vegetable crops and fruit crops (trees, vines, plants, etc.), livestock grazing, poultry, cereals and oilseeds. As a starting point, we use these primary grown, cultivated and consumed crops in the Netherlands and exported to the neighbouring countries - wheat, tomato, onion, carrot, potato, sugar beet, grape, apple, peach, strawberry, rapeseeds, sunflower, soya and olive. Using the USDA Soil Texture Triangle and combining it with our soil texture map of the Netherlands we placed the crops depending on the soil they would grow the best in. Water requirements, fertilisers, pH levels are other important determinants for regulating crop growth. The USDA Soil Texture Triangle divides soils depending on their properties and proportions of silt, clay and sand. For example, if a soil texture type is 80% silt, 40% sand and 40% clay, it belongs to the loam soil but can be suitable in sandy loam to silt loam. However, the limitation of this graph is the exclusion of chalk soils and peat soils but it helps us frame our scenario for the crops we have settled on. It is limited to crops leaving out animal farming. Firstly, these crops are categorised on this triangle. This helps us understand that most of the crops would flourish in loamy soils. They range from silty clay, silty clay loam, sandy clay to sandy loam. Water irrigation or rainfall is necessary for these plants to utilise the sun's energy to make their own food through photosynthesis. Water is calculated on the basis of crop requirements that is absorbed by these soils. For the triangle, this requirement ranges from very high water/rainfall to least water/rainfall. Currently, fertilisers speed up the process of crop growth. The fertilisers are measured in the ratio of N : P : K (Nitrogen : Phosphate : Potassium). Every crop has a special requirement for fertilisers. The fertiliser requirement further helps us understand the manure requirement by these crops which will result in a circular system. Not only the fertilisers recover the soil's nutrients but the soil needs to be brought to a recommended pH level. Sulphate is added to soils to make them acidic and limestone is added to make them basic. Some soils are neutral whereas others require these additional nutrients. The growth period of the plants is distributed into short-term(<5 years) and mid-term(>5 years). Rotational crop patterns and cycles can be pre-planned depending on these growth periods and requirements.

The following conclusions are drawn:

1. Most crops thrive in a loamy textured soil.
2. The crops situated closely on the soil texture triangle have similar soil requirements and thus can be in the same larger rotation cycles.
3. Different families of crops can be grown in the same rotation cycles.

Peat soil is an extremely fertile soil. Due to the difficulties with water and irrigation, it is a high maintenance soil for crop growth. Although it is not included in this graph, its high availability in our region deems essential to include it in the next table that explores crop patterns at length.

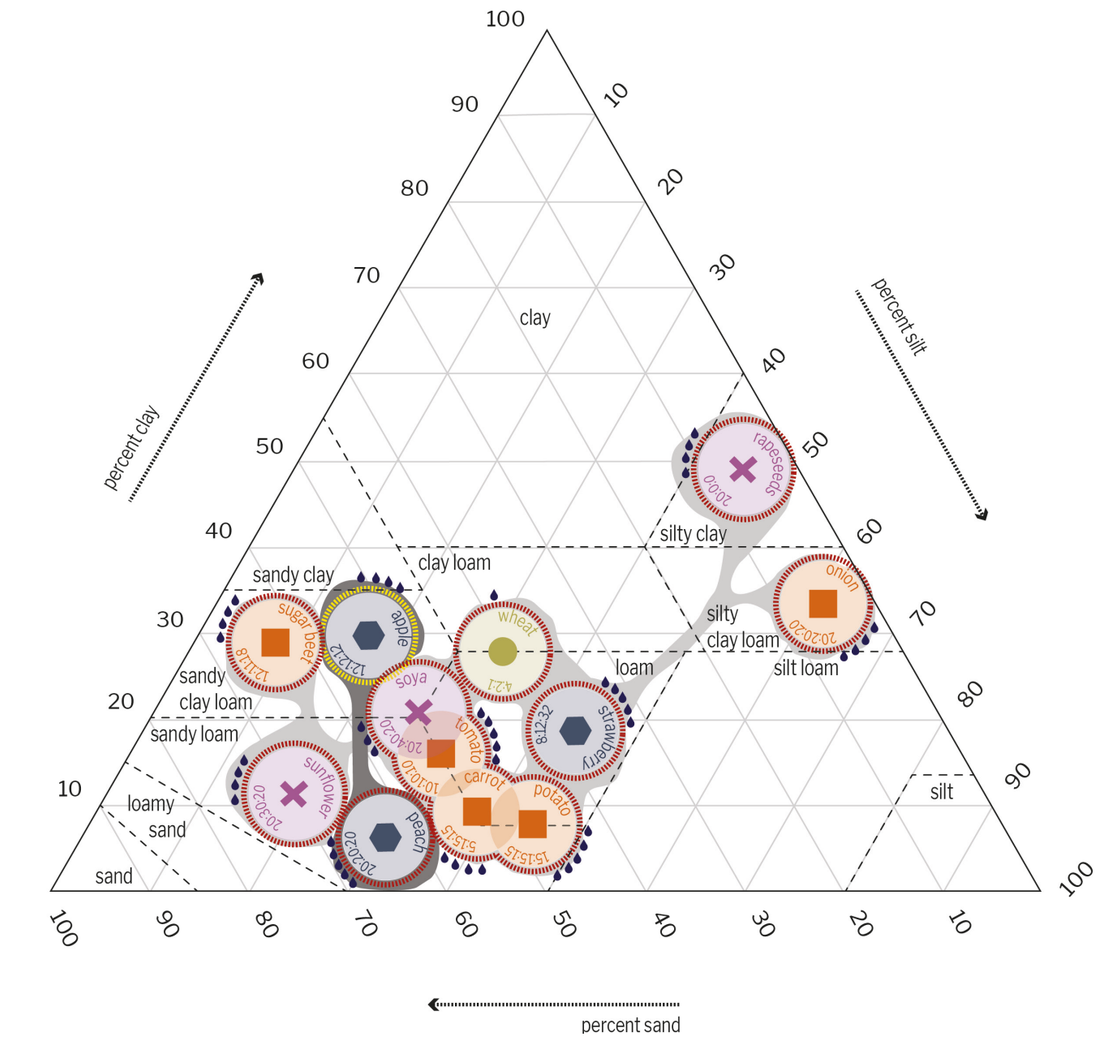


Fig. 41: Evaluation Graph for major crop productions

MAJOR CROP FAMILIES		CREEPERS	FRUIT TREES	OILSEEDS	LEGUMES FAMILY	CARROT FAMILY	SQUASH FAMILY	NIGHT-SHADE FAMILY	GRASS FAMILY	BEET FAMILY	LETTUCE FAMILY	CABBAGE FAMILY	ONION FAMILY
GROWTH PERIOD	short term	strawberry		sunflower, rapeseeds	soybean, peas, clover, vetch	carrots, coriander, celery, parsley	melons, pumpkin, cucumber, squash, gourds	tomato, potato, peppers, eggplant	corn, oats, rye, wheat	beets, spinach, swiss chard	artichokes, chicory, endive, lettuce, e	broccoli, cabbage, sugar beet, beet, etc.	onions, shallots, leeks, garlic
	mid term		apple, peach										
SOIL DEPLETION PROPERTIES	light feeder								●				■
	medium feeder		⬢			■					■		
	heavy feeder	⬢		✕	■		⬢	■		■		■	
	soil builder												
SOIL TEXTURES FOR CROP GROWTH	sandy loam		⬢	✕	■	■	⬢	■	●		■	■	
	sandy clay loam									■			
	loam	⬢											
	clay loam												
	silty clay loam												■
	silty clay			✕									
	peat soils					■		■		■	■	■	■
SOIL RECOVERY PROPERTIES	cover crops/fallow	⬢		✕		■	⬢	■		■	■	■	
	crop residue-grass	⬢	⬢						●				
	animal grazing	⬢	⬢						●		■		
	livestock manure									■		■	

Fig. 42: Crops Typological Characteristics

5.2 INTEGRATED CROP-LIVESTOCK SYSTEM

The Catalogue for ICLS is put together to understand the nuisances of crop and livestock systems. Crop growth patterns and requirements are complex so this catalogue is a bottom-up approach to breaking open this complexity into comprehensible concepts. We propose this catalogue as a tool for urban planners, students and policy practitioners and farmers to further investigate.

This catalogue should be read through the broad frame of two axes - The Major Crop Families (horizontal X axis) and Crop Growth Period, Soil Texture Properties, Soil Depletion Properties and Soil Recovery Properties (vertical Y axis).

All crop families are chosen depending on their importance in the Netherlands, some might have been missed out on but we attempt to cover most. The crop circles are carried forward from the USDA Soil Texture triangle (Fig. 41) and have now been expanded to families. The water requirements and pH requirements are complementing the information about these families. Knowing what family a plant belongs to can be useful in making decisions about rotating plants for managing pests and soil fertility in the garden. Plants in a family are genetically related, so they have similar characteristics. (Sánchez, 2023) Some families are the nightshade family - tomatoes, potatoes, the squash family - pumpkins, legumes, oilseeds, fruit trees, creepers, etc. These families are further classified on the basis of their growth periods. Most families are short-term because crops are grown according to seasons. Productive summer months in the Netherlands range from March-September. An exception is fruit trees which usually can take up to numerous seasons or 1-5 years depending on the fruit.

Crops deplete soil's nutrient value. Healthy soil has its limitations to growing crops and once emptied, it needs to be refilled or recovered by fertilisers. This theory is the basis for understanding these crop politics - you must gain what you lose. The crop families are categorised into heavy feeders, medium feeders, light feeders and soil builders. Out of the most consumed crops in the Netherlands, tomatoes and potatoes are extremely heavy feeders and require immense soil replenishment as compared to onions which are light feeders and can be grown on various soil ecosystems. Legumes are commendable soil builders and add nitrogen to the soil. In simpler terms, they fix the soil. Legumes may or may not be fit for human consumption. Some legumes such as soybean are consumed. Some such as clover and vetch is suitable for pig grazing. The feeding levels or soil depleting/building levels help us in forming crop rotational cycles. Shorter or one -season cycles require less labour as compared to longer ones. These require agricultural expertise and practical trials on the field to perfect over time. Through various trial and errors, these crop politics is understood better by farmers and practitioners.

The crop families are then distributed on the basis of the soil textures. Most families grow on a range of closely situated soil textures rather than a specific one. This is where the Catalogue adds to the understanding of the USDA Soil Texture Triangle. In the Catalogue, peat soils have been included to expand on its presence and importance in our geographical context. The onion, cabbage, lettuce, beet, nightshade and carrot families thrive in peat soils.

Soil builders recover soils, however, soil recovery properties are where cover crops, fallow seasons, animal grazing and livestock manure are introduced. Fast-growing cover crops like buckwheat, sorghum-Sudangrass and Japanese millet can suppress weeds. Cover crops and crop residues can also be fed on by animals such as cows and pigs to ensure soil activity with their hooves and automatic manure planting. Soil-feeding crops are never planted on the same soil in the same rotational cycle. The soil builders and recovery take on from there to fix the soil nutrient levels to grow crops in other seasons. Cover crops are left for a season, grass can be left for a season for animals to further graze on its residue or in some instances, the soil is recommended to be left fallow for underground earthworm activity. Extreme tillage by machinery might also destroy soils hence these measures also help in rebuilding an existing drain field or farm of soil. With crop politics, exists animal politics. Pigs are monogastric animals that feed on diverse plant species as compared to ruminants such as cows that break down grass (pasture) into dairy products. Finding the right balance is important since multiple animal species can forage together efficiently since they consume different things. On the same field, cows consume grass whereas chickens consume insects. Sometimes, they prefer different plants or different parts of the same plant. This is symbiosis.

The following are the benefits of the ICLS system as put down by the Rodale Institute based in Pennsylvania, United States of America. This study has been important in understanding the multifaceted nature of our design proposal:

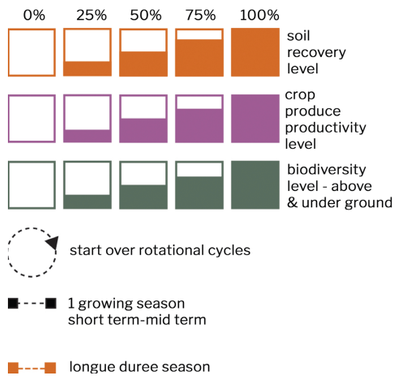
1. Reduced animal feed costs.
2. Utilize marginal lands.
3. Reduce labour but efficiently distribute labour.
4. Reduce machinery inputs.
5. Improve soil health.
6. Reduce tillage.
7. Increase farm biodiversity.
8. Additional weed management strategies.
9. Additional source for plant fertility.
10. Reduced pest problems.

In order to achieve this:

1. Identify land-use practices based on the suitability of the land.
2. Plan your crop-livestock rotation. Flock-herd size, crop species and seasons.
3. Be conscious of the stocking rate. Including multiple animal species and the number of animals per pound per unit area.
4. Select pasture type for optimal grazing where the goal is to reduce the amount of additional feed needed.
5. Soft fencing where required. Either temporary or permanent.
6. Move livestock frequently instead of standardising on specific farm locations.
7. Encourage plant regrowth from grazed pastures.
8. Provide fresh water access.
9. Be weather aware.
10. Maintain farmer economic and social viability.

Multifunctional landscapes are those providing multiple ecosystem services (ES) simultaneously (Lovell and Johnston, 2009; Butterfield et al., 2016). By balancing the delivery of provisioning, regulating, supporting and cultural ES, the promotion of landscape multifunctionality is critical to ensure the sustainability of "working lands" (sensu Kremen and Merenlender, 2018) and human well-being (Millennium Ecosystem Assessment, 2005; Butterfield et al., 2016; Wood et al., 2018; Fagerholm et al., 2020)

These strategies for implementation are a step towards mature ecosystems and future multipurpose foodscapes. Forage species are chosen because of their biomass production potential and the feasibility to no-till systems. These can also be utilised on lands with little or no productive value (marginal lands). Fig. 43 shows various crop rotation cycles to be adopted as the initial phase of ICLS in the Netherlands. Refer to the legend to read the drawing. The recovery of an existing drained farm is included as a starting point for existing farmlands. Exhausted farmlands that can not be recovered, adopt the rewilding future, long duree strategy. Farmlands are exhausted due to high salination levels as well, desalination and bio remedial technical processes should be adopted. This report leaves out desalination of soil as a solution and limits itself to ICLS for soil recovery. The ICLS system opens up opportunities for seasonal farmers and initiates the formation of temporary farming communities based on growing seasons.



