

Online exhibition



R&D studio Spatial Strategies for the Global Metropolis (AR2U086 & AR2U088), part of MSc Urbanism, Delft University of Technology

This exhibition presents results of the Research & Design studio *Spatial Strategies for the Global Metropolis*, part of the *MSc Architecture, Urbanism and Building Sciences/Track Urbanism* programme at Delft University of Technology.

Students of the 2023-2024 edition of the studio explored how sustainability transitions affect peri-urban areas in a selected Dutch sub-region of the Rhine, Meuse and Schelde delta region. Taking as a starting point the challenges around the CO2 and Nitrogen balances, they observed how the multiple and often interrelated spatial claims that transitions lay on these areas unfold above, on, and below ground, envisioned how claims can be accommodated within scarce space, and how they can be reconciled with other competing demands for this space. Using the concepts of circular economy, decentralisation, and sustainable land use, students addressed core issues in ongoing Dutch national spatial planning. The resulting projects, presented in this exhibition, set out visions and strategies for a more sustainable and just future.

The responsible section of the quarter Spatial Strategies for the Global Metropolis is Spatial Planning & Strategy. Results of the studio feed into the [Democratising iUst Sustainability Transitions \(DUST\) project](#), funded under the European Union’s Horizon Europe research and innovation programme; and the project [A Spatial Strategy for the Eurodelta, boosting a circular built environment \(ASSET\)](#), led by the municipality of Amsterdam and co-funded by the European Union through the INTERREG program. PortCityFutures, an initiative of the Leiden-Delft-Erasmus (LDE) collaboration between universities in Southern Holland, supports the studio.

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Introduction



Urbanism is concerned with understanding the spatial organisation and dynamics of the built environment and with inventing new ways to maintain spatial quality and equality. The MSc Urbanism education at the TU Delft develops core knowledge and skills as a basis for innovative practical and theoretical applications. It provides students with typological knowledge and insights into urbanism tools and techniques. MSc Urbanism is a scientific design education, characterized by interaction between thinking (analysis and reflection) and doing (the speculative/intuitive imagination of spatial interventions).

Regional design is the core theme of the Spatial Strategies for the Global Metropolis studio that occurs during the third quarter of the MSc Urbanism curriculum. The way global economic powers and planetary natural change influence spatial development is best sensible at the regional level. The practice of regional design explores prevailing spatial conditions, political agendas, and planning regimes, by means of analysis and imagination. It promotes and debates solutions to improve good democratic decision-making, and to inform long-term strategic planning approaches to desirable spatial change.

Sustainability transitions - Students of the 2023-2024 round of the studio investigated how 'sustainability transitions' affect areas 'beyond the urban', which are highly dynamic due to the multiple spatial claims that these transitions unleash in-between urbanised areas. Claims are ordered by two plus one main themes: CO₂, nitrogen, and water. It is important to note that the theme 'water' is overarching; it can be expected that most projects cover aspects of it. Students observed how claims unfold above, on, and below ground, envisioned how claims can be accommodated in specific spatial situations, and how they can be reconciled with other ones in areas. Students used the concepts 'circular economy', 'decentralisation', and 'sustainable land use' to discuss issues that matter in ongoing Dutch national spatial planning.

Areas beyond the urban - The region under investigation for the 2023-2024 round of the Spatial Strategies for the Global Metropolis studio is a self-selected Dutch sub-region of the Rhine, Meuse and Schelde delta, which has a population of about 4.5 million, and is in one of the densest, most urbanised, infrastructure-richest and affluent mega regions of Europe. Focused on peri-urban areas in the above-described multi-scalar setting. These areas are constituted by land covers that are not dominated by urban or industrial use, including agricultural areas; forest and semi-natural areas; wetlands; inland waters; and marine waters. This focus does not exclude the consideration of what is typically considered the "urban fabric," including areas such as urban centres; towns; suburbs; villages; industrial centres; main road, rail, water, energy, and material infrastructure; etc. Depending on the selected sustainability themes and related spatial claims (CO₂, NO_x), analysis, visioning and strategy-building will require an account of the interactions between peri-urban areas and these more urban structures.

A vision and strategy - Responding to their assignment, students formulated spatial visions and development strategies that support a socially cohesive transition towards circularity in the South Holland region. Their designs - presented in this exhibition - imagine the redesign of material flows that currently produce grave negative environmental and social externalities in the region and that have therefore been identified to be in particular need of reform. Building upon knowledge gained during the supportive course Research & Design Methodology for Urbanism students also paid particular attention to ethical issues involved in the activity of planning and designing, in particular socio-spatial justice.

Exhibition



Students’ regional designs - This exhibition presents the projects that the 18 student groups of the 2023-2024 Research & Design studio *Spatial Strategies for the Global Metropolis* have designed over the course of 10 weeks. Each project is represented by an executive summary, which gives key information on the project, and the title page of the group’s project report. Visitors who want to gain a deeper insight into projects can access the actual project report in the TU Delft education repository via links collected in this exhibition.

How to take a tour - Projects are organized according to the two plus main themes of the studio: CO2 and nitrogen, while water remains an underlying common theme that becomes central in some projects. By clicking on the below tiles, visitors are led to a theme page that gives more information on the respective material flow in the South Holland maritime regions, and that lists projects that investigated this flow. More information on a listed project can be accessed through clicking on the title of the project. All routes are indicated by links that have a blue font.

Image: Anne Marije Bodde

CO2

NITROGEN

CO2

CO2 emission & carbon sinks, carbon capture and storage - Several key areas hold potential for effectively mitigating carbon emissions and fostering a greener future. One crucial aspect is recognizing the role of soil as a carbon sink. By transitioning from intensive to extensive farming practices, agricultural production can be optimized to maximize carbon sequestration in the soil. Emphasizing the re-use of soil and adopting regenerative agricultural techniques can significantly enhance the soil's capacity to store carbon. Vegetation also plays a vital role in sequestering carbon. Integrating agroforestry practices and encouraging the preservation and expansion of natural vegetation can have a profound impact on carbon sequestration. However, it is essential to strike a balance between such initiatives and the need for agricultural production to ensure food security. The oceans hold vast potential as carbon sinks, but their health is crucial for effective carbon sequestration. Protecting marine biodiversity and habitats is vital to enhance the oceans' capacity to absorb and store carbon. Sustainable fisheries management is essential to maintain the delicate balance between carbon sequestration and food production. Carbon capture and storage (CCS) technologies are pivotal in the fight against CO2 emissions. Repurposing empty gas fields in the North Sea for the storage of captured carbon presents a viable option. Implementing and advancing CCS methods will be crucial in achieving climate goals.

CO2 emission & renewable energy production - Renewable energy production is a key aspect of reducing CO2 emissions. Prioritizing local and decentralized renewable energy production, such as solar, wind, biomass, and geothermal sources, can significantly reduce

reliance on fossil fuels. However, it's essential to carefully consider the impact on land use, including above and below-ground spatial claims like sweet water storage and underground infrastructure. The development of renewable energy transport infrastructure, including energy grids and sub-stations, is essential to ensure efficient distribution and utilization of clean energy. However, striking a balance between energy infrastructure and preserving the visual and spatial quality of landscapes, including historical ones, is imperative.

CO2 emission & a (bio-based) circular economy - The transition to a (bio-based) circular economy is another key step in reducing CO2 emissions. Producing bio-based feedstocks and raw materials is critical for the building industry, bio-based plastics, and fuels. A circular agriculture approach that emphasizes the circular use of bio-based raw materials, agricultural waste, and organic waste from food industries and households can further enhance sustainability.