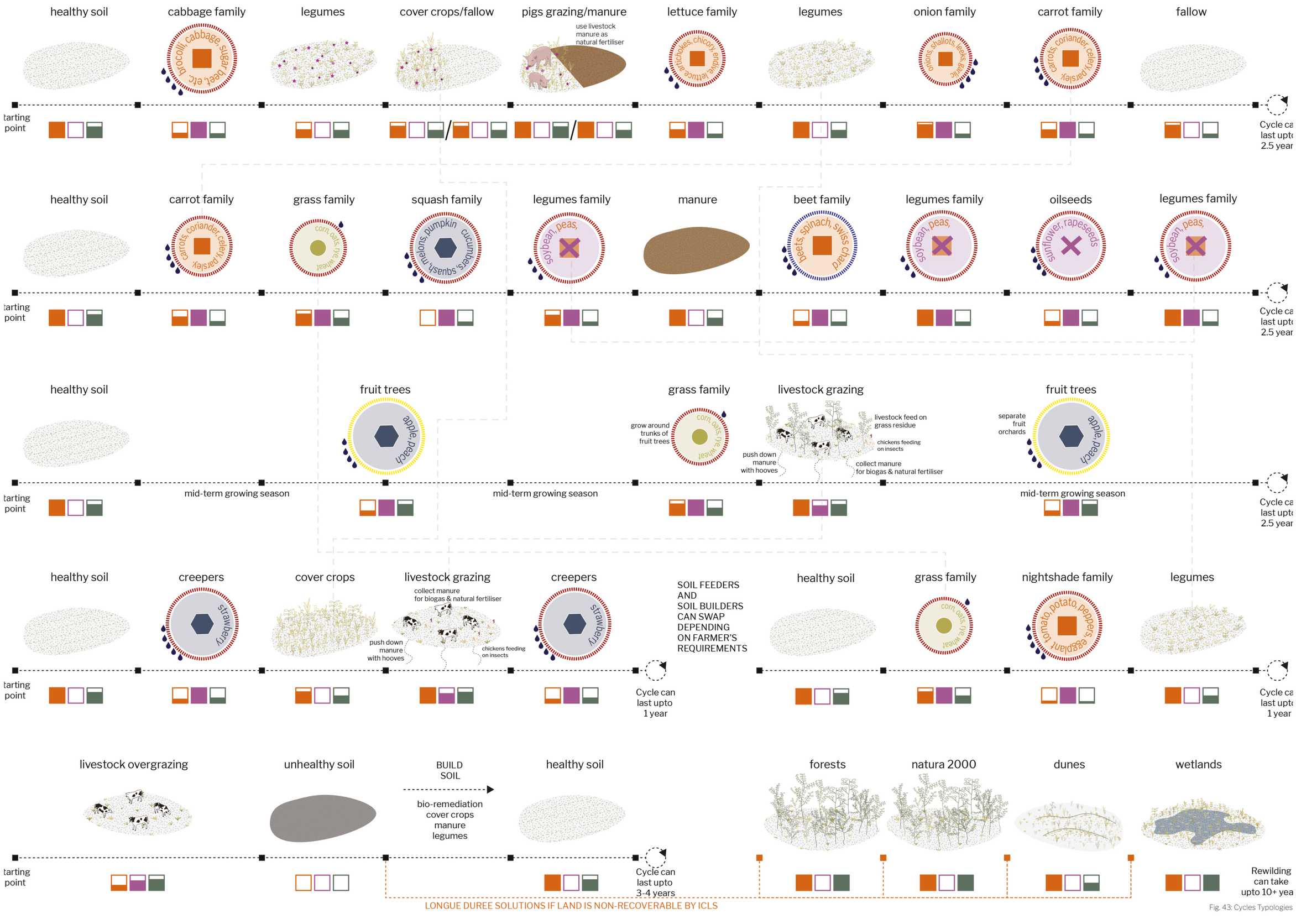


Fig. 43: Cycles Typologies

5.3 TOOLBOX

Fig. 44

Fig. 45

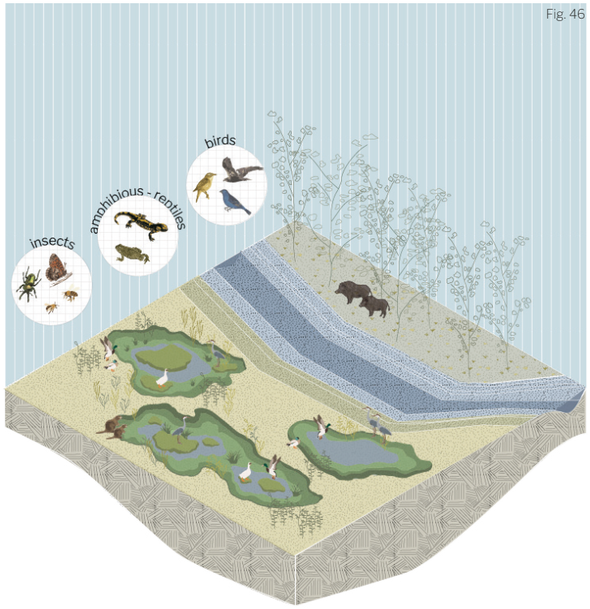
LAND CONVERSION

Conversion of arable land to grassland
Grasslands can provide very efficient ecosystem services, such as carbon storage, water filtration and habitat for biodiversity. They are also more resistant to soil erosion and drought than arable land.
Grassland management
Grasslands need to be properly managed to o provide these ecological benefits, pastures must be properly managed. It is recommended to mix grass species with each other, but also with clover. This leguminous species can fix nitrogen from the atmosphere into the soil. This can reduce the need for nitrogenous fertilisers, which can be expensive and have a negative environmental impact. Clover can also be grazed by cows, increasing protein content and digestibility and adding more nutritional value to their diet. Different grass species have different growth patterns and rooting depths, which can help maintain soil structure and nutrient availability. Species mixing can also increase biodiversity and provide a habitat for a range of insects and other wildlife
Silvopastures and agroforestry
Silvopastures and agroforestry are two related land-use practices that involve the integration of trees or woody vegetation with agricultural or pastoral activities. These practices provide important ecosystem services such as carbon sequestration, soil conservation and habitat for biodiversity. In silvopastures, trees are integrated into a pasture, providing shade for animals and additional fodder. In agroforestry, trees are integrated into agricultural systems through intercropping, forest cultivation or windbreaks.

SOIL AND CROPS

Improved crop rotation/intercropping
These practices improve soil health, biodiversity and reduce plant diseases and pests. Improved crop rotation refers to the practice of planning the sequence of crops on a given piece of land over time. Intercropping is the practice of growing two or more crops together in the same field, either mixed or in alternate rows. The idea of both practices is to balance and restore nutrients in the soil according to the sequence and selection of plant species.
Minimising soil tillage
This practice consists of reducing the frequency of soil tillage between sowing and harvesting of crops. In this way, farmers can improve the health of the soil, its capacity to store water and reduce the need for fertilisers.
Cover crops
Crops that protect the soil between crop cycles from erosion and nutrient loss. These crops can also help minimise tillage and can be used for animal grazing.
Leaving crop residues on the soil surface
This practice also helps to improve nutrient cycling increasing soil health. It also creates an additional protective layer for the soil, reducing erosion by wind and water. This protective layer prevents the formation of surface crusts and improves water infiltration.
Field borders
These borders composed of permanent plants and trees create a marginal habitat for many animal species that would otherwise be naturally removed from agricultural areas. They also provide a refuge for pollinators that are often the enemies of pests and help crops to remain healthy.
Avoiding insecticides, fungicides and herbicides
By prioritising regenerative farming practices, the use of these chemicals can be avoided altogether. This alleviates soil and water contamination.

Fig. 46



BIODIVERSITY

Rewilding / conservation of natural and semi-natural habitats

These conservation practices allow ecosystems to develop more naturally, restoring habitats and promoting health and resilience. The main principle is to reduce or eliminate human intervention in these areas, leaving native animal and plant communities to thrive. These practices can be incorporated at any scale, improve biodiversity and restore many ecosystem functions while mitigating climate change.

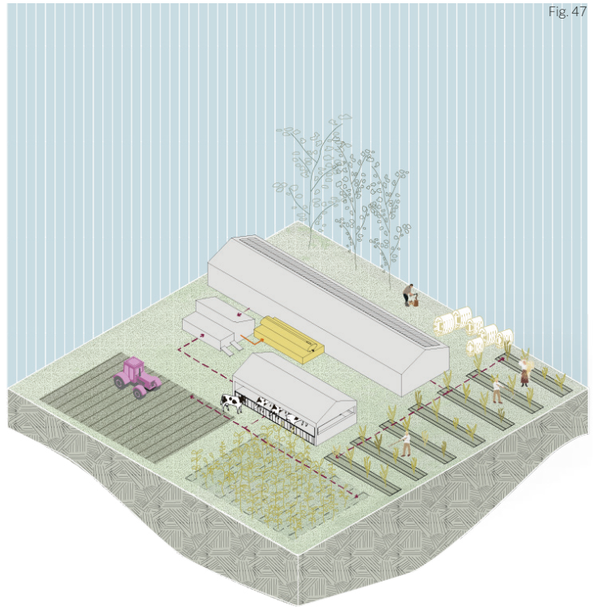
Earthworms

These animals deserve special attention for their extreme importance to soil health, fertility and nutrient cycling. They aerate the soil by improving water infiltration and making room for roots, they also decompose plant residues allowing these substances to fertilise the soil naturally. Earthworms also play a very important role in supporting biodiversity by providing food for birds.

Wetland restoration

It involves returning drained (usually for agricultural purposes) or degraded wetlands to their natural state. This strategy can improve water quality and reduce the impact of flood events by absorbing excess surface water. Wetlands can also store significant amounts of CO_2 from the atmosphere, being known as carbon sinks.

Fig. 47



MANURE STORAGE AND MANURING / ANIMAL AND FEED

Extending the longevity of dairy cows - improving cow welfare

By reducing the consumption of milk and meat, the number of productive cows needed to supply these goods is drastically reduced. Thus, prolonging the longevity of dairy cows becomes possible and suitable for increasing their quality of life.

Adjusting feed composition

Adjusting feed composition is an important strategy to reduce methane emissions from cattle. One approach is to introduce low-methane concentrates into the diet. Low-methane concentrates, such as cereals and oilseeds, can replace part of the high-fibre forage in the diet and reduce overall methane production in the rumen. Another approach is to add nitrate to the feed. Nitrate is a natural compound that can be converted to nitrite and thus to ammonia in the rumen. This process can help reduce the production of methane by rumen microbes, thus reducing the amount of methane released into the atmosphere. This process must be done in moderation, otherwise it can be toxic.

Developing sheds to collect and separate manure from urine

Manure management is a very effective way to reduce the negative environmental impacts of animal husbandry. Especially during winter, cows spend long periods inside sheds that should be adapted to collect and separate manure from urine. Subsequently, the latter must be managed appropriately: urine can be treated to reduce the amount of ammonia and manure can be processed into fertiliser or generated into biogas for energy production.

More protein from one's own land or direct neighbourhood

Reduce the consumption of feed from abroad, which can have a significant environmental impact due to the land use and transport required for their production and transport.

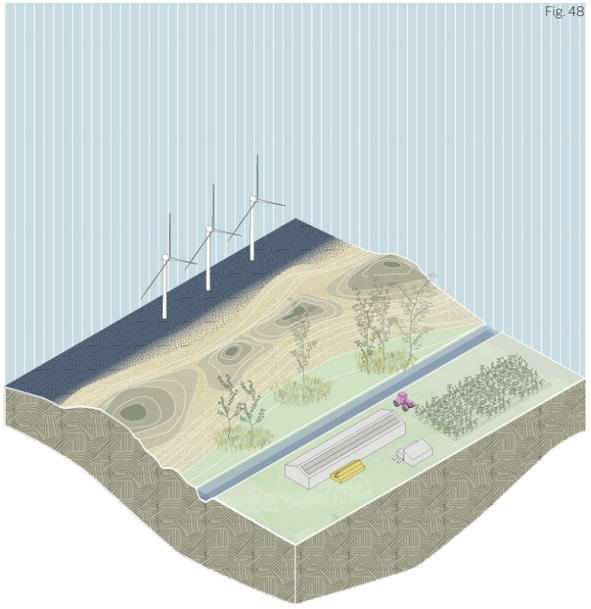


Fig. 48

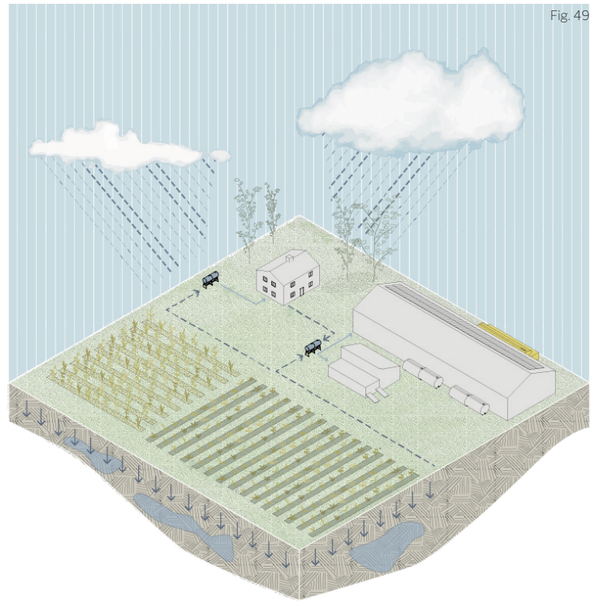


Fig. 49

ENERGY SAVING AND SUSTAINABLE ENERGY PRODUCTION

Manure monofermentation

Manure monofermentation is a process in which manure is treated in an anaerobic digester, resulting in the production of biogas and digestate. The biogas can be used as a renewable energy source, while the digestate can be used as fertiliser and used in agriculture. These practices prevent manure from releasing harmful pollutants into the environment.

Windmills

The generation of electricity from wind power is a renewable energy source. It can be widely applied on coastal ecosystems, harnessing the wind and with minimal environmental impact.

Solar panels: can be widely incorporated on farms, promoting a renewable source of electricity for local consumption.

Electric tractors

The benefits of replacing normal fuel tractors with electric ones range from reduced negative environmental impact to increased income for farmers due to reduced fuel consumption and the use of locally produced electricity.

Heat pipes

Heat pipes work by transferring heat from one place to another using a closed loop system that relies on the evaporation and condensation of a working fluid. They are very useful for maintaining temperature and humidity at desired levels within a greenhouse or animal shed. Once installed, they can significantly reduce energy consumption costs. For example, on dairy farms one source of heat can be fresh milk.

WATER MANAGEMENT

Water saving in irrigated agriculture

There are several techniques that can be used to reduce water losses in agriculture. They mainly revolve around high-efficiency irrigation systems, e.g. drip irrigation can be used to deliver water directly to the roots avoiding evaporation and surface runoff. Reuse of water within the farm is also an important measure to reduce water losses.

Increasing water storage capacity in the soil

The storage of water in the soil has many advantages. For instance, it leads to mitigation of flood risks, as it absorbs excess water from rainfall. It also helps improve soil structure and reduce erosion and surface runoff. Finally, it also improves plant growth as it maintains soil moisture and allows plants free access to water and improves soil fertility.

5.4 SUPPLY CHAIN

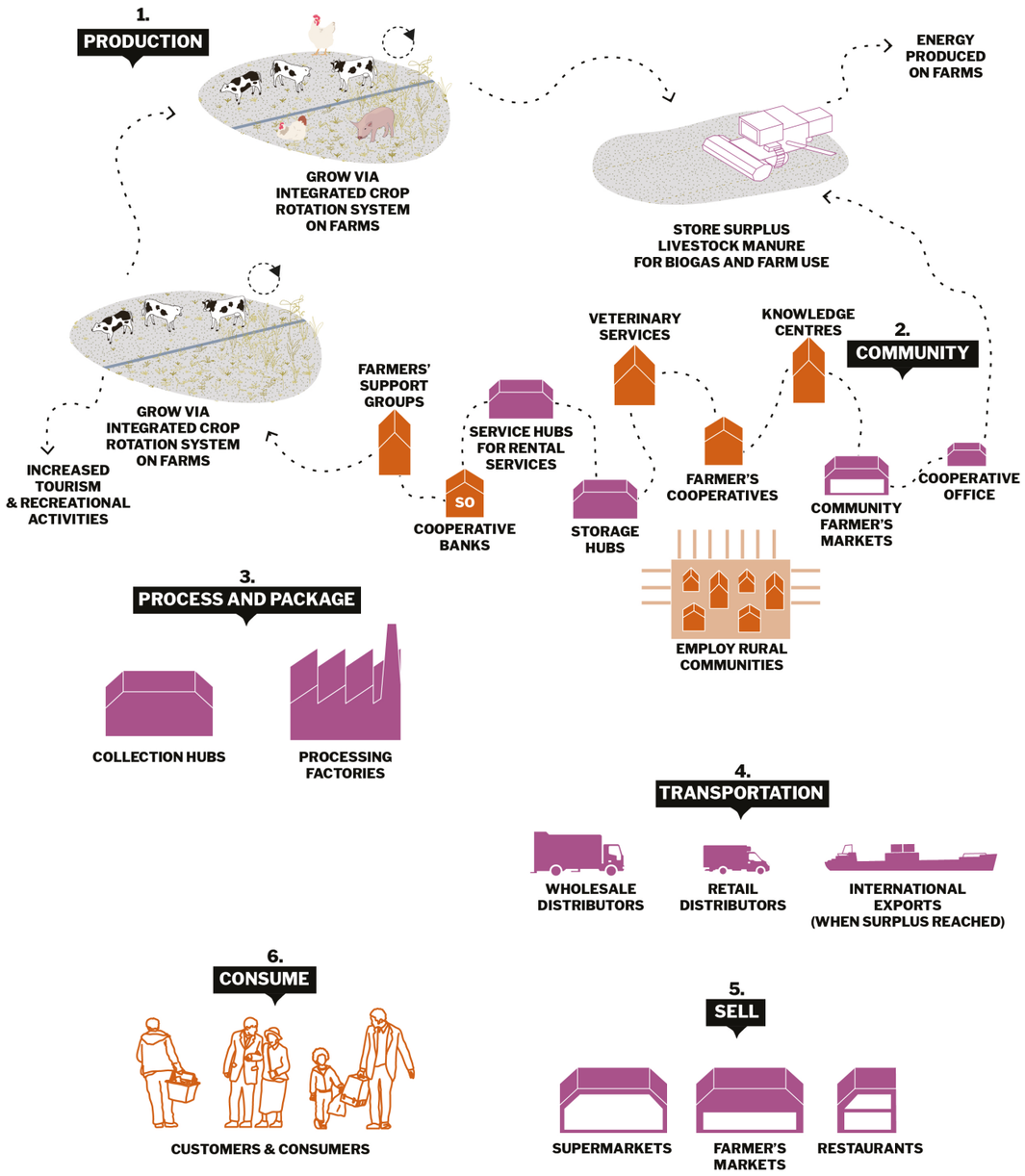


Fig. 50

Having discussed the spatial and environmental conditions in Chapters 1 and 3, it is made clear which problems need to be solved. Chapter 4 shows our vision to solve the tools of technology and agricultural management to the benefit of soil health. The final piece to this puzzle is the question of social justice. Here, the importance of the small farmer and the rural community surrounding them comes in and where the social intervention of our project takes place. The decline of small farmers and the subsequent decrease in rural population is what our cooperative farmer governance will address. The proposal to create such a system lies in our belief that we as urbanists/planners do not have all the answers. Working in an academic environment isolates us from the realities we attempt to solve. In the book "Planning in the Face of Power" Forester argues that "Planners are often separated from the planned for" (Forester, 1989). The implementation of our vision thus needs to be in connection with the farmers and community we design for. The techniques used to communicate a vision to rural communities are comprehensibility, sincerity, legitimacy and accuracy. This community planning approach is due to time reasons out of the scope of this research but is strongly advised to planners and municipalities looking to shift to sustainable agricultural practices. The inability to test the theory of communicative planning does however make us design an even more flexible and farmer-driven organisational structure for the rural community.
The new supply chain itself is abstracted along 6 general actors:

1. The production side where our technical tools of ICLS, CR and the toolbox will be implemented.
2. In the community to support the production storage and service hubs will be placed under the management of the farmer cooperatives with the support of several services. We classify these services as public goods for the community. Veterinary services to ensure animal welfare. Knowledge centers for farmers including training opportunities. A cooperative bank for financing. Farmer's support groups for inter-cooperative conflict, problems and mental health groups. All these new functions increase the number of people working and living in rural communities. This extra vibrancy will attract recreational tourism in a newly green ecological environment.
3. Process and packaging of the produce from the land is the connection from the farmer to the wider market.
4. Transportation will on a national scale be done in wholesale and retail distribution and when a surplus after food security of NL is reached to be able to export internationally.
5. The selling of food will stay in the current system but have a heavy emphasis on farmer's markets as a retailer of food to consumers. The price-setting power of supermarkets will decrease for fair prices and restaurants will use more locally produced products.
6. This is all for the benefit of the largest link, the consumer. They will with all this work benefit from healthier food, revitalised rural communities, an efficient processing and transportation section and be able to acquire these products for a fair price.

5.5 WHO'S INVOLVED?

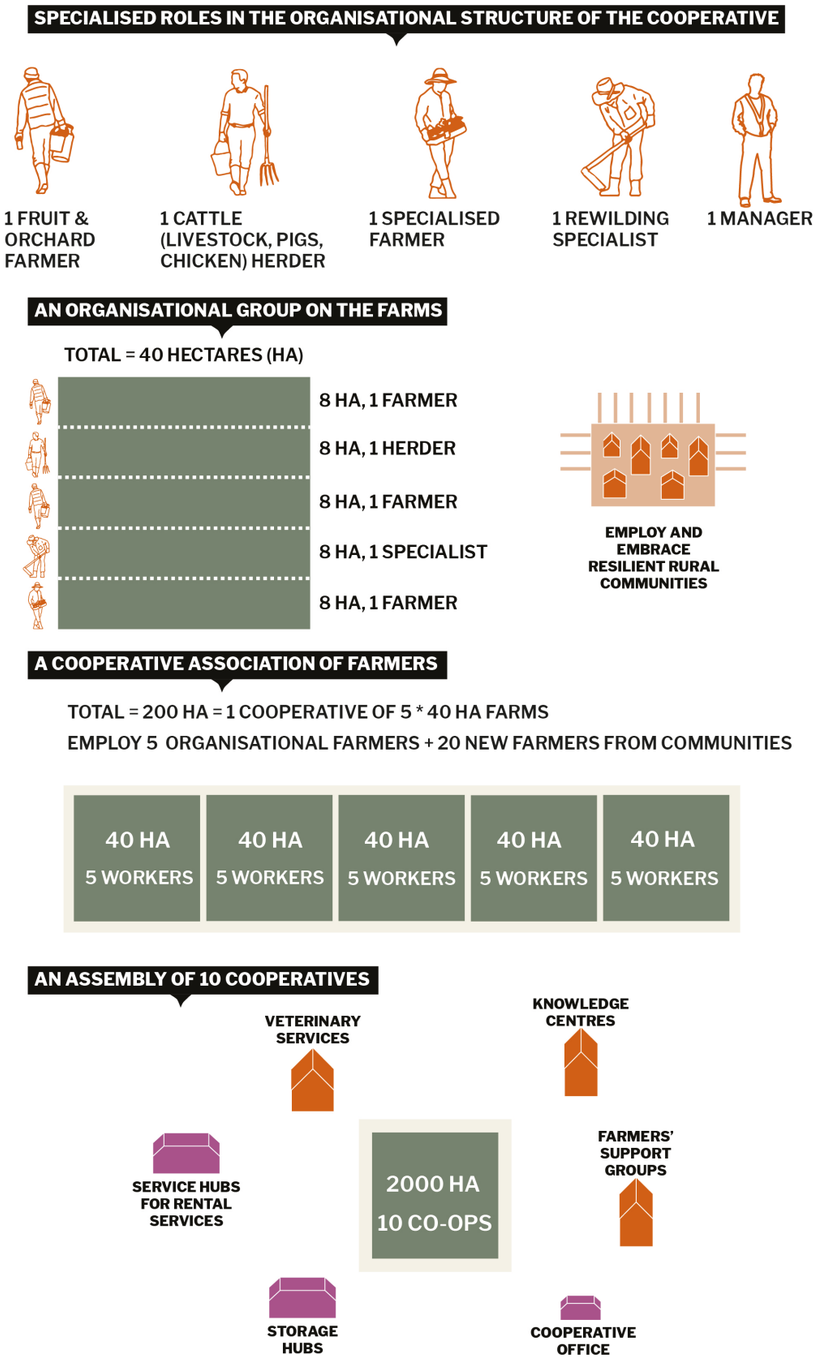


Fig. 51

Now that the technical outline for implementation of a sustainable agricultural system has been laid with ICLS Catalogues, suggestive Crop Rotation Cycle Typologies and Toolbox, we suggest an organisational structure to ensure how we deal with this implementation. The goal of this report is to communicate to the farmer and agricultural worker a tool to implement. We propose a companion to realise these technicalities. As stated in the Stakeholder Analysis, the farmer as popularly portrayed is not a monolith but made up by a myriad of different actors with varying motivations. Our goal is to empower the small farmers, often ignored, the farmers (the people that work the land) that are suppressed by state bureaucracy and private monopoly. We thereby propose a cooperative organisational structure on the local scale to use and produce the land. This, on a broader scale, critiques the dominant position of the agricultural sector that sets prices and production decisions. The desired goal is to allow the rural community to benefit from the wealth that is produced on their land. The rural communities are declining and these measures help in uplifting their involvement in this ecosystem.

The farmer, seen commonly as the producer of the means of subsistence, is not able to feed themselves on the produce of their own labour. The economic forces push the common farmer, who on a surface level produces enough for personal caloric intake is forced to sell it all to big corporations.

The cooperative is the social expression of our project to reach our desired goal of a sustainable non-market-based food system. The Stakeholder Analysis provided an analysis of the stark differences in income of farmers, agricultural workers and the rural communities surrounding them. A sustainable economic mode of production, to empower destitute farmers and agricultural workers based on local food security is essential to revitalise the rural space of being. Our cooperative framework is:

Layers of collective structure:

- A group of 5 people works on a 40 HA piece of land. Average farm sizes in the NL are 40 HA and they're parcelled into 5-8 HA each.
- 40 HA is broken down into 5 parcels or paddocks of land (8 HA each).
- The main professionals involved are – 1 Fruit and Orchard Farmer, 1 Cattle Herder, 1 Specialised Farmer, 1 Rewilding Specialist and 1 Manager to look after the new system.
- The goal is to have these 5 professionals over the total 40 HA farms.
- 5 groups of 40 HA each = 200 HA of farmland forms a cooperative structure occupying a total of 25 people out of which the other 20 are people willing to work or seeking employment in these rural communities.
- From this cooperative, a representative is elected to speak at the Assembly.
- 10 cooperatives form an Assembly of 250 people managing 2000 hectares with additional roles of management introduced over time with its internal and external actors.

This Assembly has some additional functions relating to the well-being of the communities, animals, crops and farmers – veterinary services for animals, service hubs for rental services of tractors, machinery and farming equipment, storage hubs for hay and manure to share amongst farms, farmers' support groups to ensure spatial and social justice to farmers, cooperative office as the spokesperson of this system and knowledge and training centres to help share knowledge amongst new learners from rural communities and beyond.

The land is owned by these cooperatives, these cooperatives will choose their representatives and leaders based on mutual understanding and decision-making. Existing farmers will form and join these cooperatives and new farmers will be added. A new resilient community will now be formed.

5.6 POLICY IMPLEMENTATION

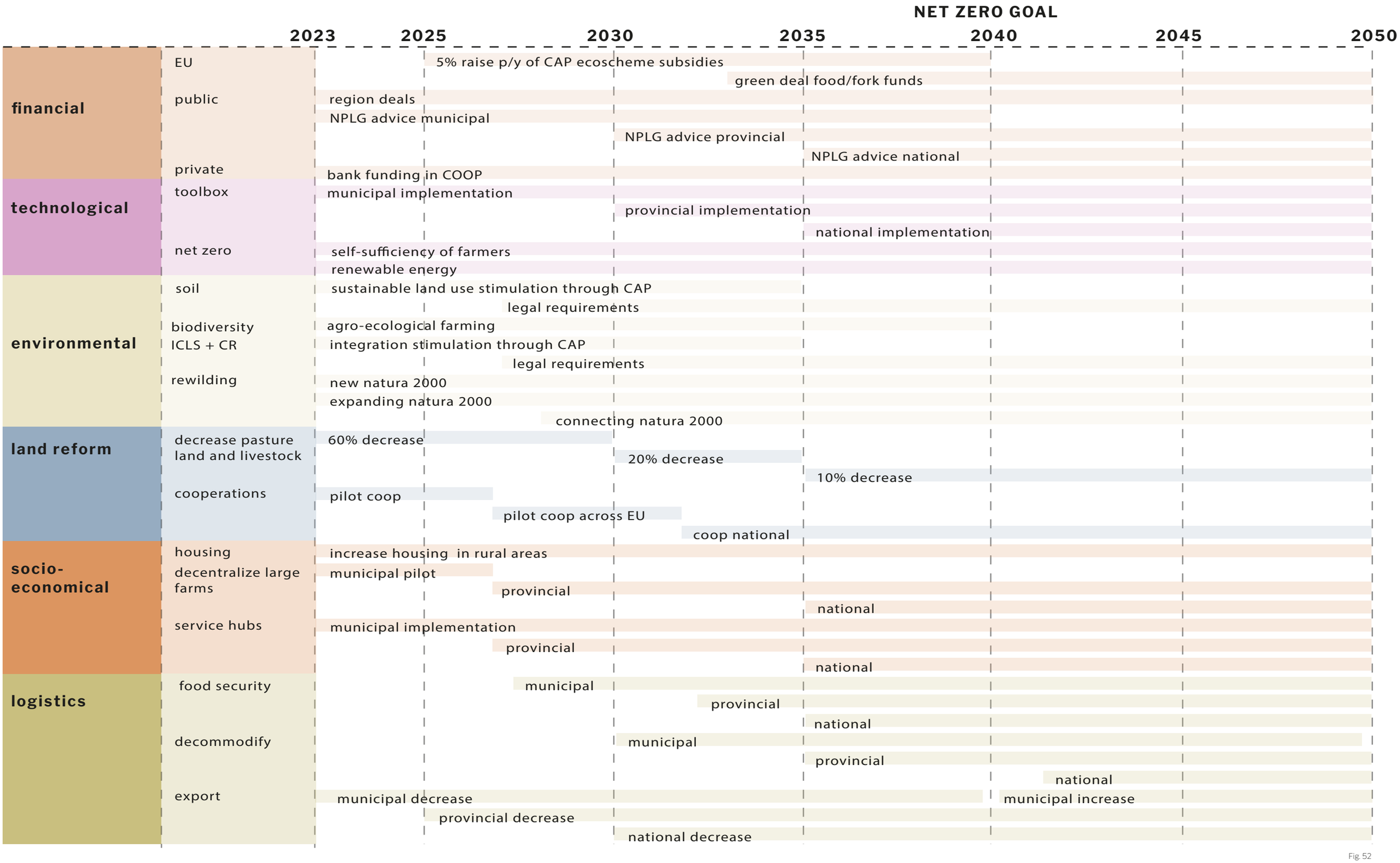


Fig. 52

The policy proposals are explicitly meant for the Dutch national, provincial and municipal governments. Our policies follow a phased approach of the pilot farmer cooperative starting at the municipal scale in the municipality of Hoekse Waard in South Holland. After proving the concepts and adjusting them where needed it will move up the scale to the provincial scale, while it goes EU wide on the municipal level with similar pilot projects. Subsequently to this moment, legistlations will be implemented on the national level, to then be converted into EU Policies in 2050.