MINISTERIE VAN BZK 2022. Programma NOVEX [Program of the National Strategy on Spatial Planning and the Environment Extra]. The Hague: Ministerie van Binnenlandse Zaken en Koninkrijksrelaties.
MINISTERIE VAN I&W 2022a. Water en Bodem Sturend [Water and Soil Guiding]. The Hague: Ministerie van Infrastructuur en Waterstaat.
MINISTERIE VAN LNV, I. W., AND BZK, 2022. Startnotitie Nationaal Programma Landelijk Gebied [Starting notions on the National Program Rural Areas]. The Hague: Ministerie van Landbouw, Natuur en Voedselkwaliteit, Ministerie van Infrastructuur en Waterstaat en Ministerie van Binnenlandse Zaken en Koninkrijksrelaties.
MINISTERIE VAN I&W, E., BZK, LNV, AND BZ, 2021. Uitvoeringsprogramma Circulaire Economie 2021-2023 [Implementation Program Circular Economy 2021-2023]. The Hague: Ministerie van Infrastructuur en Waterstaat, mede namens de ministeries van Economische Zaken en Klimaat, Binnenlandse Zaken en Koninkrijksrelaties, Landbouw, Natuur en Voedselkwaliteit en Buitenlandse Zaken.
MINISTERIE VAN LNV 2018. Landbouw, Natuur en Voedsel: Waardevol en Verbonden - Nederland als Koploper in Kringlooplandbouw [Agriculture, nature, and food: Vannuable and Connected]. The Hague: Ministerie van Landbouw, Natuur en Voedselkwaliteit.

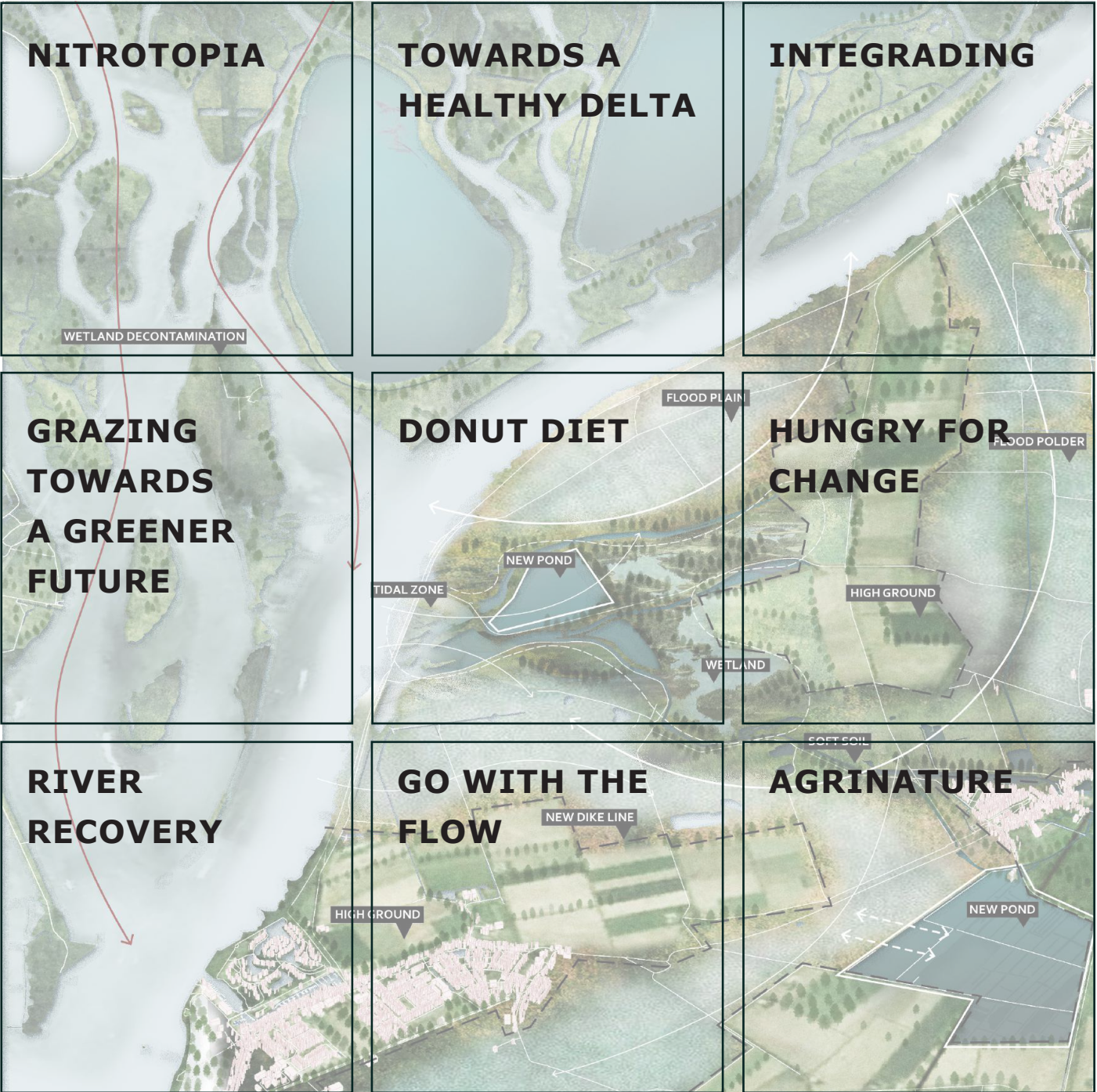


Nitrogen

Nitrogen & nature - The pressing issues surrounding nitrogen and its impact on nature demand immediate attention and sustainable solutions. Creating space for nature is crucial to preserve biodiversity and mitigate the effects of excess nitrogen emissions, particularly from intensive animal farming and agricultural activities. Encouraging practices such as agro-biodiversity, biological farming, and agroforestry can help restore ecological balance and reduce nitrogen-related environmental impacts. Additionally, investing in nitrogen infrastructure, such as the construction of a new Euro-pipeline for nitrogen/ammoniac, can aid in more efficient and responsible nitrogen distribution. A vital aspect of addressing nitrogen concerns lies in adopting circular agriculture practices. This includes the circular use of organic fertilizers and restricting the reliance on fertilizers derived from fossil raw materials. By implementing circular agricultural systems, the recycling and careful management of manure can be prioritized, reducing nitrogen waste and pollution.

In conclusion, promoting nature conservation, agro-biodiversity, and circular agriculture are essential steps towards mitigating the negative impacts of nitrogen on the environment. By striking a balance between agricultural production and ecological sustainability, we can safeguard ecosystems, foster sustainable food production, and work towards a more harmonious relationship with nature.

MINISTERIE VAN LNV, I. W., AND BZK, 2022. Startnotitie Nationaal Programma Landelijk Gebied [Starting notions on the National Program Rural Areas]. The Hague: Ministerie van Landbouw, Natuur en Voedselkwaliteit, Ministerie van Infrastructuur en Waterstaat en Ministerie van Binnenlandse Zaken en Koninkrijksrelaties. RIJKSOVERHEID. 2019. Aanpak Stikstof [Approach Nitrogen] [Online]. The Hague: Rijksoverheid, in samenwerking met het Interprovinciaal Overleg, de Unie van Waterschappen en de Vereniging van Nederlandse Gemeenten. Available: <https://www.aanpakstikstof.nl/> [Accessed 9-12-2022 2022].





A reinvention of the forest as we currently know it into a multifunctional sustainable spatial structure, on land and in the sea

2024, Delft University of Technology
MSc Architecture, Urbanism and the Building Sciences
Track Urbanism

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Tutors: Caroline Newton, Irene Luque Martín

Key words: Sustainable land use, carbon capture and storage, CO2 emission, agroforestry, marine forestry

This research introduces The Forest of the Future, a transformative visionary that reimagines European forests as multifunctional, sustainable spatial structures extending over land and sea. It confronts current environmental challenges, including deforestation, biodiversity loss, and climate change, by proposing an innovative spatial strategy for the BeNeLux bioregion within a broader European context. The strategy aims to integrate forestation within other land uses enhancing ecological, social, and economic values towards a sustainable future by 2100. Based on conceptual frameworking and a multi-criteria decision analysis, it evaluates current land use, soil quality, climate zones, biodiversity, and the state of marine environments, proposing new forest types and forestry-based regenerative agricultural practices. The envisioned forest network serves not just as a carbon sink but as a catalyst for biodiversity, sustainable agriculture, and community well-being.