1. Financial
Policy funding will be allocated to the categories described below, benefiting the environmental and socio-economic status of the rural landscape. State funding will take place at every level and will be directed towards the financial implementation of sustainable agriculture. The EU will amend its C.A.P. to allocate it entirely to Ecoschemes by 2040, with an increase of 5% per year from 2025. The public sector will begin to finance the various efforts by implementing municipal financial support. By 2030 this will be extended to the provincial level and to the national level by 2035. The private banking sector, through state policy guidelines and coercion, will be induced to invest in environmental agricultural practices and purchase land for rewilding.

2. Tech
The implementation of the Toolbox needs popular knowledge and support for the meriate of techniques used, small and large. The branding of the toolbox therefore is essential to promote sustainable farming and the use of clean energy.

3.Environmental:
By implementation of the ICLS and CR systems soil health, water quality, GHG reduction and increased biodiversity will be reached. Soil health, gain of biodiversity, ICLS and CR systems will be the driving forces for these environmental transitions.

4.Land Reform/Environmental:
To be able to increase rewilding, large sections of current pasture and non-irrigated arable land need to decrease. The opening up of this space allows for the creation of forests, wetlands and grasslands. The decrease in pasture land and therefore the amount of livestock and dairy cows will be reduced by 60% by 2030, another 20% by 2040 and another 10% by 2050. Reducing the consumption of cheese to 10% of what it is today.

6.Socio-Economic:
These policies will work in synchrony with each other to create a viable rural social community. In order for these cooperatives to be able to start agricultural enterprises with large properties, their size and number will be reduced and distributed among farmers and farm workers. The creation of cooperatives controlled by small farmers with technological policies allows for the creation of a strong rural socio-economic community working for food security. The expansion of the agricultural labour force also requires more housing, increasing the rural population and reversing the current downward trend.

7.Socio-Economic/Logistics:
Logistics systems support socio-economic policy by enabling the movement of people, goods and knowledge. These service hubs and knowledge centres will generate employment in rural areas. The process of moving from food security to decommodification of food systems will be a long-term one. The goal of a socially just food system, which guarantees food security, allows free access to food at the local level.

8.Logistics:
The question of reaching food security is interwoven with the policy surrounding exports. To reach a food secure system, the number of exports need to be reduced to a point where every person has enough sustenance. When a food secure system is reached exports can rise again but only the surplus from the production process.

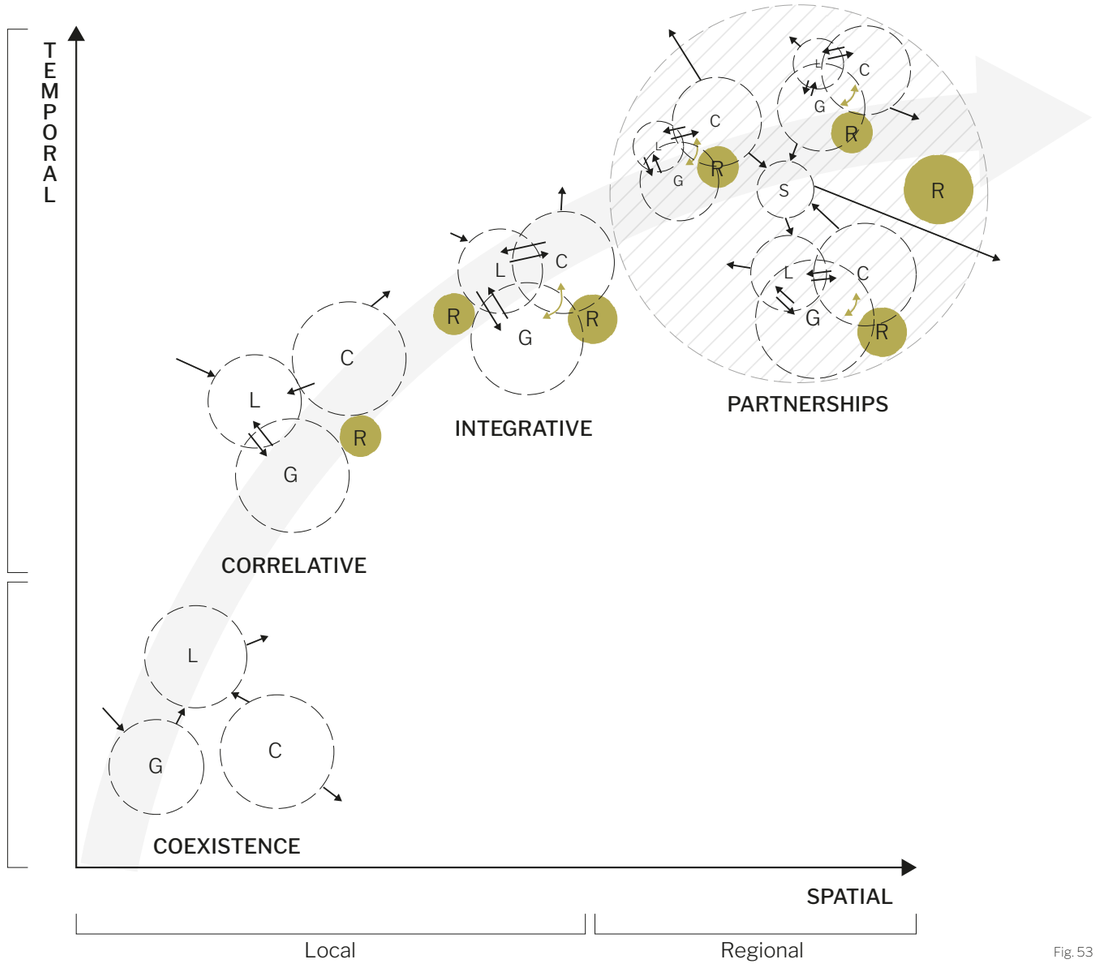


Fig. 53

Depending on the financial support available to farmers, implementation of cooperations will start from the small scale of a single farm. First, the cycles and production of livestock, pasture and crops will become more integrated, and links within the farm will be reinforced. This system operates towards a state in which partnerships are formed within farming communities: the cooperatives. Goods will be exchanged through the service hub. In addition, rewilding will be slowly introduced around and within the farm. These areas can expand and slowly grow towards each other, creating biodiversity corridors.

5.7 PROJECTION OF STAKEHOLDERS

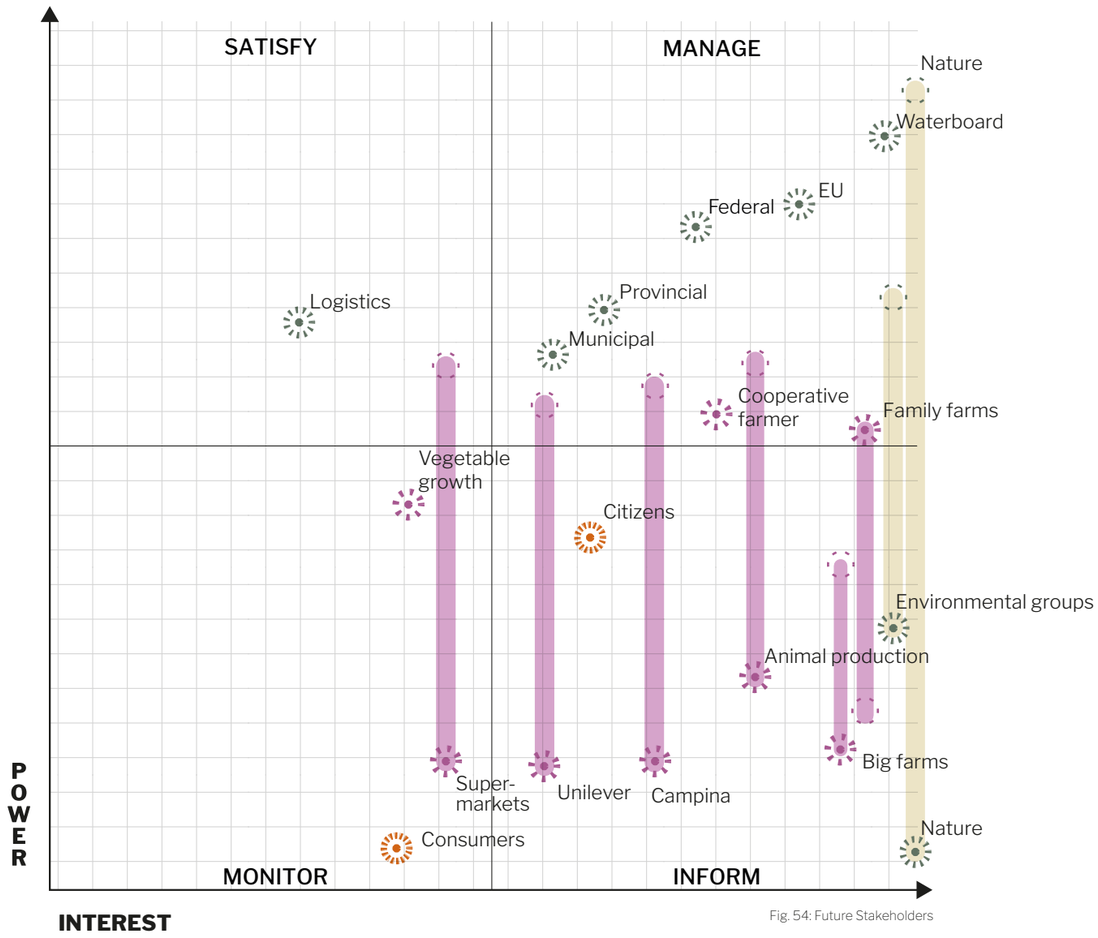


Fig. 54: Future Stakeholders

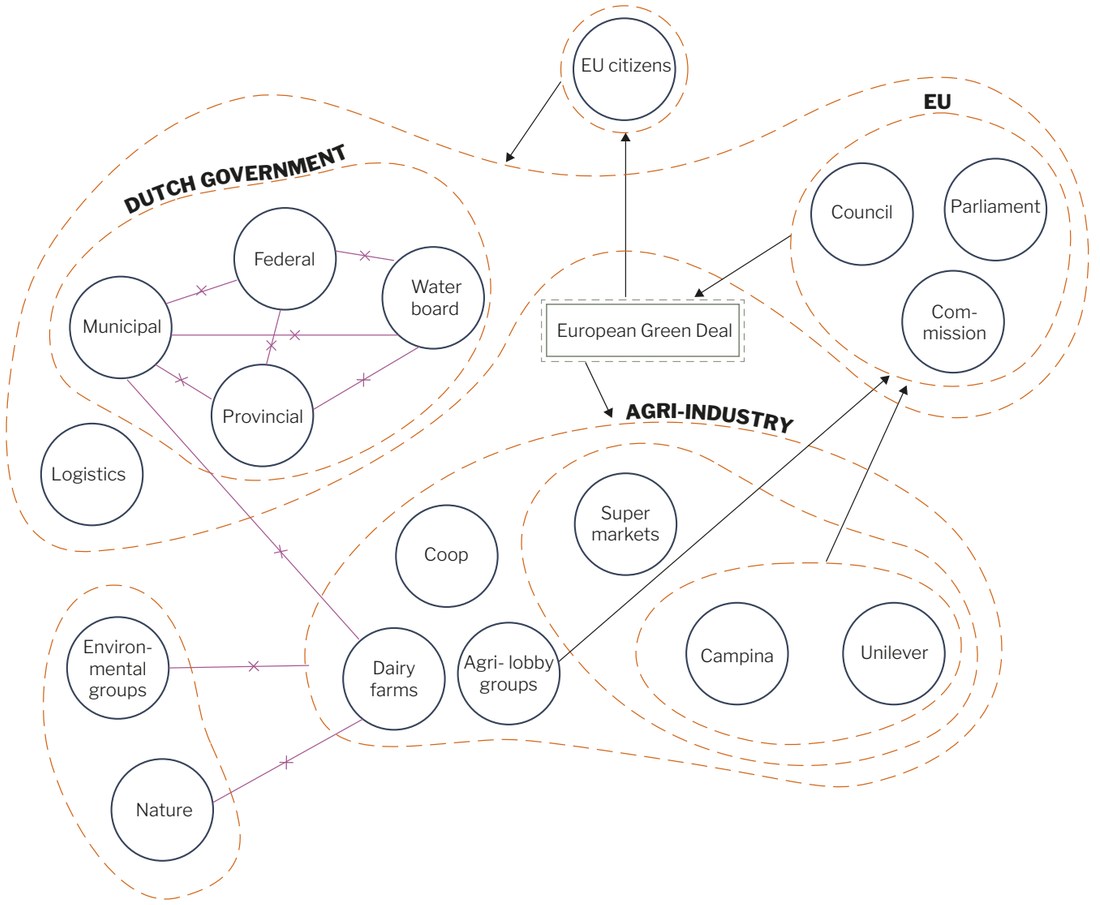


Fig. 55: Stakeholders Conflicts

FUTURE STAKEHOLDERS AND CONFLICTS

Public sector
Private sector
Civil society
Coorperations
Conflict
Party
Agreement
Pressure

Conflicts between the stakeholders will definitely occur. Especially the conflict between the EU, federal and provincial governments against the influential agrilobby and business will be monumental. Due to the EU's history with agricultural policy mostly being an agricultural union first and foremost. For half the EU's history more than 50% of its budget would go to agricultural subsidies and currently still hanging around 40% of the total budget (*https://www.ftm.nl/artikelen/glb-miljarden-voor-de-boer-wie-krijgt-wat-van-brussel*). An institution that has functioned as the largest agricultural supporter this shift will occur with large industry pushback. To hold the EU and national governments to account the goals and policies already written need to be faithfully implemented. The major winners of our policies will be the small farmers, now working in strong cooperatives, making their own decisions in sustainable land management using the tools we have described. These cooperatives will (hopefully) bring a just relation between the urban and rural. The non-human benefactor will of course be the natural environment, with biodiversity supported by healthy soil, clean water, and fresh air. This in turn benefits the overall population of a NW European region as a whole.