Achieving this transition requires a multifaceted approach, including policy reform, stakeholder engagement, and the development of a strategic implementation plan that aligns with regional and European sustainability goals. This strategy requires a combination of regulating, stimulating, engaging and capacity building instruments, Additionally, the transition to a forest-based land use

system requires a combination of policies tailored to 'planting the seeds' in the near future, launching the Future Forest, and ones ensuring the healthy maturation of those ecosystems over the following decades. The research concludes with an evaluation of potential impacts on greenhouse gas emissions, suggesting significant contributions towards Europe's climate goals of climate neutrality.

[Complete report](#)



SowGrowConnect

Circular Delta 2050: Sowing the seeds for a zero-emission society through a locally-oriented, knowledge-based greenhouse horticulture.

Laura Oosterhoff
Layne Perry
Gillian Weber
Lotte Wiegers
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Ultimately, SowGrowConnect aims for a future where greenhouse regions are not just endless rows of glasshouses but inclusive and diverse energy and social landscapes.

Tutors: Diego Andres Sepulveda Carmon, Marcin Dabrowski

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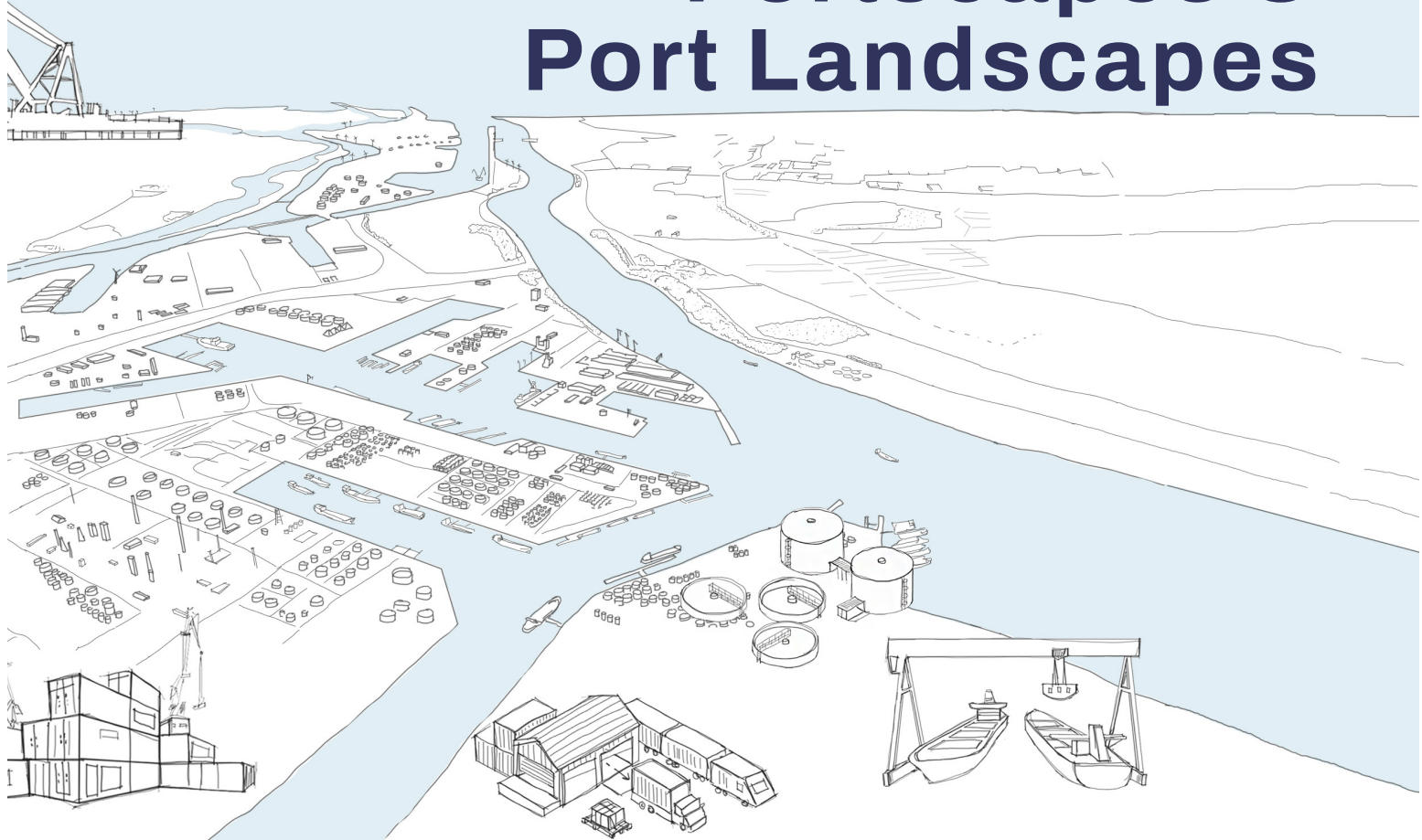
Key words: Greenhouse Horticulture, community engagement, renewable energy, knowledge economy, circularity

The Dutch greenhouse industry contributing 19% of the national carbon emissions, highlights its significant role in the ever-increasing environmental, social, and political challenges developing from climate change. Geopolitical tensions including the war in Ukraine and the Covid-19 pandemic, coupled with resource scarcity and a world population growth underscore the urgency of transitioning societal practices within the food-energy nexus. Existing policies such as the European Green Deal emphasize the need to transition toward renewable energy. Given the horticulture sector’s substantial spatial and global exportation footprint, there is potential to strategically utilize these spaces and economic flows. If successful, Dutch greenhouses can be the catalyst for a circular society model that emphasizes environmental regeneration, peri-urban community empowerment, and representative policy.

This report builds from theories including social justice, circular economy, glocalization, and regenerating peri-urban landscapes. By applying a circular society framework, which prioritizes sustainable consumption patterns, co-created policy, and spatial justice, this report develops a regional strategy for connecting and diversifying greenhouse sub-regions. The goals of this strategy include enhancing community engagement, ecological restoration, innovative knowledge-based production, and fully renewably sourced systems. An analysis through the lens of these intended goals leads to an instruction manual for redesigning industrial landscapes and an index of potential building blocks to implement in the redesign.

This instruction manual offers to scientific relevance through a large-scale combination of innovations, and a circular 15-minute social and 30-minute economic system, and societal relevance through lowering political unrest and the combination of technical and social functions. The manual is useful for a diverse range of parties including municipalities, policymakers, scientists, students, and residents.

Ports, Portscales & Port Landscapes



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Key words: Portscales, Circular economy, Energy Transition, Socio-Spatial justice, Transitional landscape, Eurodelta, Port of Rotterdam

Portscales are one of the most important hubs in the global economic system that facilitate the movement of goods and shape the socio-economic conditions of their surroundings. However, in times of climate change, they face unprecedented challenges to completely transform their current ways of operating and fully reduce their contribution to a linear economy and socio-spatial injustice. These challenges go far beyond purely economic considerations and calls for a closer analysis of their current spatial impacts and system flows.

Despite their significance, the spatial effects of Portscales and their role in a shift towards sustainability and circularity is rarely the main focus of urban and regional design efforts. Drawing upon key theories such as circularity, decentralisation, socio-spatial justice, and sustainable land use, our approach involves a multidisciplinary analysis of ports and Portscales in the Eurodelta portlandscape in North-Western Europe. Through analysis we have identified the different functioning of portscales, the stakeholders they encompass and the spatial dynamics shaping ports, Portscales and Port Landscapes.