5. 8 LANDSCAPE EVOLUTION

Fig. 56

HISTORICAL MAP 1815

Fig. 57

HISTORICAL MAP 1922

Fig. 58 0 2 10 Km

MAP AS OF TODAY

The historical site analysis places the strategy in a timeframe. Agriculture being the main type of labour for the last few thousand years, The Netherlands, or what would become the Netherlands was no different. Even while a fraction of the population works in agriculture it faces many of the same challenges.

1800 (Including Pre-1800s)
During the period before 1800, a large shift took place in agricultural production and land management in the low-lying sections of NL. From 1350 forward no original natural landscapes were left. In this middle to the late medieval period, the towns and major diked areas that are still used today began to form, being recognisable by 1350. Original landscapes were fully transformed from their natural state to urban and agrarian. Dutch farmers dealing with water is nothing new, since 800 CE farmers have been forced to move due to the subsidence of peat soil due to irrigation techniques, shrinking the available agrarian land. This shrinking saw the shift from crop-based agriculture towards dairy, meat and cash crops (Rennes, 2010). The increased economic activity of the 16th to 18th century created even more demand for animal-related food products changing the landscape to a livestock-raising function. The subsided lands mentioned before would stay submerged in a wetland state until the onset of steam power.

1922
The industrial revolution, with steam power, allowed the subsided land to be pumped dry again and turned into pastureland. An example is the expanded fields around Gouda increasing its cheese production.

Current Situation:
The change from the early 20th century till today shows the historically unprecedented urbanisation, the majority of which is a post-war development. The agricultural output reached high levels, becoming the 2nd largest agricultural exporter. Rural agriculture is still present close to urban areas, South and East of Rotterdam. These are the areas of non-irrigated arable land and pastureland our design intervention will focus on.

5. 9 PROJECTED LANDSCAPE EVOLUTION

Fig. 59

VISION MAP 2025

Fig. 60

VISION MAP 2035

Fig. 61 0 2 10 Km

VISION MAP 2050

- Water
- Urbanised areas
- ICLS
- Natura 2000
- Area of interest
- Agricultural land
- Pastures
- Clay / loam
- Sandy loam / loam
- Urban centres

Phase 1:
Start by implementing the cooperative structure and rewilding in Hoekse Waard while increasing rewilding in East South Holland. The 1st vision map looks at the near future of 2025. The interventions over the next 2 years are the major spatial intervention of decreasing pastureland in the east low-lying region and turning it into a Natura 2000 area for the purpose of rewilding. ICLS efforts will start to be implemented surrounding these natural areas for the support and protection of EC within the cooperative system. These cooperative pilot projects are there to prove the validity and viability of green pro-labour farmer organisational structures. The lessons learned during this phase will be used to correct and adjust farming and governance systems going into the next phase.

Phase 2:
Towards 2035 is all about scaling up the process. The date of 2035 may seem soon but, as this report has argued, the urgency to make a quick Just Green transition is necessary. During this period the earlier established Natura 2000 area will be expanded and new ones be placed. The first cooperatives, now 12 years after their farming, have proved their way of working and have developed unique solutions to unique conditions. The rural communal networks created between farmers and their neighbours have created a base for the implementation of local food security, starting on the road towards the de-commodification of the local food market.

Phase 3:
Coops will be the dominant agricultural producer in South Holland. The last phase has created a radically different landscape in its spatial, environmental and organisational character. The former small cooperative system has become the new status quo where the control over land and production is in the hands of interconnected groups of farmers and agricultural workers. The close rewilded areas, some polders having been completely turned into wetlands, has made the water, air and soil cleaner making both human and non-human life healthier.

5.10 IMPLEMENTATION OF DESIGN STRATEGY

Fig. 62

CURRENT SITUATION

- Natura 2000
- Urbanised areas
- ICLS
- Pastures
- Clay / loam
- Sandy loam / loam
- Agricultural land
- Rural centres
- Urban centres

The chosen location of design is the municipality of Hoekse Waard. The area is exemplary for its focus on the 6 typologies surrounding crop land. The presence of non-irrigated arables around the Natura 2000 area of Oudeland van Strijen. These non-arable land parcels have an average size of 40 hectares. A number of small rural communities exist here, such as the village of Strijen, ‘s Gravendeel, Maasdam, Puttershoek, Westmaas and Klaaswaal. The total population of Hoekse Waard is just above 17 thousand people. These communities are close but not connected to the larger towns of Dordrecht and Zwijndrecht. Around the large urban area of the city of Dordrecht exists an industrial harbour connecting the cropland to the rest of SH by waterway transportation, allowing large scale imports and exports. Finally the municipality is framed by Natura 2000 areas alongside the rivers of Oude Maas and Hollands Diep.

With this local context, this area is adequate for implementation of all the tools offered by this report. This section of our report is focused on applying the practical solutions of the Toolbox, the sustainable agriculture practices of the ICLS+CR and the social organisational of the farmer cooperative system in this determined portion of SH. The pilot project of 10 cooperatives combined into 1 assembly on a 2000 HA land will be introduced in the southside of Hoekse Waard. Here the service hub for the community will be placed in Strijen, the largest town of the intervention area. The export collection hub near the port of Dordrecht can be used for the management of exports when food security is reached. Outside of the rural towns a biogas plant, which processes the produced manure for fertiliser and fuel, will be installed. Windmills will be built for energy production to reach climate neutrality. Labour housing will be constructed within Strijen and in other small towns to support the intensified land use with an increased labour force that will work the smaller plots of land. The livestock grazing network set-up allows the herders to migrate their cows periodically between the cooperative plots and graze on the Natura 2000 area outside of bird breeding seasons. This pilot will constantly be readjusted to improve its social and environmental suitability.

The expansion of this system, starting in 2030 will slowly introduce expansion of Natura 2000 areas into land of the pilot cooperative, rewilding current arable land, while the cooperative itself expands alongside of it. From the work and experience of the cooperative, new ones can be formed to keep the system local and to better connect to the land qualities and social practices of each area.

The vision collage (fig. 64) shows an aerial view of Hoekse Waard from the east. The differentiation of polycultural agriculture is visible on two types of soil, sandy loam at the bottom and clay loam at the top. In the distance, there is the harbour of Dordrecht, the economic link of the inter-municipal area to the rest of the economic region of SH and NL.

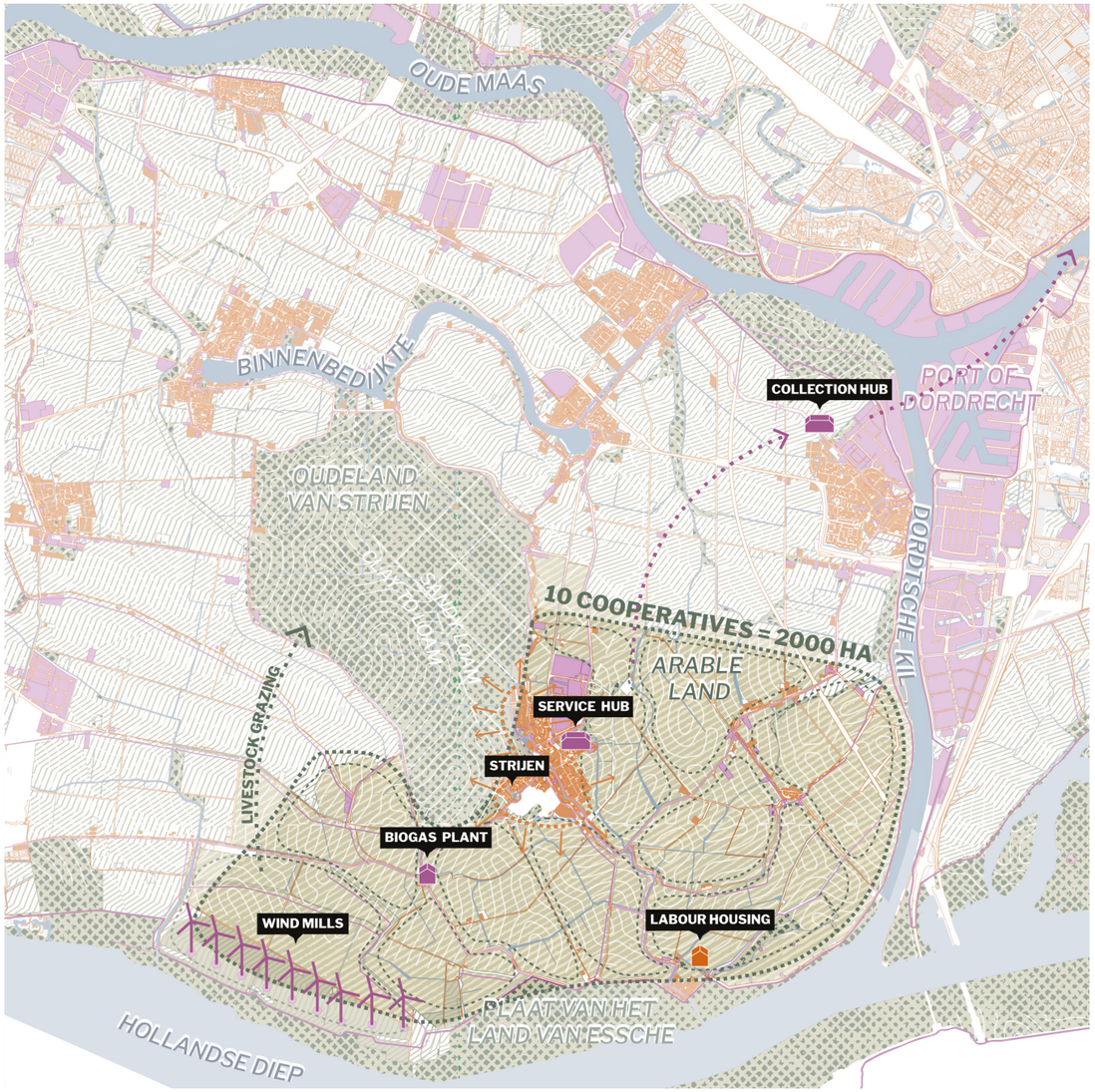


Fig. 63 0 10 200 Km

DESIGN INTERVENTION 2030

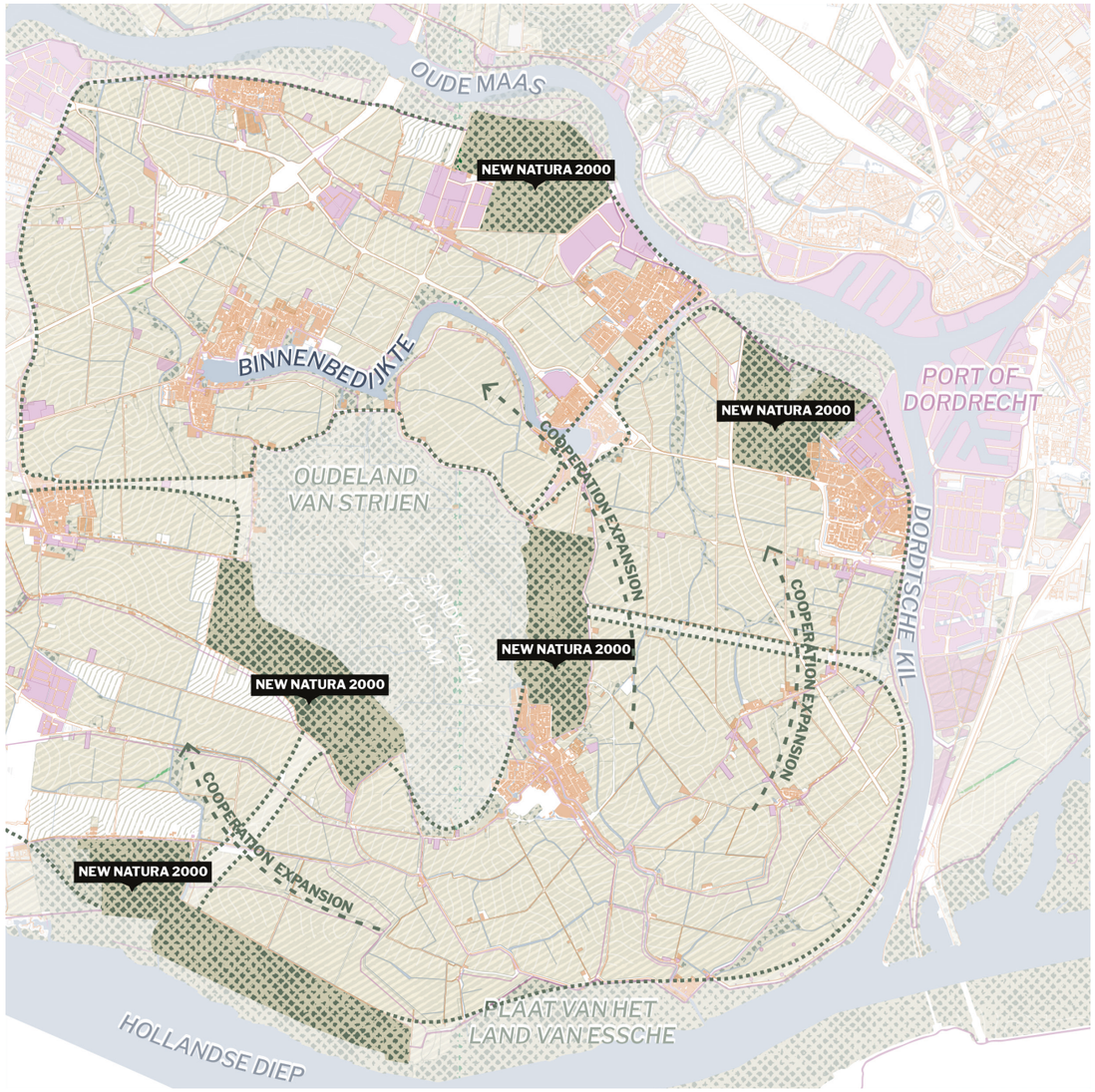


Fig. 64 0 10 200 Km

DESIGN INTERVENTION 2040

- Natura 2000
- Urbanised areas
- ICLS
- Pastures
- Clay / loam
- Sandy loam / loam
- Agricultural land
- Rural centres
- Urban centres

Fig. 65

Biokaas farm Kinderdijk, Alblasserdam

6. EVALUATION

6.1 INTERVIEW WITH A FARMER

To find out the pros and cons of our design, we interviewed a farmer to know about the feasibility of the design solution for the polyculture farming we proposed. The whole interview, including background information about this farmer, can be found in the appendix.