Our goal is to develop a strategy for the future of the European Portscales after a successful transition towards circular and just development to create a sustainable Eurodelta. This is achieved through a set of five objectives; integrating the ports, Portscales and portlandscapes; increasing the resource efficiency of Portscales; regenerating Portscales for humans and nature; embracing technological innovation; facilitating a socially just transition.

The spatial implications of these five objectives should not be neglected, and our strategy outlines what changes need to happen and when. In four Phases of spatial interventions and regulatory frameworks, we propose to build a just and truly circular Portscales, in harmony with the Eurodelta Port Landscape.

This report holds key implications for both academia and practice, as further light is being shed on the

spatial dynamics of Portscales and potential transition pathways. By understanding the interplay of ports with their surrounding environments better, policymakers, urbanists and other related stakeholders can make informed decisions that promote sustainability and resilience. Ultimately, our efforts regarding the creation of more sustainable Portscales contribute to broader (global) goals of addressing climate change, promoting socio-spatial justice and ensuring inclusive development.

[Complete report](#)

PowerShift

Towards a sustainable post-fossil scape



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Tutors: Lei Qu, Francesca Rizzetto

Key words: energy transition, decentralisation, fossil-fuel landscape, Port of Rotterdam, climate change adaptation and mitigation

Since the Industrial Revolution, fossil fuels, such as coal, oil, and natural gas have provided the vast majority of energy used by our globalising civilisation. The rapid growth in energy use in the past 250 years has led to increasing fossil fuel usage, which has been the primary driver behind the ongoing climate emergency. Policy measures in the Netherlands aiming to reduce the country's carbon emissions have so far been insufficient because of a lack of visioning and concrete strategies. A primary source of the persistent emissions is the Port of Rotterdam, which acts as Europe's fossil fuel gateway as well as the most polluting port in the continent, due to the excessive petrochemical activities. The pollution is one of the causes of climate change, which threatens the Dutch landscape with possible extreme sea level rise and weather conditions. The main objective of this report is to imagine a carbon-neutral post-fossil fuel future where the changing water landscape is considered, and the Port-region of Rotterdam adopts a decentralised energy system by 2100.

Historical and social analysis of the ports' position in the energy system together with the current policies of the energy transition was used to formulate goals and a conceptual framework. By using scenario building for uncertainties and their evaluation, a final vision of an inclusive energy transition was developed. To achieve the desirable systemic shift, this report outlines a set of development strategies through toolkits, new policies, and strategic sites namely in the Port of Rotterdam, Zeeland, Dordrecht, and the Green Heart. A detailed example of Port of Rotterdam is chosen to illustrate how specific actors can define the new energy-inclusive built environment.

This report aims to outline a transition pathway from the polluting and exclusive energy system towards a decentralised, sustainable, and carbon-neutral energy

system that empowers communities and individuals in the Eurodelta region. A crucial element of the project is the establishment of a resilient energy system, taking in the consideration of sea level rise and worsening climate situation expected in the next decades. The integration of renewable energy, nature-based water management solutions and redevelopment of obsolete fossil-fuel scapes will transform the ports, urban centres, and peri-urban areas into a dispersed energyscape. This way, the new energyscape is inclusive and adaptive, allowing people to have a voice in their energy production while also being more in touch with nature.

[Complete report](#)



Cross me if you can

approach to CO2 through mobility in the areas of cross-border regions

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of active/ non-motorized modes of transport of any kind. More medium and long-distance/ not daily movements will be replaced by the use of sustainable alternatives, such as EVs, optimized public transport networks and smart sharing systems.

Tutors: Alex Wandal , Birgit Hausleitner

Key words: mobility, CO2, cross-border, sustainable landuse, peri-urban

Cities are responsible for a great amount of CO2 emissions related to transportation (CBS). However, the greatest amount of CO2 is caused by private transport and is mainly associated with peri-urban (the peri-urban area is a common place to live for the natural environment and also near accessibility to city facilities) and rural areas due to the lack of public transport, proximities to Services of General Interest (SGI) and access to jobs. This problem is especially evident in the cross-border regions.

When zooming in on North-West Europe, more specific issues around transport, mobility and battling CO2 arise. The European railway network, which spreads across national borders, is a patchwork filled with gaps around those national borders. Considering that a large share of the European Union’s territory consists of border regions and includes more than one-third of the EU’s population, this fact is rather alarming (European Mobility Atlas, 2021). The spatial vision and strategy presented in this report will focus on the challenge of carbon emissions caused by the transport and mobility sector with a focus on cross-border and last-mile connectivity of peri-urban areas.

The region of Maas-Rijn is used as a case study. This project explores how the region can become a place where what is not in your direct vicinity, is still within reach in the next 30 years. In saying this, the project is not only referring to physical proximity to amenities, services and (infra)structures but also to the possibility of accessing job opportunities, education, social networks, communities and other intangible resources.

Based on our analysis, the relevant trends and values are identified for a region covering three different scales: Local scale within national borders, Cross-border scale, and Multi-nation/ European scale. Key findings emphasize the role of enhancement of short-distance transport trips, the reduction of motorized vehicle use of any kind by promoting development aimed at close proximity to physical and intangible resources and promoting the use

[Complete report](#)



A Solarpunk Energy Landscape

Decentralizing the Energy Transition Towards Sustainable Energy Communities

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Tutors: Nikos Katsikis, Rodrigo Cardoso

Key words: Renewable Energy Production, Decentralization, Energy Community, Energy Landscape, Agglomeration Shadow

In our project, we are proposing a vision and strategy for the re-envisioning of the energy transition and integration of a new cultural energy layer into the living environment, thereby creating energy communities. The emphasis lies on transparency, community engagement and the reduction of agglomeration shadows, resulting in the creation of a new narrative for the energy transition. In doing so, we advocate for decentralized energy systems that exchange, store, and contribute energy to the grid. The project spans across technical, social, and policy domains, aiming to achieve a fair and sustainable energy transition that reflects a purer form of democracy.

[Complete report](#)

In our vision we began by analyzing the current situation in the Eurodelta and later on Zeeland, in order to fully understand the situation and to lay the basis for the strategy. In our strategy we show a clear timeline that outlines the necessary interventions for creating an inclusive energy landscape. In the report, we also address the technical aspects of energy communities, whilst exploring the spatial implications of various energy systems and their integration. Through a catalog developed from our vision analyses, we demonstrate diverse energy system possibilities within the landscape.

Policy implementation strategies were also a key focus, proposing new systems that call for purer forms of democracy and bottom-up decision-making processes. In this system, residents play a key role in the establishment of the aforementioned energy interventions. We used maps and visual examples to depict potential energy landscapes and communities in Zeeland—Klaaswaal and Oud-Beijerland—and Rotterdam.

In the end we were capable of reshaping the energy landscape towards a more distributed and participatory model, whilst reducing the agglomeration shadows.



CO2 by mobility = 0

Network approach for reducing CO2-emissions in peri-urban areas in the Rhine – Delta region by 2050

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Rick Klootwijk

presented by peri-urban zones, the initiative seeks to contribute significantly to the EU's climate neutrality goal by 2050.

Tutors: Lei Qu, Francesca Rizzetto

Key words: Rhine-delta region, Mobility network, Sustainable transportation, Peri-urban areas, Transit Oriented Development

The emission of CO2 is a significant contributor to global warming, with the mobility sector being a major source. The EU has set a goal to achieve climate neutrality by 2050, requiring substantial CO2 reduction efforts, particularly in densely populated regions like the Rhine-Delta (RDR). This region's extensive mobility network, serving both urban and global trade needs, generates significant CO2 emissions.

[Complete report](#)

To address this, a research initiative aims to make the Rhine-Delta's mobility network CO2-neutral by 2050 through reimagining its design and operations. The focus lies on peri-urban areas, where urban and rural landscapes intersect. These areas are essential for economic and social functions but are currently reliant on polluting road transportation.

The research identifies the need to rethink connectivity to peri-urban areas for sustainability. Traditional urban-focused transportation concepts often overlook peri-urban needs. Therefore, the initiative proposes developing context-based mobility nodes tailored to peri-urban requirements. These nodes aim to promote sustainable transportation and enhance network efficiency.

The approach involves creating an interconnected network of such nodes throughout the Rhine-Delta region, addressing the specific needs of lower-density areas like peri-urban zones. By considering local contexts, these nodes can effectively serve peri-urban areas, promoting sustainable transportation practices.

To demonstrate the feasibility of this approach, the research zooms in on a representative area within the Rhine-Delta region, focusing on peri-urban patches around Arnhem-Nijmegen. By showcasing how context-based mobility nodes can be implemented in such areas, the research seeks to pave the way for a broader transition towards a CO2-neutral mobility network by 2050.

In conclusion, the research aims to transform the Rhine-Delta's mobility landscape by making it CO2-neutral through the implementation of sustainable transportation solutions tailored to peri-urban areas. By recognizing and addressing the unique challenges and opportunities

from **CarbOn 2** construction



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Tutors: Nikos Katsikis, Rodrigo Ordonhas Viseu Cardoso

Key words: Nature Based Solutions; Climate Change Mitigation; Bio-based economy; Land-use change; Carbon Capture

In an era marked by pressing environmental concerns and the urgent need for sustainable solutions, our project embarked on a transformative journey, envisioning a future where nature-based strategies not only combat climate change but also foster economic prosperity and social justice.

With CO2 emissions reaching alarming levels and posing grave threats to the environment, human health, and global stability, conventional approaches to combat climate change often fall short in addressing the intricate interplay between social, economic, and environmental factors. Our research sought to tackle this challenge towards a just transition to a low-carbon economy: "How can we design a circular economy of carbon storage focussing on nature-based solutions?"

Grounded in the principles of sustainability and equity, our approach initially focused on proposing nature-based solutions to reduce CO2 levels. However, recognizing the need for a holistic transformation, our methodology evolved to integrate bio-based economy concepts and community-centric design principles. This involved a rigorous examination of existing policies, spatial analyses, and stakeholder engagement to develop a comprehensive strategy.

The overarching goal was to present a visionary blueprint for transforming land use, emphasizing nature-based solutions as central to carbon mitigation efforts while fostering economic development and social resilience. This entailed the creation of green corridors, the establishment of productive communities, and the promotion of collaboration within the bio-based economy.

Through our research, we identified forests and wetlands as beneficial nature-based storage methods for the Netherlands, with significant potential to accelerate the transition to a low-carbon economy. Despite spatial conflicts and implementation challenges, investing in the bio-based economy, particularly in construction using bio-based materials, emerged as a promising avenue for economic growth. Our phased approach to implementation outlined pathways for achieving equitable CO2 reduction while maximizing environmental and social benefits.

Our work extends far beyond environmental conservation. By presenting a transformative vision that integrates nature-based solutions with socio-economic considerations, we offer a roadmap for policymakers, businesses, and communities to navigate the complexities of climate change mitigation. This matters because it signals a paradigm shift towards sustainable development, where the preservation of nature goes hand in hand with economic prosperity and social equity, ensuring a resilient and thriving future for generations to come.

[Complete report](#)



Waste Houses

Messing up The Netherlands

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Julia Schasfoort
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Madelief van der Kraan

Tutors: Verena Balz, Lukas Höller

Key words: waste management, circular economy, transition theory, behaviour change, chaos

The Netherlands has the ambition to transition to a fully circular economy before 2050. Between this future and where we stand now, there is still a large gap. The Netherlands produces 60 million tonnes of waste per year. This fact contains two problems that this project aims to deal with: 1) the height of this number in the first place, and 2) that approximately 20% of the waste does not find its way back into the system. In 2020, 7.6 million tonnes of waste was incinerated and 32.7 million tonnes of waste was exported to non-EU countries, where waste often ends up in landfill or is sent for incineration with adverse health effects.

This project takes the radical stance to stop incineration and export, which means the Netherlands must take responsibility for the waste it produces. For much of the waste that currently follows one of these trajectories, there are no adequate solutions for reuse or recycling. Hence, we designed a system of waste collection, sorting, and storage where materials can be stored in waste houses until they find their way back into the system (problem 1). The piling up of the waste will create awareness of the consequences of irresponsible consumption, affecting the behaviour of people through confrontation (problem 2). The system we design aims to create a disruption of the existing linear system at different levels. The large-scale societal perception of production-consumption-waste generation will slowly change, while the waste houses will create a sense of urgency at the small scale. This will stimulate niche innovations to find innovative solutions to deal with waste that is stored. Our project is thus both an instigator of change and part of the change itself in the transition to the circular economy.

If the project is successful, the waste houses will gradually become obsolete as consumption and waste production go down. In the far future, the former waste houses can house different functions, or they can be demolished in a circular way, returning the materials into the resource loop.

[Complete report](#)



N⁷ ITROTOPIA

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Key words: recalibrated nitrogen cycle, transitional landscapes, socially just transition, dairy farming, Friesland-Drenthe-Groningen

Nitrogen is an essential element of planetary life. Yet, human actions create such a surplus of its derivatives like ammonia (NH₃) and nitrogen oxides (NO_x) that the naturally occurring amounts doubled, causing a cascade of environmental and societal problems.

Our research studies dairy farming in North-West Europe with a focus on the Netherlands, as this industry is responsible for most nitrogen-related problems. The starting point of the project is the parliamentary letter 'Nationaal Programma Landelijk Gebied' (National Rural Area Program), which offers the alternatives of quitting, transforming or relocating dairy farms in areas where the nitrogen surplus exceeds critical loads. We reevaluated this approach using the methods of extreme scenarios, in-depth stakeholder analysis, as well as layering and clustering areas with high nitrogen deposition, pasture lands and socio-geopolitical issues. This led us to the realisation that a substantial spatial and societal transition is needed in order to reach balance again. The goal of this study is therefore to recalibrate the nitrogen cycle by radically changing current dairy production practices. We created a gradient from quitting to transforming farms and pastures, based on the theories of transitional landscapes and socially just transitions, resulting in a toolbox of eight strategic interventions, as well as a thorough policy framework. We choose a multi-scalar approach to test the new typologies, starting from the Netherlands, looking at the Groningen - Friesland - Drenthe region, further zooming in on the municipality of Ooststellingwerf, showing the phasing of the strategy from a human perspective. Essential lessons learned are the importance of collaboration on all scales, as well as the flexibility and openness towards change, whether it is technological or societal. Finally, based on these findings we extended our zoom to the scale of North-West Europe, giving suggestions to regions with similar problems.

This project describes a possible future based on our interpretation of the parliamentary letter, giving an intriguing input to decision makers on what their policies could mean, hoping to change the discourse regarding nitrogen, shifting its perception from pollution to a valuable resource. Welcome to Nitrotopia!

[Complete report](#)



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Key words: Ecosystem adaptation, Delta restoration, Community based, Agroecological zoning, Borderless, Decentralisation

Currently, the Southwestern Delta is ill. The inability to produce its essential ecosystem services hinders the Delta from being healthy. Systems that make the Delta economy prosper are the main reasons for this obstruction. If current hazards like salinisation, soil depletion, and nitrogen pollution continue; the livelihood of the peri-urban Delta communities will be under threat. In contrast, the direct relation to the Delta makes them a potential stepping stone for change.

The main question: ‘How can local peri-urban communities be the base of the just transition towards a healthy Delta, which restores the production of ecosystem services and improves the climate resilience of the Delta?’ forms the foundation of this research. This research aims to explore the potential of communities as the missing link in the just transition towards a healthy Delta.

By creating a vision and designing its strategy, the Delta area will be able to produce its ecosystem services from 2050 on. The combination of environmental assessments, mapping and spatial analysis, stakeholder engagement, a SWOT matrix, the development of action perspectives through scenario planning, and a policy review provides the base for a vision towards a healthy Delta. This vision is translated into a strategy where a design catalogue, community engagement approach, and a knowledge network bring everything together in the spatialisation of three zoom-in areas: Schouwen-Duivenland, Oesterdijk, and Haringvliet.