"EVERYBODY WANTS US TO BE MORE EXTENSIVE FARMERS"

answers Hans* as he starts to talk about the future of farming. *"I don't know if much is going to change".*

Hans owns 35 hectares of land, only one kilometer away from a Natura 2000 area. With eighty milk cows, a company that sells milking machines, a chair in a municipal party and a family of seven, his week is fully planned. The farm he owns was inherited from his parents and they inherited it from theirs.

With the introduction of new agricultural laws and funding, changes in the field are noticeable. The land he owns is used to feed the cows: four hectares of corn and permanent grassland make sure there is almost enough throughout the year. Some minerals are added. On the other hand, the manure used to fertilise the land. This micro-circuit is in his case quite small; only a small amount of manure is deposited to another location, a nearby farmer. A share of corn is also bought annually here. The amount of disposition of manure to be drained from each farm is predetermined. With the recent introduction of buffer zones around ditches, a change is about to come - less arable land can be fertilised, which means a loss of area for manure placement, and consequently more manure discharge. The Common Agricultural Policy (CAP) linked these buffer zones since 1st January 2023 to the subsidies farmers can receive for their land.

> *"Everyone has a lot of work to adjust their business to the new rules. [...] I still don't know the full details myself. [...] Just this afternoon an advisor was sitting here because it's all quite complicated".*

When I asked him about the future of farming, he seemed quite positive. *"We have a lot of land in the Netherlands, and you can't do much with it otherwise. On a lot of land, you can only grow grasses. How else are you supposed to profit from it?"* Crops, on the contrary, seem to be more difficult to fit into a business model. The only possibility seems to be to practice this on a significant size of land, in the polders, or at least in an area with large and straight plots. Shifting to large-scale crop farming means the introduction of high-value products next to less intense crops such as cereals. With a limited amount of manure available, this looks like a solution, but Hans is doubting the feasibility of this farming practice:

> *"I'm wondering whether that's really the big earning. Because the land is enormously expensive, isn't it? If the land costs 8.,000 or 90.000 EUR, calculate an interest rate of 5%, you must make a lot of money per year to ever earn that land back."*

Moreover, he does not see the point in reducing his livestock to be able to produce other crops in the future. He elaborates on the fact that in his municipality, there is a desire for more extensive farming, because of the close relation with a Natura 2000 area. A clear solution has not been presented yet. A new law that restricts the growth of the same crop to a maximum of three consecutive years seems like a transition toward change. After these years, a new crop should be introduced. *"Either I rent it to a potato farmer, grow beetroot, or another crop that is not corn, but then I have to check the rules about what is and what is not allowed."* Another issue with extensive farming is the fact that maximum yields would not be possible, which can also be seen as a sub-optimal resource deployment. Higher costs and a smaller harvest led to lower profits therefore, smaller change farmers would voluntarily like to switch to this method.

Introducing a farming method where cows are merely used to produce manure, does not seem like a crazy idea to him. He would advise to try this out on 10 acres of land. Moreover, he would not even use cows to fertilize the land: *"If you say you don't need the milk [...], I would take sheep. They are even more austere".* A discussion about the transition towards a world where the demand for dairy products is less led to an interesting statement about prioritising consumption or the environment.

> *"People are now saying we should reduce our meat and dairy consumption because that's bad. But that is reasoning the other way around, and you must reason from the environment and from the soil."*

Reasoning from environmental perspectives, the usage of sheep for manure would make sense. These animals are not ruminants and therefore emit way less CH4 (methane). In the old days, farmers in the region used manure from sheep and goats to fertilize the land.

In a way, our proposal would be to return to the past. Hans elaborates on the way farmers used to work together. This merely happened within corporations, where you could rent machinery. I explain we are planning to form new corporations that share a plot of land, machinery, and knowledge. He thinks this is a very good idea, that can ensure connectedness within the farmer community. As an individual, farming could be quite lonely. Connectivity is important within small rural communities, such as Hans'. Some neighbours have recently been bought out, causing a movement of young families towards regions with the availability of land (Groningen, Friesland). Its impact on the community is severe. Relative old people, who can afford a big plot of land with a large home, move into the farmhouses. A severe impact on the social resilience of the village is noticeable; the tiny primary school becomes less full, sports clubs are having a hard time filling teams and the village pub is missing some regulars.

> *"I'm wondering whether that's really the big earning. Because the land is enormously expensive, isn't it? If the land costs 8.,000 or 90.000 EUR, calculate an interest rate of 5%, you must make a lot of money per year to ever earn that land back."*

6.2 GROUP REFLECTION

Our research project focussed on the technical and social aspects of implementing regenerative agriculture to mitigate climate change. In-depth research about possible alternatives for livestock farming led us to a collection of farming practices, transformed into a toolbox. These tools have been around for decades, and have become more specialised over time. But, their lack of implementation is not due to their ineffectiveness. A lack of policy and financial backing prevented a widespread adaptation of these practices. What strikes us, is the fact that in northwestern Europe there is a lot of public investment in the farming sector, by means of subsidies.

The social aspect of our project involved a stakeholder analysis and a projection of how these actors will reposition through the future.It is important to recognize that the agricultural sector is not a monolith, and a collaborative approach is necessary to overcome the challenges associated with the implementation of sustainable agriculture.

Our report demonstrated that regenerative agriculture is the future, as it allows nature to restore itself intelligently. The soil is the future of environmental stability: iit is urgent to shift away from the current situation where we only extract nutrients from the soil and move towards a regenerative system that engages all ecosystem services.

In summary, our project aimed to provide a feasible solution to the challenges of implementing regenerative agriculture. We provided the why, what, and how, and highlighted the importance of a collaborative approach to ensure its success. With political and financial backing, regenerative agriculture can be scaled up and established as the understructure of our future.

6.3 INDIVIDUAL REFLECTIONS

DIVYA AGARWAL

What is the role of a vision in the planning and design proposal of your group project and how has it influenced your development strategy?

‘Spatial Strategies for the Global Metropolis’ – the title itself felt largely intimidating at first, it felt like an infant placed in a hot air balloon floating through the landscape from above but unable to see it due to its limited height. I was that infant only to realise I was being carried along the process by a tall person breaking down the landscape bit by bit for me. Now that tall person was embedded in two joint courses of Q3. Firstly, the Capita Selecta courses held in the first week itself were helpful in grasping the regional scale. The regional scale can be perceived through simple concepts often plugged together in the form of nodes and networks. A short description by Prof. Roberto Rocco viewing the tomato as part of a large complex yet simple system opened a new vision for me. Prof. Carola Hein’s Port Strategies hopping from one country to another and Prof. Alex Wandl’s explanations on different kinds of “circulars” backed me with tools to break down this regional scale to envision a plan for it. Although we were handed over many tools in that process, our group chose the vision tool that felt navigable. Choosing the right tool to expand regional scale concepts is the first step to be taken. Even though I mention the word “right”, the regional scale can be viewed under different concepts and one chooses the tool that feels right for themselves. With my group, we chose the tool of “material flow analysis” of an everyday consumed product of cheese. I know of people who would travel for fifteen hours for the kaassouffle and that was it, the right product to explore. Cheese very soon led us to the pasturelands, having worked on the design of a cow shed earlier for my undergraduate Architecture thesis, I knew slightly what I was getting into. I worked on a design thesis and this was about vast expansive grassy landscapes. These landscapes hold the valuable lives of animals and farmers that are often ignored in this commodified world. They seem to be completely left out of the network. As Urbanism students, we delved into the depth of it only to realise the importance of polyculture and regenerative farming methods. Figuring out an Integrated Crop Livestock System was an extremely important part of the process. As I constantly use the word “crop politics”, I realise how soil is a living being just waiting to be awakened by recovery after degradation. This simple understanding influenced the development strategy. The Methodology lectures, booklets and workshops opened new writing styles for me, that of narratives beyond the usual academic writing. I felt I did not understand the directives of policy and governance enough. A few lectures helped me understand their importance but they lacked the depth of their power in these regional systems. A few more lectures would introduce an international student to a different method of policy making. I am glad to be assisted by Prof. Caroline Newton and Lukas Höller, they helped in formulating independent thoughts as a regional strategy planner. Their structured feedback and their constant support helped me get through this quarter. Overall, I am happy I got to work with multicultural and varied age groups with strongly opinionated thinkers resulting in unhealthy conflicts clarified by healthy discussions.

DENISE BRAZ DEL GIGLIO

What is the relationship between research and design in your group project?

Without doubt research was the core of our group work throughout the entire quarter, taking different emphasis according to the stage of development of our project. We started out very investigative, all a bit unsure on how to handle our first impressions over the extremely complex topics that were being discussed on the first lectures that inaugurated the quarter.

Unlike other groups that had a clearer assessment of the big topics they would tackle, our experience was instigated rather by a method of approach. Inspired by one of the Capita Selecta lectures, we decided to do a material flow analysis and trace the trajectory and production process of a specific product within the North-Western European context. This vast first sprint of research led us to understand how the trajectory of cheese is imprinted over the territory enlightening where the main environmental and social issues took place.

Once we arrived at our research question (that would be endlessly rephrased throughout the quarter) we managed to understand that our research would tackle the spatial redefinition of dairy farming. Looking back, I think this uncertainty towards where we wanted to head with our research was fundamental to arrive to our shared conclusions, conceived and embraced by all of us as a result of our first research and discussions. We concluded this first research exercise with our conceptual framework, that became a concise guiding tool that could set us back on track whenever our research seemed to be pushing us in different directions. This initial shared investigation gave us the conceptual unity necessary to peruse to the next step, the spatialization of all this theoretical knowledge we already mined.

The challenge to combine theoretical knowledge with spatial solutions required specific context related studies and map analysis about the current land use status and its impacts over the land and the environment. We needed to understand where our ideas would take place and that required the unraveling of many layers. This phase was constantly fed with deeper knowledge about spatial solutions – the work process was always this exercise of zooming in and focusing on the particularities and potentials of NW Europe and zooming out and deepening our knowledge about regenerative agriculture, soil, crop rotations, policies, stakeholders and methods. We could conclude this stage with the shy materialization of our vision. From here on, research took a more focused and direct place, and we precisely deepen our knowledge on the concepts needed to feed our vision and strategy with real solutions. It was interesting to notice that each one of us naturally specialized on the area of personal interest, keeping our discussions inspired and the research productive and creative.

The extensive research allowed us to go towards a path that questioned administrative borders, deeply related to resources, social and geo-morphological configurations. At our first encounters with the tutors with the task to pitch first possible ‘visions’ our group had brought up this idea. It is interesting to see how much we seemed to have forgotten this concept during the extensive research we did, but how much it is reflected in our work. It has been a challenge for us to work with the regional scale, that none of us was experienced at. We aimed to create a vision suitable for an entire region but proposing a local decentralized approach towards land use and productivity, having to build this robust bridge that could connect both opposing ends. In my opinion this bridge has been research – leading us and connecting our ideas with solutions.

GERMAINE TER BRUGGE

In which way is the governance aspect embedded in the planning and design proposal of your group project and what are the reasons for this embedding?

The design focus within the context of ‘Spatial Strategies for the Global Metropolis’ is the creation of sustainable and resilient systems. These should not only benefit the environment, but also meet the needs of society. In the context of agriculture within Northwestern Europe, this becomes a complex challenge, given that the sector has deeply been influenced by policies and governance structures. Over the years, agricultural policies have focused on economic growth through the maximalization of productivity. This resulted in negative environmental externalities. A new policy paradigm seeks to balance economic, social and environmental gains. This means the abandonment of the linear economic growth model, and a movement towards a more sustainable future.

In our project, the analysis of the environmental context of the Netherlands went hand in hand with socioeconomic research. After understanding the role of the European Union and its significant influence on farming practises, we build a new framework for regional design processes. Starting from the north-western Europe context, ensuring effective governance through a multi-scale and multilevel approach is needed. Municipal input is key, nevertheless should the provincial, regional, national and supranational scales also be included. This holistic approach to leads to an agricultural sector where risks and benefits are shared through these scales.

Our strategy merely focusses on the actors: the public, private, and civil sector. While questioning the borders of our research and approach, we made a decision to concentrate on the future of the farmer and -communities. To be able to achieve social and environmental goals, we need a shift towards full and effective engagement. The sketching of a desirable future, the why and what, as done in our vision, is fundamental. In this vision the farmers have an indispensable role. The how is focused on through literature research, related to the needs of the farmers. Zooming out again, governance and spatial organisation are tools to implement the individual farmer strategies on municipal, regional and national scales. The decentralized governance system of the Netherlands can be used to achieve this. The supranational government sets broad policies and regulations, but the municipalities work towards this with their local knowledge about farming practises. With a focus on local micro-cycles, a new relationship between farmers and nature can be developed. Regional and national levels support and cater to the needs of these communities.

Reflecting critically on our process, the decision to focus on the small scale farmer severely affected our project. The discussion about where to stop and which stakeholders to convince led us to understand what could be a realistic goal for this project. Other stakeholders, whose role is now taken for granted, could not be taken into account. We realise that the significant share of supermarkets and large farms on governance could steer our plan in a different direction. Balancing the needs and power of all stakeholders is incredibly difficult. However, this is also leading to recommendations for further research into the realisation of this paradigm shift.

LORENZO NOVAJRA

What is the relationship between research and design in your group project?

The complexity and vastness of the topics covered in 'Spatial Strategies for Global Metropolis' have implied the need for exceptional amount of research, unprecedented during this Master's programme. It was necessary to understand a whole range of spatial, social and environmental dynamics to question our role as urbanists in this framework, to identify and solve problems on such a vast scale, never before addressed by us. The breadth of the issues addressed opens up a myriad of questions to be answered. The answer to those questions often paved the way for other, even more specific questions, so it was our task to define the borders of topics that would otherwise have been very porous. It is crucial to emphasise that the research took place throughout the whole Studio, obviously with different facets. Our methodology was not linear, as moments of reflection and analysis led to the need to take a step back from the initial queries, to question the results and to assess whether we were going in the right direction.

Furthermore, the project was implemented with a dichotomy of evidence-based solutions and personal choices. The design implementations and the selection of the variables playing a role were obviously supported by a research background, but at certain moments it was our duty to take a concrete stance on the topic, on how extreme we wanted to be for a future scenario and to logically evaluate all the consequences of our decisions. One example for us was to quantify or reduction of cattle heads to have a clear vision of the have a clear vision of the drastic impact of our vision.

The beginning of the study was based on pure literature research of the topic. None of us had an in-depth knowledge of the dairy sector in North-Western Europe, so the analysis of all the dynamics inherent in the system and the production chain was essential to subsequently understand the problem and locate it spatially.

Subsequently, a second stage of research focused on collecting the necessary data to understand what factors had to be taken into account within the project and how these could influence our decisions. Once these factors were fully understood, it was necessary to figure out how to translate these data into analysis and strategy tools and reflect them in the design proposal. The third phase of research, alongside vision and strategy, was to find research-based solutions to our design questions and to align them with our personal vision on that matter. Our effort was to convert theory-based research into spatial aspects.