Through education and recognition, the awareness of the Delta communities will rise which will motivate them to be part of the urgent transition towards a healthy Delta. Field labs and knowledge centres stimulate cooperation and sharing of knowledge. The ecosystem can be restored

through the collaboration of the communities with other stakeholders. The combination of ecosystem-based adaptation, knowledge networks, and the borderless approach creates a regenerative and resilient Delta that serves as an example to other estuaries in the world.

[Complete report](#)



INTEGRADING

Creating a balanced landscape, integrating food production and biodiversity in agricultural areas

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Tutors: Verena Balz, Lukas Höller

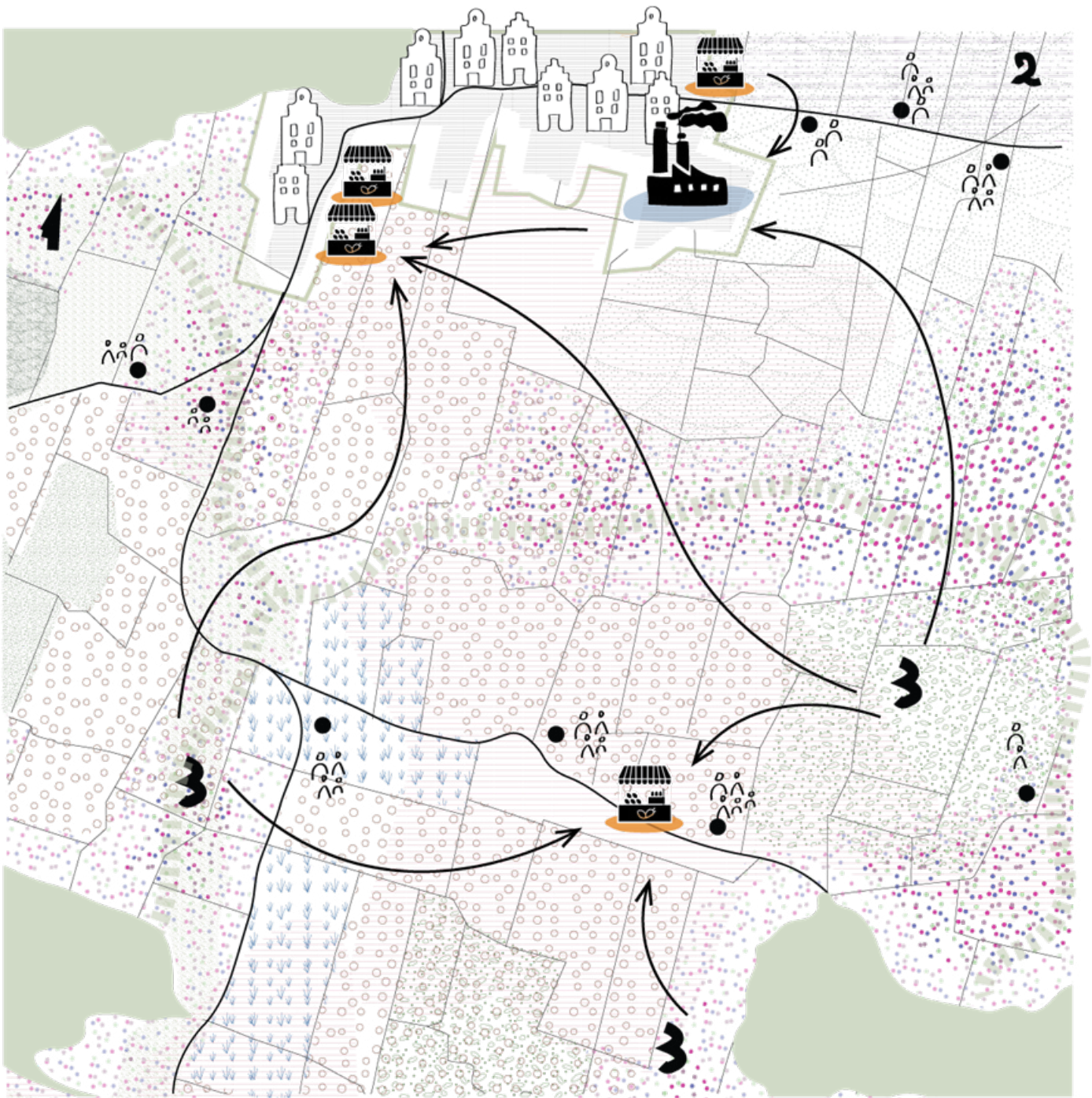
Key words: Biodiversity Conservation, Food Production, Nitrogen Pollution, Farmers, Land Use, Land Sharing, Gradient, Peri-Urban Areas.

The Netherlands has created a large nitrogen pollution problem in its soils, which is harming biodiversity. By intensifying and industrialized farming, by importing animal feed for dairy production and fertilizer for crop farming, too much nitrogen has accumulated in the soil. Consequently, ecological processes are disturbed due to eutrophication (over-feeding of nutrients), from which only a few species profit, causing other species to lose the competition and cease, with detrimental effects on reliant other species.

This project explores how this intensive/industrial farming can be substituted by more sustainable alternatives in which creating and maintaining biodiversity is key. An alternative system is proposed based on the spatial intergrading between cities and protected natural areas with typologies that focus on balancing food production and biodiversity creation. This alternative system is then detailed concerning the small-scale effects it has, the necessary process of policy creation and the necessary systemic changes as preconditions for a successful execution. The transformation design is developed along a framework of values which are reflecting on current best practices in the discipline of urbanism touching on issues of planetary boundaries, justice and transitional thinking.

Our key takeaways are to keep the city and adjacent areas productive, close to where consumption of goods is high but also where functions like education and food markets can be sensibly integrated. Further from the city and closer to already biodiverse and protected areas of the Nature Network Netherlands (NNN), the gradient leans more towards focussing on the creation of biodiversity. Humans and non-human species can find their thriving space on the gradient, food production is still an integral part as well. By creating a system in which farmers are working together, and are guided to create this balance on their farms and are paid for their efforts and the services they provide to society, they can be encouraged to change their farming practices for the better.

[Complete report](#)



Grazing Towards a Greener Future

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

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Key words: Nitrogen Crisis, Cooperative, Regenerative Farming, Polder, Biodiversity

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

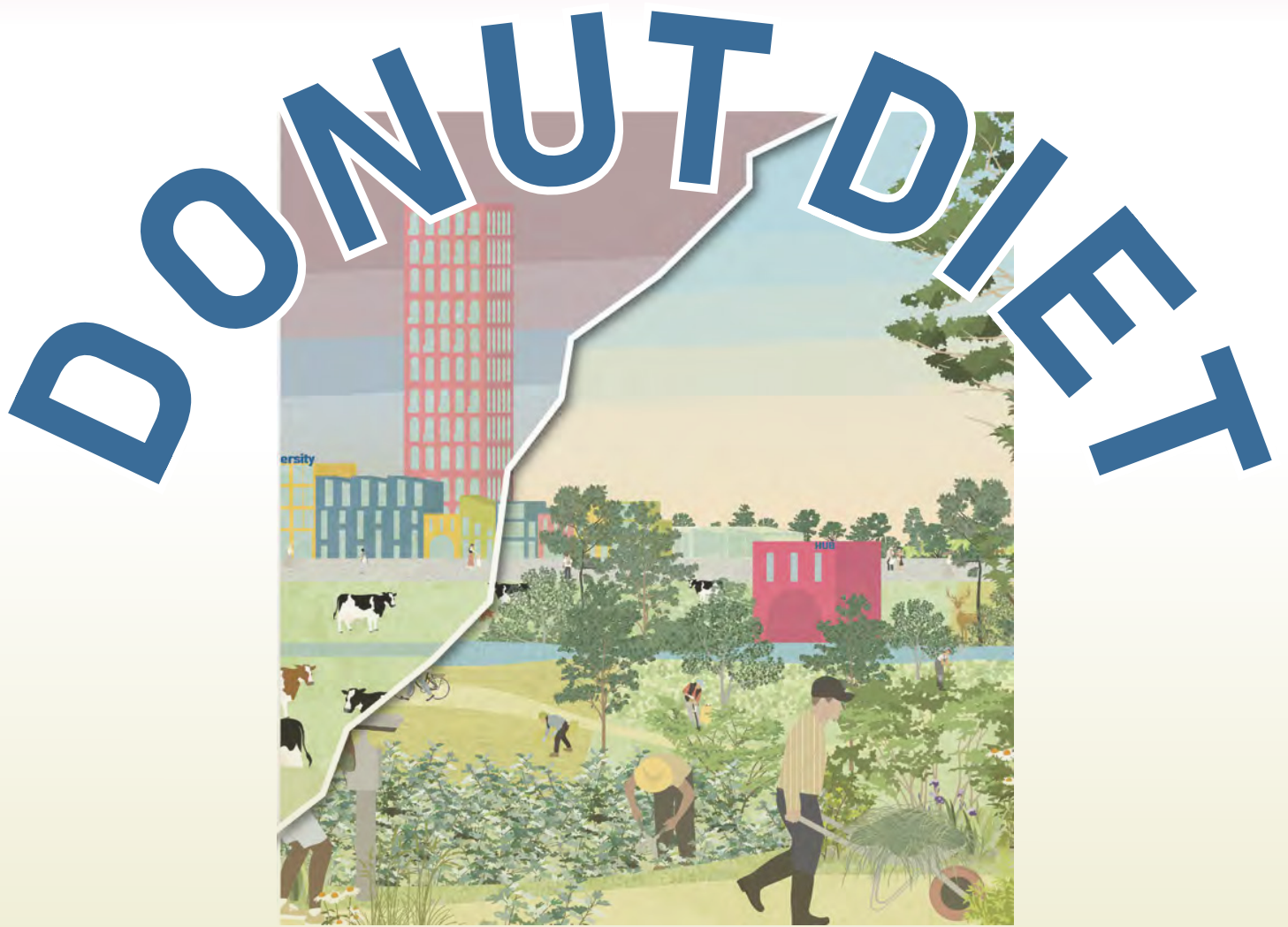
This project aims to explore the future of the dairy industry by creating a shift from the current monoculture and centralized dairy chain to a more local and self-restoring model. Recognizing the polder as a crucial spatial element of grasslands in the Netherlands, we view it as a fundamental unit for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

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

new social and economic configurations. A larger organizational structure in which polders co-operate is implemented to redistribute trade and production.

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

[Complete report](#)



A vision and strategy for an agricultural transition towards a circular, collective, and regenerative future.

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Key words: Nitrogen pollution, Collective farming, Circular economy, Regenerative agriculture, Seasonal diet

There is an imbalance in the nitrogen cycle, mainly caused by an increasingly intensive agricultural sector. This leads to the degradation of nature and the loss of biodiversity. Measures have been taken at European level to reduce the amount of nitrogen emitted by the agricultural sector, but this has caused a backlash as farmers in many European countries have protested strongly. Many farmers fear for their future and something must be done to safeguard their livelihoods and the quality of Europe’s nature.

To address this, we propose a vision for 2150 in which the food system of north-west Europe shifts from intensive agriculture to a regenerative, small-scale and collective farming system. We envision diversified and rotational land use to close nitrogen cycles and thus reduce the burden on the climate, giving the soil space and time to regenerate so that nature can thrive. Food and bio-based materials will be produced locally and seasonally, making food and material consumption more transparent and integrated into the daily lives of communities, transforming peri-urban and rural structures and the way we live in them. This regenerative production system, coupled with new incentives, will provide affordable food for all, while being more circular, organic, sustainable and fit for the future world we envision.

To enable diversified farms, farmers will share facilities, tools and land to enable soil-based crop rotation. This will have an impact not only on the local diet, but also on the food and materials produced. Focusing on local production also means introducing other collective infrastructures that increase local and regional flows.

It also means reducing some of our international infrastructure while increasing knowledge flows between countries to empower people in the Global South to process and produce food locally, thus ensuring a more equitable distribution of resources. Finally, at the heart of the strategy is the conservation of nature, which will shape the boundaries of the newly structured peri-urban rural agricultural landscape. The existing boundaries of the built environment will remain, with the emphasis on densifying and transforming our current structures rather than expanding them.

In order to visualise the vision, we selected three pilot projects based on three different typologies and existing infrastructure: Nijkerk (sand, rural, a practical school and a milk processing unit), Utrecht (clay, urban and distribution centres) and Bodegraven (peat, peri-urban and dairy related businesses). These pilot projects show the necessary landscape transformation over time with the introduction of regenerative agriculture, food and material hubs along with food production within city boundaries, working towards a sustainable landscape and local diet.

[Complete report](#)

Hungry for change

Research on a systemic way to tackle the nitrogen crisis



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Key words: nitrogen crisis, water pollution, nitrogen emissions mitigation, sustainable land use, land regeneration

The Nitrogen Crisis has become a focal point for the global community, with the related European policy stirring uncertainty in the agricultural sector. This political unrest has been clearly manifested in the Netherlands, while natural areas remain exposed to high emission levels. Society calls for systematic solutions to the nitrogen issue that conserve the existence of farmers, the preservation of nature and the national economy.

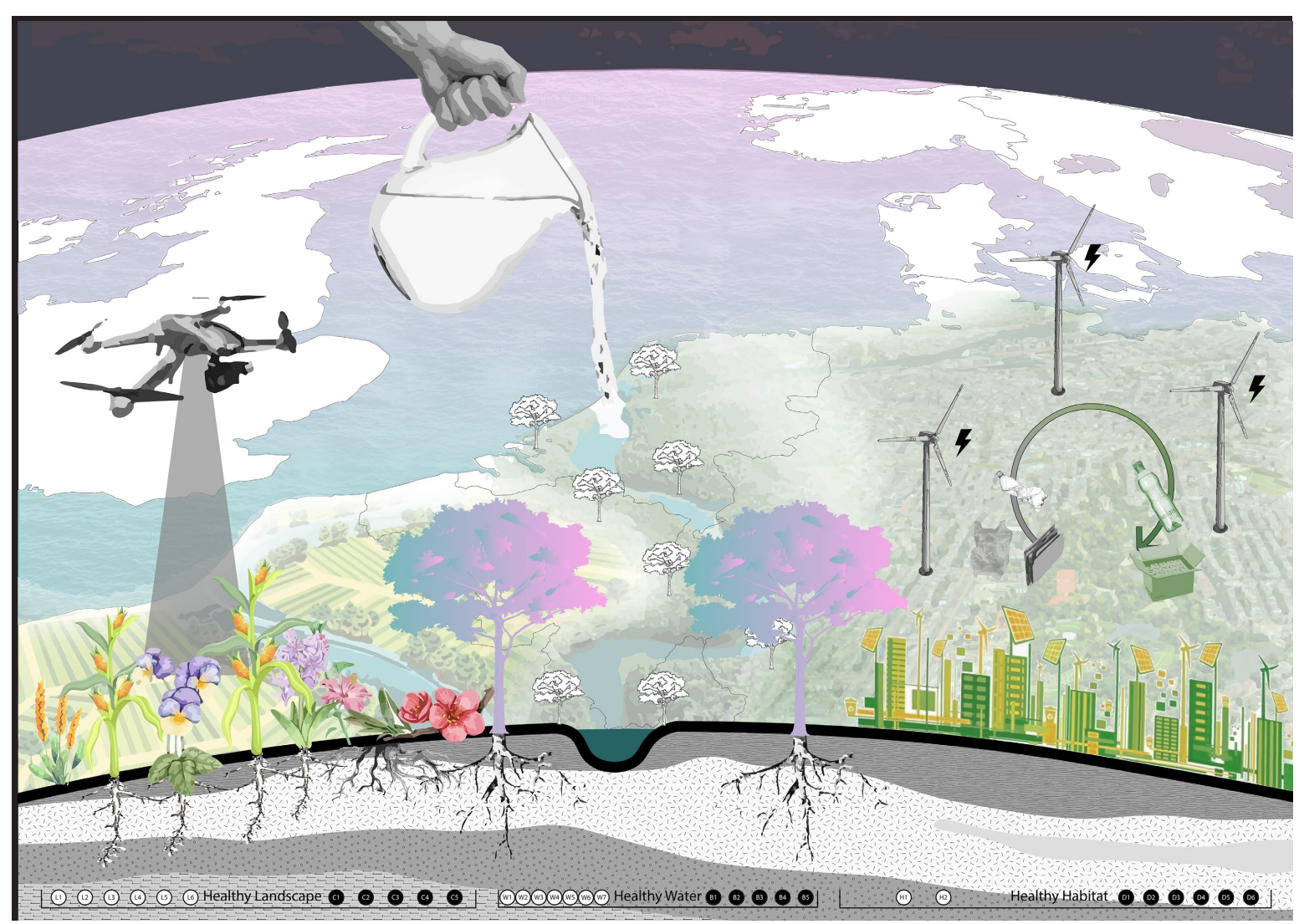
This report focuses on the agricultural sector, as it accounts for 52 per cent of emissions (RIVM, 2022). We investigate opportunities to mitigate NH4 and NO3 surplus in soil caused by current agricultural practices and we spatially explore a systemic approach to cut emissions caused by livestock farms and inefficient use of fertilisers within field crop farming in the Eurodelta region.