Unlike previous studies, this Studio was based much less on the "Research by Design" Methodology widely promoted at our faculty. This is partly due to the inherent dynamics of the group and the approach to the design as a fusion of different methodologies. On the other hand, however, it is also due to the nature of the project itself. Research is necessary a priori to understand the subject matter. Only after a detailed understanding of the topic in question and all the variables and dynamics, can the project descend in its spatial dimension.

FEIKE SMITHUIS

In which way is the governance aspect embedded in the planning and design proposal of your group project and what are the reasons for this embedding?

Coming from the architecture bachelor at the TU Delft, I developed the opinion that the spatial expression of the built environment is subservient in importance to the large and small scale planning of that environment. The third project of the Urbanism Master went to the large scale of the NW European landscape from which I expected enormous strategic intervention. The opposite was true. Instead of approaching the environment from a spatial perspective our project analysed the space from a commodity and object point of view. What are the relations of cheese to people, industry, environment, and then, yes, the spatial impact. This approach was partly sparked by the introductory lectures of SDS and Capita Selecta, The reiteration of commodity flow between the urban and the rural started out our preliminary exploration of the given context. The choice for the commodity flow of cheese allowed us to approach the spatial realities of the locations it touched in a very narrative and logical manner. This brought out the embeddedness of governance from the private and public sector into full focus to the regard of land management. Land management being distinct here from design. Where design is hands on, land management allows for societal and economic expressions of design. Just as I held the opinion that the spatial expression of architecture was subservient to planning, I now developed the standpoint that even the spatial expression through planning is arbitrary to the social, economic and environmental conditions presented. Analysing, critiquing and then reworking of governance and their impact on socio-economic relations would be the focus for me during this project. The reworking of only governance would however not be enough. These are still institutions often perceived as removed from the problems and concerns of the governed. This combined with our authoritative role as urbanists/planners being prepared to be incorporated into the public sector or advising from the public sector does not bridge this gap. Therefore the community planning became an important aspect of the project by developing a cooperative farmer network. The sustainable land management and toolbox technologies provided are not there to be forced onto farmers but to help as a summary tool for farmers to be used. Their own local and technical knowledge far exceeds our own. Approaching the environmental problem as not that of a challenge of which practise to use but of a problem of implementation is the most valuable lesson learned during this course. This approach was greatly encouraged by our tutors, Prof. Caroline Newton and Lukas Höller. The advice and collaborative thinking by both tutors pushed our ideas and process further, being both critical on oversimplified solutions and offering directions to resolve it. The community planning theory was also immediately applied within the group itself. Being outspoken politically, I could be very combative in group discussion. This was often the wrong approach. Backing up my ideals with more argument based reasoning, which I often take for granted, helped to resolve these issues. Lastly, what I enjoyed most practically about this report is to more effectively put our group and my ideas into words instead of only fleeting thoughts in the ether.

Biokaas farm Kinderdijk, Alblasserdam

7. APPENDIX

INTERVIEW TRANSCRIPT

Interview on 05-04-2023, 16:00-17:00, recorded via zoom.

What crops are you producing now? is this only feed for livestock?

At this moment we have about 35 hectares of land, that belongs to us. We also have 80 dairy cows and therefore 4 hectares of maize to feed them. The rest is all grass. The grass include bushes, and herb-rich field margins for biodiversity. But these don't help for the production of fodder. I need to use al off this land to produce enough food for those 80 dairy cows. But that is not enough, so on top of that I also buy some feed.

To what extent do you apply crop rotation? Is the location of the corn and grassland always the same?

The grassland I have is always in the same place. It has to do with the fact that we milk with a milking robot, and a plot of a kilometre away is difficult for the cows. I can't take them there. There is no water supply, there is no power for a fence device. Controlling the animals there is difficult for me. On this plot far away I now grow the corn and a contractor takes care of it. We used to grow corn at home too, but nowadays the rules don't allow me to destroy grassland. With European agricultural policy, the grassland is labelled permanent grassland, which means you are not allowed to destroy that either. That does deter me a bit from applying that at home. Next to that, suppose I start growing corn on the pieces I can reach with the cows, on my home plot, then I can't use them for grazing the cows either. So that's why I still don't do that on those plots. But things are about to change, because the rules are going to change again. This year is the first year and then I can only grow corn on a plot for a maximum of four consecutive years, in the fourth year there has to be something else. So I have to think about what I'll do then. Either I rent it to a potato farmer, grow beetroot, or another crop that is not corn, but then I have to check the rules about what is and what is not allowed.

Do you use cow manure to fertilise the land?

All the manure from the cows is used. Well, I still drain. Just this afternoon an adviser was sitting here, because it's all quite complicated with the rules. They are a bit stricter again: I have to leave 1 m or 3 m or 5 m buffer strip along each ditch, which does not count for fertilisation. So that automatically means that I drain more manure from my farm. And basically it just goes like this: you look at how many cows and land you have, from there you can calculate how much manure you are allowed to use on the farm. The rest is disposal. I dispose 300 cubic metres of manure. Most of it goes to someone where I also buy corn. He fertilises his land and I buy that feed back later, which in itself is circular. I personally think the big disadvantage of the system is that I like to take the cows outside, just in the meadow, but that also means they defecate a lot outside in the meadow too. In consequence, I can't collect that manure in the basement. So, I have to remove 300 cubic metres of manure. So then I have too little stock to fully fertilise my own land: that's a bit crooked. That almost causes me to keep the cows inside more than I would actually like. I don't think that's good, not even for the environment.

Is it a problem that there is an accumulation of manure when the cows are outside?

Yes that too, we prefer to spread the manure with a machine, so that we can spread it accurately. But I don't mind that so much in itself. For the grass it's not so bad either, it does spread a bit. But the disadvantage is that you don't have the manure and urine in the pit so you can't dispose it. On this farm, the cows walk on 8 hectares every time, and those other bits I mow for fodder. But for where I mow I have to apply manure or fertiliser with the machine, because otherwise the crops won't grow.

Because the cows end up sitting on the same piece on the same back acre all the time, or does that shift?

Yes that shifts: soon I'll be taking the cows out and then they'll come into a piece of about 7 or 8 hectares, I have to see how much grass there is. There will be about 1,500 kg of dry matter per hectare there, which is about 15 cm high. When you go to mow, you wait until 18 or until 20 cm, then there is 3000 kg of dry matter, so that takes a few more weeks. My cows walk in that piece, then I mow those other pieces, around there, and then after that we use a bit of fertiliser. Then another plot grows, also until it is 15 centimetres, then the cows go to another piece, they walk there again for 6 weeks, and then that piece is fertilised again; afterwards we mow again. This way, the cows have a fresh plot every 6 to 7 weeks. That is then nicely mown, young grass and the cow's manure is not there yet either. Wherever a cow defecates on a plot, the grass grows very fast around it. But they don't like that, because it stinks and they don't eat that there. So it's best to have cows in a nice mown pasture again. That is, at micro-scale, the crop rotation of the cows, grazing a different piece each time. In spring, the grass grows fast, then I can have ten cows per hectare. Soon in summer, then we go down to 7 or 6. That depends on how the grass grows, but then the piece where they walk has to be a bit bigger. Otherwise they can't stay there for six weeks.

What does sustainable farming mean to you?

Well, I would say my bank account stays filled, but you know, we are quite busy with sustainability. The milk processing establishment looks at how many litres I produce and how much fat and proteins it contains. They also calculate how much CO2 emissions you have per litre of milk. For me, that's just a calculation in hindsight. You can steer very poorly on this number, for it depends on whether it's a growthy or dry year. Right now, I am going to fertilise a plot of land, but if there is no rain, the effectiveness will be much lower. You do prefer that you maximise that input, which will lead to the least emissions. Any loss we have is also efficiency loss, which will have an influence on the profitability.
In terms of sustainability, I think I'm doing okay. We have quite a lot of solar panels on the roof. We milk with a milking robot, I just got a new one that is much more economical. The old one was 13 years old, this one is 20 KWatt per day more efficient. I have heat pipes, for the hot water. In the barn, I no longer use gas at all, and I try to generate all electricity with solar panels. Where normally in a parlour a lot of milk comes twice a day, now a little bit comes the whole day. That's why I can make use of a smaller cooler. The heat goes back into a big 600L vessel, the recovery of heat from the milk, and that water goes back into another boiler where the heatpipes are located. This way, we can extract 80-degree hot water, which we use for cleaning the tank and the robot. I have almost no machinery, an economical new tractor and an electric shovel. I can run my entire farm on 1,000 litres of diesel a year. This is also because I have a lot of land near home, if I had to go everywhere to fetch feed it would have been much less sustainable. It is most sustainable if the cow itself collects the grass from the pasture, but that does not always fit within the farm. Sustainability helps me a lot in the wallet.

And what exactly about the buffer zone you mentioned earlier? Is this mandatory?

Yes, this is mandatory throughout the Netherlands. I'm on the municipal council, so I'm not much for demonstrating. But when the buffer zones were introduced, nobody protested: not the bank, not the accountant, not the farmer. Even though everyone has a lot of work to adjust their business according to the new rules. It's a loss of manure placement space. I still don't know the full details myself. If your land is located next to a water-bearing ditch that offers water all year round, you have to stay 3 m away from it on both sides. Here it's a hilly area, so we don't have an aquifer, it's dry in summer. That's why we have to stay one metre away from it. If you have a ditch that is nearby the Water Framework Directive, which is

a heavier category, you have to stay 5 metres away from it. This does not count for manure placement which also means you have more manure discharge.

So it is a legal requirement to just apply that strip?

It is enforced precisely with the common agricultural policy, where you have to register everything. Some farmers say, no, I won't participate. But if you don't comply with the rules, you won't get agricultural support from Europe. Soon, the Water Framework Directive will become compulsory. Then you can't say, I won't do that, because you are obliged to comply.

Do you notice that the land becomes less fertile, and you have to use more manure?

No, I cannot say that the land is becoming less fertile. But, there are much less minerals in the feed. In fact, you have to see it this way, you should not use the manure to make the plants grow, you should instead stimulate soil life, the bacteria in the soil and soil fertility. But that doesn't just require nitrogen and phosphate. It also requires magnesium, potassium, manganese, boron; all those trace elements. That is more likely to become deficient in the soil. So this is also less present in the feed, and means I have to supplement. There is very little phosphorus in it now, I notice that in the cows after calving: when they have too little phosphorus they can't get up. You get all those kinds of problems because of that.

So you solve that by adding those minerals?

Yes, but I have mixed feelings about that: its much less natural. I do regret that sometimes. I used to say, what an organic farmer was when I attended the HAS [University of Applied Sciences] in 1992, that is what we are doing now. We are much more careful with the soil. There is less extreme fertilisation, less soil pressure and row damage. The contractor also drives over the plots with low instead of high pressure. Next to that, we make use of GPS, which is much more accurate. It also provides information about the compactness of the soil, and the oxygen levels. The contractor that works for me has light sensors in the grass mower: with infrared spectrometry and GPS I can evaluate how much sugar and protein the grass contains. Therefore you can fertilise less than was usual in the past. Now you are more likely to notice if you make a mistake: if you don't hit a patch, you can see it immediately in that plot.

Do you feel you can compete against big farmers?

Yes, more than enough. I don't see the economies of scale in cattle farming. When a farm gets bigger, its private expenditure are a relative smaller part of the costs. Let's say our farm delivers 550.000 litres of milk, and our private expenditures are approximately 6 cents per litre. If my farm would produce 1 million litres of milk, that would make a difference. But, there are many other aspects of a farm that also affect these costs. I bought about 3 hectares of land last year, which cost about €90,000 per hectare. If you have a smaller size farm, that financing weighs more heavily on the whole. When I consider how much profitability we make with our cows, that is much bigger than at larger farms. We have old-fashioned fat cows, which don't give as much milk, but they also need less concentrate. I am lucky to own land close to the barn. If you don't have that, the cows cannot be outside as much. Those cows spend more time inside, have to eat more pellets or other products, and results in higher vet costs. In short: more revenue, but also higher costs. For some, one farm model fits better than the other. Me and my wife do all sorts of things next to the farming, which would make such a farm unsuitable for us. If our cows would give 10 or 15.000 l of milk, everything has to be absolutely on point, which is just like someone running a marathon every day. A strict feeding time and monitoring which cows still have to go into the milking robot: in our situation that is just not possible. It's all a bit lower level, which makes it much more sociable. That's the difference. Because we do other things on the side, our family expenses don't have to come out of the business revenue as much, which makes it work for us. In short, the differences are: how much family expenditure do you have? How much financing do you have? How is your business parcelled out? And what is your ambition? Yes, someone who wants to milk 200 cows, has to invest a lot in that respect.

What about the subsidies you mentioned, on what ground do you get these?

The subsidies started when the EU was established to ensure food security. They never wanted hunger again, leading to a great incentive for increased production. Did you produce more, you would also receive more subsidies. This was extremely successful. Eventually, the high production led to big surpluses. Next to that, the EU had shielded the market by import duty and export subsidies, resulting in a protected market. After worldwide consultations with Amerika, among others, these levies had to go. That meant more meat import from Brazil and more milk from America.
Then we had to give up, we have 10 hectares of maize and it was said per hectare you get so much support. What the EU spent on import duty and export support, was a certain amount, and then they calculated back and you got paid that. So no longer related to production, but related to the farm. Well, that has been phased out, phased out, phased out for a very long time. I think it was eight or nine years ago that we received €800 per hectare in aid, and now it is still at 300, until last year I think. And next few years that will go even lower, I'm just saying, to €200 per hectare, but for that you have to do so much about biodiversity. There are a number of requirements you have to meet, and then you get that amount.

And, so that means that the EU is putting a lot of money into other pots, because this has been very much phased out in recent years?

Yes, but the whole budget at the EU is also less. A lot still goes to Natura 2000 area development and it also goes a lot to site management organisations, say Schiphol. I think Schiphol in the Netherlands gets the biggest agricultural support of anyone. That is simply because they have a lot of land. And then they say we have so much fallow land, well, then they get set-aside premium and in such a way it is still unfair. For me, the ideal situation was: abolish the whole subsidy, rubbish, abolish everything. Yes, I would really hope that would happen.

What would happen then?

Then you have to pay a bit more at the shop for the milk and cheese and everything. And that's fine too. That amount, that should be much more linked to something we want socially in the country. So no more food security, that's settled now. I won't say that the Netherlands, if we continue like this, can still produce enough food for itself, it is very often said. But I hardly think so. But that could also come from Germany or from Poland. Now some farmers are very dependent on that, on that amount. And now if you make a mistake in filling in the manure, you get fined the amount of the subsidy. That's a lot. Look and I just find that very unfair. And normally you have to assume that even if you have an agricultural business, you should be able to earn your money with your normal way of working, and not that you are dependent on subsidies. That's just super bad. But a lot of people disagree with me. Of course, if you have a big company and you get €20,000 or so, that's a lot of money. Your income, that consists of the subsidy, your family income. The rest of the business, you use that a bit to keep your business going. Yes, I think that's a pointless way of working. But that's my personal opinion, mind you. Not many people would agree with that, I think.