Through document review and archival research, followed by spatial analysis and mapping, we investigate what changes in agricultural practice can restore balance in the nitrogen cycle. A vision for the Netherlands’ primary agricultural production future is formulated. This vision focuses on sustainable land use, alongside nature protection, research development and community engagement. We elaborate on this through a spatial strategy, which concentrates on five strategic projects used to assess the interventions on-site and demonstrate their potential to all stakeholders.

Our proposal involves the recognition of natural protection zones in areas where agriculture borders natural habitats. Actions and policies are suggested to facilitate land conversions and support the farmers in this transition. Furthermore, we propose a network of living labs and community centres aimed at applying sustainable farming methods and connecting the city and agriculture.

We conclude that to prevent harm to human health and the environment we need to explore ways to combine the farmers’ and the environment’s interests. The systemic approach requires equitable regulations governing permissible emissions for farmers throughout the Netherlands. However, it should allow farmers to autonomously shape emission reduction initiatives locally.

[Complete report](#)



River Recovery

A pilot for making healthy rivers in Europe

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Key words: water quality, soil quality, water pollution, sustainable land use, research-by-design

Only 1% of the surface water in the Netherlands has been classified as 'good', making it the EU member state with the worst quality of surface water (Didde, 2022). Polluted rivers cause problems such as worsened human health, reduced biodiversity, and poor soil fertility. To comply with the Water Framework Directive, there is an urgent need to transform water management in the Netherlands. This report adopts a research-by-design approach to address the issue of water pollution on a pilot project scale, specifically the river Eem in the Netherlands. The policies and interventions implemented in the river Eem area are categorised according to their transferability to different programming areas, namely urban, industry, or agriculture, creating a toolbox that can be used to upscale the same approach in various parts of the Eurodelta. The report answers the following research question: How can the transformation of the Eem Valley turn the river Eem into the healthiest river in Europe as a pilot for the Eurodelta? It catalyses rethinking pollution flows from human activities, industries, and agricultural practices. The goal is to come up with sustainable practices for the land surrounding the river and to create a synergy between the improved soil and water quality. Finally, the report concludes with a toolbox of interventions and policies that contribute to the improvement of river water quality. The toolbox forms the basis for implementing this small-scale approach on a larger scale.

[Complete report](#)



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Key words: dynamic river delta, sustainable land-use, agriculture, nitrogen

The Netherlands, renowned for its flat landscape and strategic location at the confluence of major rivers, combined with fertile soil and a mild climate, boasts optimal natural conditions for agricultural production. However, the success of the Dutch agricultural sector and its developments has significant implications for biodiversity, as excessive nitrogen levels contribute to a decline in plant and animal species, ultimately disrupting the ecosystem balance. Currently, functions are separated by human engineered boundaries with little to no interaction with each other. Agriculture is hyper focused on the productive part of the system, lacking equilibrium. Ideally, water, agriculture and soil live in perfect harmony and so envisioned for the year 2070 is a dynamic river landscape in the Dutch Delta region; a landscape where there is room for the water to flow as it pleases. In this vision, a river's natural flow is embraced; free flowing water with little constraints. Instead of seeing this freedom as a problem that must be controlled, this project values the river's morphological changes and water fluctuations through time. This vision and strategy not only makes room for the river, but creates a new dynamic system in which water, biodiversity and agriculture works together. Adjustments are mainly made to the land-uses to correspond to the shifts of the river, using several interventions. A green network of 'in between' wetlands is situated within the river basin. This network serves as vital ecosystems that enhance the resilience of the region. These green marshes overflow with biodiversity, serving as havens for formerly threatened animal and plant species alike to thrive and flourish. In this project, we apply strategic tools to three locations with different conditions, such as moderately wet, wet, and extremely wet, acting as pilots to be extended into more parts of the Dutch Delta region in the future. This forward-thinking approach not only ensures the sustainability of agriculture but also fosters a healthier, more diverse environment for generations to come.

[Complete report](#)



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Key words: Sustainable Land Use, Nitrogen, Biodiversity, Protein Transition, Nature-inclusive Agriculture

The Netherlands holds the title of the world’s second-largest exporter of agricultural goods, primarily due to Wageningen University’s pioneering research and innovation. However, this success has led to significant challenges. Intensive farming practices have strained resources and disrupted local water and soil cycles, sparking protests from frustrated farmers. Moreover, the quality of fresh water in the Dutch Delta has deteriorated due to pollutants like NO2 and PO4, exacerbated by increasing salinization pressure from the North Sea. This linear system has resulted in waste accumulation and biodiversity loss, endangering both agriculture and natural ecosystems’ sustainability.

To address these challenges, our goal is to integrate nature into existing agricultural practices, thus restoring a balance with local ecosystems. The AgriNature project aims to achieve this by analysing the interplay between agriculture and nature, assessing water and soil management spatially, and fostering a participatory approach with farmers.

The first phase of this transition starts with engaging farmers who are already implementing sustainable methods like agroforestry and saline agriculture, the project establishes Living Labs for co-creation, knowledge sharing, and policy influence. Waterboards and governmental agencies will mediate and provide support, connecting farmers to stakeholders and creating financial incentives. The project also recognizes the necessity of a protein transition towards more plant-based or lab-grown alternatives, aiming to decrease nitrogen pollution and eventually rewild cattle. In the second phase, AgriNature plans to expand innovations to other farmers and establish Agroparks as hubs for innovation and technology. Consumer awareness centres will promote understanding of the protein transition and the need for biodiversity. A nature regeneration centre will oversee rewilding efforts and flood risk management using nature-based solutions. The third phase will future proof these efforts by continuing innovations within the established research and development networks.

Ultimately, AgriNature envisions a symbiotic relationship between agriculture and nature, empowering farmers as stewards of the land and promoting ecologically sensitive practices. Through multidisciplinary collaboration and

integration of natural cycles into urban planning and agriculture, the project aims to serve as a global model for sustainability, fostering soil health, water conservation, and biodiversity preservation.

[Complete report](#)