How is your relationship with other farmers? Are there any collaborations? As you said you have an agreement with another farmer about the exchange of manure and corn, does that happen a lot?

I'm extremely busy in winter. With this neighbour I have long-standing appointments, which is very convenient for me. This afternoon a consultant

came to see me and said you have to remove so many cubic metres of manure. And then I can say to the other man, you get so many cubic metres from me, is that fine? Yes, that's fine and then I get maize from him and then it's done. Most farmers use transport companies, they come with a truck that collects the manure from you, because it might be €1 cheaper per cubic metre. They want to remove the manure as cheaply as possible, then it goes to Groningen or Friesland. But they then later buy maize back in Germany, for example. To me, it makes sense that where you get the feed from, that's where the manure goes too. That is the ideal situation, because then you have a micro-cycle. And for the rest, yes, I get along very well with a lot of farmers. You also have to keep in touch with the neighbours, because if I just walk around the barn, I just get dead lonely. But in terms of farming, it's not as much as it used to be. It used to be a lot more. The cooperative is still there though. I am still chairman of a cooperative, say a contracting cooperative. There we still have a contract work company with 34 farmers. They used to have a combine or harvester there. They used to do joint purchasing, and then you could rent machines there. But that is different now. The machines are now very expensive, so now it's just a contracting company. We own the company with 34 farmers. Well, they now have a turnover of 7.5 million euros, so it is already becoming a very big company. And the agricultural works they do, that's part of the business.

How does land ownership work? Do you own the land?

Yes, I am an owner. Here in Twente there are quite a lot of estates where you pay rent, but in other parts of the country it is much, much more. And here in Twente it's all from the past, from grandfather goes to father and then on. That's much more regulated here.

Some questions about the future. Can livestock farming remain a revenue model in the future?

Yes I think so absolutely, yes, yes. We have a lot of land in the Netherlands, and you can't do much with it otherwise. On a lot of land you can only grow grasses. How else are you supposed profit out of it?

And growing crops?

Can be done, but it is more difficult to fit in business operations. For me, that is very difficult. I do think it can be done, though, but you have to have a certain size, don't you? If you are in the polders of the Netherlands, they have large, straight, square plots. And with us, it's all high, low, small pieces, two hectares, three hectares and lots of wooded walls, no straight pieces all. For that, it's all more difficult. It might come. Everybody would like us to become more extensive. If you become more extensive, in my mind you have a few more hectares. But you don't have more manure from the cows. So you are going to use manure to apply certain hectares of high-value products. Other bits where you have products or crops that require less intensity, like cereals. But whether that's really the big earning I wonder. Because the land is hugely expensive, isn't it? If the land costs 85,000 or 90,000 euros, and calculate an interest rate of 5%, you have to make a lot of money per year to ever earn that land back. That's just the very big disadvantage.

How do you see the future of farming? Do you think a lot is going to change?

I don't know if much is going to change. I always say at our house, you shouldn't become a farmer at all. You can work much easier at another company. Then you work 30 or 40 hours a week and then you're done, then you go on holiday once. You have a much more secure existence with a boss. That's going to change, though. We have a lot of Natura 2000 areas here in Twente. That's definitely going to change too. Next to that, we are supplying to Friesland Campina, a corporation that processes a lot of milk. We also own a little bit of that of that dairy. You get your milk paid out, and part of the profit is put into the company, and part is paid out. We have always bought bonds from that payout back into the company itself. And so over time, you become a little more owner of the company. But the risk comes later: Friesland Campina processes 11 billion litres of milk, which is the largest company in the Netherlands. Just watch as more farmers stop, that tipping point of the company swings the other way one day and then the critical mass becomes too small for the company. Then your factory has to start divesting. Your sales become more difficult, that would be very damaging not only for the farmers, but for the whole of the Netherlands.

For the economy at all?

For employment. And that's a bit of a risk for the future. For example, at Friesland Campina, at ForFarmers or at the compound feed companies, those are risks. But other than that, if you have the kind of business we have, we're doing pretty well, you can do it for another 50 years. That's really nice work. Whether a young person or our children are like 'I'm going to be a farmer', if someone really wants to do that, I don't know, but you're stuck with it your whole life. If you have a job and you tell your boss that I don't like his head, you can go somewhere else and start something else. As a farmer you can sell it, then you're done too. I actually always see the future in a very positive light. For the younger generations: it has always been uncertain. The difference between an ordinary job and being an agricultural entrepreneur is extreme.

About the Natura 2000 areas, does any part of your land border on them?

No not directly to us. In the municipality, we are almost the furthest away from the Natura 2000 sites, but it is all within 1 km.

Do you then notice that the neighbours are already more bothered by this? Are they already having to change things?

The people where the Natura 2000 area has been established and where they have their property in it, they have already received a notice of expropriation. These are now the consultations about not being allowed to fertilise there anymore. You are no longer allowed to take the cows outside, so they do notice. But they have had talks to get replacement land.

Is that the offered solution?

Yes, but the solution socially is of course heavily seamy. Other farmers may want to have 200 cows or 150. And then the province says fine, we'll buy your farm, you can go to Drenthe or Groningen or somewhere else where there is more space. Well that's fine, and I don't begrudge those people that. But the problem is that it is in fact only a small village, and the people who are leaving are not the 80-year-olds, they are young families. And those young families with small children, they are no longer at school here. They are no longer at the sports club. They don't go to the carnival, and that's what I find unfortunate, the area is actually becoming less populated.

Who will come back in place of those young families? Who will they put back?

Preferably someone from the West of the country with a very fat wallet. Who turns that into a nice villa. These are usually people who are a bit older, who are already 50, 60 years old. Those have already earned the money. Look, and what do those people do who come, they don't sit with us in the café at night, they put the Porsche in the garage, they put one of those big, automatic fences around their property, close the gate and then they sit in the house. Then this weekend we have to get wood for the Easter fire, and then they don't go with us. Things like that.

So there are some people who have already moved?

Yes, there are quite a few of them already yes. We do sit here in little Wassenaar. Don't underestimate us, we are so moving along. Fewer and fewer farmers

and more and more people with fat wallets, yes. And then the land is distributed, or for other farmers who have land very close to nature. Or some more nature is developed.

Are you willing to reduce livestock production to be able to produce other crops?

Why? Why would I want that, then?

This is about that integration of crops and livestock. That, for example, you can use that manure locally, so suppose you then have some of fewer cows and produce other crops on that grassland. Suppose that is profitable, because I imagine it is not now, would you want to do that or would you have to be forced to do that?

What I said at the beginning, if I have to become more extensive, if that is the desire, and that is so near us in the Natura 2000 area. I cannot have more cows, because then I have more nitrogen emissions. Then I have to come up with something, that I also earn something on that other land. I could then use that for my maize land, where I am now only allowed to grow maize for three years, and then I can do that on his land the other year. The land that is left I should then use for crops that do not require slurry, because that is the restriction. Now the thing is, I have to dispose of the slurry, but I am allowed to buy all the fertiliser back. That is a very strange rule, and I have a very bad feeling about it. But anyway now is the time, and then you have to use the slurry to work a certain part of the land more intensively. And that you have other plots that you farm extensively, but that also means that you never get maximum yields there. You can never produce against people who are in the polder on the big plots. That is impossible. But yes that would be an option. But then I would have more work, and if there is anything I dislike, it is more work. Then again, I shouldn't.

Do you notice changes in politics after the farmers' protests?

No, not after the protest. Now there are many debates because BBB has become the biggest in the province. Now you get that the House of Representatives makes a law, which later may not be supported at all by the Senate or not by the provincial governments. In that case we all have no solution. If you want to govern the country, you have to come up with a solution. And that is not there now. The Natura 2000 areas are very much in our neighbourhood, aren't they? Look, that's fine, you know. We have always been careful with nature. It does feel a bit like punishment now, because you've always been frugal, it's now being set up as a Natura 2000 area. Fine, because we do like nature. But now nitrogen emissions are very much controlled and the critical deposition value stands in the way. This means that, as we have already been asked in the municipal council, if you stop every farmer, every business in the municipality and if there are no more traffic movements, we still do not comply with the law. Then the critical deposition value is still all red. That just can't be right, so then nothing at all is allowed. I think it is fine that we have to be careful with nature, I completely agree. That value is too modelled. We did raise this with the province as well. You just shouldn't have that in the law. Then you won't be able to do anything in these areas, because if someone says, "Gee, I want to renovate my house," and then someone says, "Ho ho ho, you have nitrogen emissions, that's not allowed. Then you can't do anything anymore. That would be super bad.

In our project, we make a proposal to slowly reduce the dairy cow and stop focusing on milk and cheese production. The manure from the cows will still be used. Of course, this is quite a big change. What do you think when I say something like this?

I don't think what a crazy idea, but I would advise: try it once on 10 acres or so, to make that happen. But then I wouldn't take a cow at all for that, I would take a sheep. That's even much better. Because the cow in your example doesn't have to make milk, does it?

No, it's not necessarily about that, that's more of a by-product. But, people don't want to get rid of cheese all at once anyway, so we thought of a middle ground, where instead of eating two cheese sandwiches every day, people can only eat it once a week. Continuing on what you said:Is a sheep better in terms of emissions?

A sheep is even more austere and would make sense, if you say we don't need the milk. You just have to go back in history. The people here in the barren sandy soils, they had a goat and they had a sheep, who nibbled heather or grass. Those heather slabs were put in a shed in winter, the sheep walked on them, and afterwards the manure was put on them. That was released on that high ash ground (high-lying field). They all weeded that up with their wheelbarrows, and that's how that soil became so high and fertile. I would say that's a very good system.
We also have fertiliser or fertiliser substitutes these days, for example, and we are also working on biogas, soil manure fermentation, at our company, to ensure that you do not emit to the environment, but that you store that gas so that people can use it to heat their homes. I think that's more the circular idea. It is yes fine if you investigate that, eh, you also have to do something. People are now saying we should reduce our meat and dairy consumption, because that's bad. But that is reasoning the other way round and you have to reason from the environment and from the soil. And then I would say, yes, don't take a cow but take a sheep, because they can make do with more meagre products. You can also do with a cow, but as ruminants they emit a lot of methane gas. Then you still keep a loss. But I don't know if it will work either.

Going back to when you said we should go back to the past: we have now figured out that we would switch to smaller pieces of land, alternate crops and use cows mainly for manure. Farmers would own a piece of land together and form a corporation, within which you rotate, can use machinery together and share knowledge.

Yes, that would be very good. If you have a group of people who would want that, you also have more connectedness with each other. Otherwise everyone would act individual: an individual company on its own piece of land. And that, that all seems very nice and maybe people from the city also like that, but I would guarantee you that you will get very lonely if you are only on the farm. I would encourage that they work together a lot and share knowledge. Machinery could be in a sort of pool, there is probably something to invent for that.

ABBREVIATIONS AND GLOSSARY

Agroforestry - the intentional integration of trees and shrubs into crop and animal farming systems to create environmental, economic, and social benefits

Arable Land - capable of producing crops; land suitable for farming

CAP - Common Agricultural Policy

CH_4 - Methane

CO_2 - Carbon Dioxide

Community Planning - a form of urban and regional planning that incorporates social, economic, and environmental considerations to guide future development at the scale of neighborhoods, towns, cities, and regions.

Conflict - to come into collision or disagreement; be contradictory, at variance, or in opposition; clash
Cooperative - working or acting together willingly for a common purpose or benefit.

Cover crops - cover crops are plants that are planted to cover the soil rather than for the purpose of being harvested.

Crop Rotation - the practice of growing a series of different types of crops in the same area across a sequence of growing seasons.

Crop - the yield of such produce for a particular season.

ECSC - European Coal and Steel Community.

EEC - European Economic Community.

ES - Ecosystem Services.

EU - Europe

Fallow - ploughed and left unseeded for a season or more; uncultivated.

Farmer - a person who farms; person who operates a farm or cultivates land.

Farming - the act of operating a farm.

Food Security - when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

GHG - Greenhouse Gases.

Governance - the action or manner of governing a state, organization, etc.

Grassland - land with grass growing on it, especially farmland used for grazing or pasture.

Grazing - the act of eating grass on a pastureland.

Growing Season - crop growing season depending on climate, soil health and other suitable conditions
Hectare - unit of area in the metric system equal to 10,000 square metres.

ICLS - Integrated Crop Livestock System (term picked up from Sekaran, Udayakumar, Liming Lai, David A. N. Ussiri, Sandeep Kumar, and Sharon Clay. "Role of Integrated Crop-Livestock Systems in Improving Agriculture Production and Addressing Food Security – A Review." Journal of Agriculture and Food Research 5 (September 1, 2021): 100190. https://doi.org/10.1016/j.jafr.2021.100190)

IPCC - Intergovernmental Panel on Climate Change
Land Reform - a form of agrarian reform involving the changing of laws, regulations, or customs regarding land ownership.

Land Use - the management and modification of natural environment or wilderness into built environment such as settlements and semi-natural habitats such as arable fields, pastures, and managed woods.

Land Value - the value of a piece of property including both the value of the land itself as well as any improvements that have been made to it.

Livestock - the pigs, cattle, sheep, and other useful animals kept or raised on a farm or ranch.

Logistics - the planning, implementation, and coordination of the details of a business or other operation.

Manure - excrement, especially of animals, or other refuse used as fertiliser.

Monoculture - the use of land for growing only one type of crop.

N_2 - Nitrogen.

Natura 2000 - a network of nature protection areas in the territory of the European Union.

NH_3 - Ammonia.

NL - Netherlands.

NW - NorthWestern.

Pastureland - an area covered with grass or other plants used or suitable for the grazing of livestock; grassland.

Peat Soil - formed by the accumulation and decomposition of organic materials (derived from plant remains) under the waterlogged environment where there is lack of oxygen

Policy - a course or principle of action adopted or proposed by an organization or individual.

Polyculture - the use of land for growing two or more than two types of crops.

Regenerative - tending to regenerate.

Rewilding - the practice of returning areas of land to a wild state, including the reintroduction of animal species that are no longer naturally found there.

SDG - Sustainable Development Goal.

Silvopasture - the deliberate integration of trees and grazing livestock operations on the same land.

Socio-Economic - relating to or concerned with the interaction of social and economic factors.

Soil Health - an assessment of how well soil performs all of its functions now and how those functions are being preserved for future use.

Soil Texture - the proportion of sand, silt and clay sized particles that make up the mineral fraction of the soil.

Spatio-Temporal - belonging to space and time or space-time.

Stakeholder - a person or group that has an investment, share, or interest in something, as a business or industry.

Subsidy - a direct pecuniary aid furnished by a government to a private industrial undertaking, a charity organisation, or the like.

Sustainable - pertaining to a system that maintains its own viability by using techniques that allow for continual reuse.

Tillage - the operation, practice or art of tilling land
Wetland - with wet or spongy soil such as marsh, swamp or bog.

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