Reimagining the urban-rural interface

A regenerative framework, using agroforestry to connect nature, agriculture and urban development

Lotte Bongers

Reimagining the urban-rural interface: A regenerative framework, using agroforestry to connect nature, agriculture and urban development

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1. Introduction



Sheep in treeless field, not able to hide from the sun



Treeless fields 2.0

1.1. Fascination & Motivation

As a child, I often went berry picking with my brothers, where we earned one euro for every kilo we collected. Of course, we didn't just pick the berries—we ate plenty as we went along, and sometimes, when we'd seen enough berries for the day, we'd throw them at each other in playful mischief. Some days, we'd explore the maize maze, swim in the adjacent makeshift pool of corn kernels, or gather vegetables form our kitchen garden down the road. At the time, our motivations were simple: fun and a bit of pocket money. But, even in those moments, there was an unspoken awareness of how food was connected to the natural world.

As I grew older, that awareness faded. Life became more fast-paced, and the connection between food and its origin became something I rarely thought about. Supermarkets replaced the kitchen garden and made it easy to forget the effort and natural cycles behind each meal when everything is so readily available, neatly packaged and far removed from its source. I no longer saw food as something tied to the earth, but as another commodity to be consumed without much thought. This realization saddened me a bit, as I reflected on how disconnected we've become from the processes that sustain us. It led me to question how this disconnect happened and to recognize it's not just about food: it reflects a deeper disconnect from our broader relationship with the environment.

Historically, humans were deeply connected to the land, relying on it for survival. Early human societies, as hunter-gatherers, were deeply connected to their natural surroundings. They understood natural cycles, migration patterns, and seasonal changes, which were crucial for their existence. During this period, human impact on the landscape was minimal, as small populations and nomadic lifestyles allowed the environment to recover naturally. But with the Agricultural and Industrial Revolutions, this relationship shifted. We began altering landscapes, treating them as commodities rather than living systems. This shift led to widespread environmental degradation and biodiversity loss.

The introduction of infrastructure and technological advancements like railways and refrigerated transport allowed food to travel long distances, weakening the link between cities and their agricultural hinterlands. Today, ingredients for a typical meal can travel thousands of kilometres before reaching our plates. For instance, a study found that the components of an average dinner in Amsterdam collectively cover 33,000 kilometres (J.S.C. Wiskerke & Saline Verhoeven, 2018). This extensive transport is fuelled by cheap fossil fuels, but it overlooks external costs such as environmental degradation, resource depletion, pollution, and the growing disconnect between urban consumers and rural producers.

In recent decades, environmental awareness has grown, leading to movements advocating for sustainability and the restoration of natural landscapes. Concepts like sustainable development, permaculture, and regenerative agriculture stress the importance of restoring ecosystems and treat the land as a living, interconnected system. But despite this, in many conventional approaches, land management is still often treated as if we are assembling separate pieces - water, soil, vegetation, infrastructure, urban development- rather than understanding them as parts of an interconnected whole. This realization deepened during a permaculture design course, where I learned about the intricate relationships within landscapes, including food provision.

I believe food production should play a central role in urban and rural planning, as it is critical to the health and sustainability of both cities and the environment. My fascination lies in re-imagining urban, rural, and natural landscapes as dynamic, evolving systems that incorporate regenerative processes. Through this thesis, I will explore how we can reintegrate these processes, helping to restore our connection to the land and create vibrant, living systems that nourish both people and the planet. In the following chapters, I will outline how this vision can be realized.

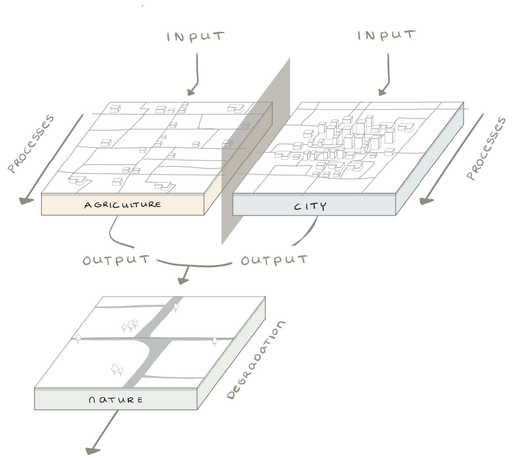
1.2. Problem Statement

The landscape of Zuid Holland has been shaped by centuries of human intervention that reflect a complex relationship between urbanization, agriculture and nature. Historically, the Dutch landscape was marked by a close connection between people and their natural surroundings, relying on an intimate understanding on the environment for the supply of food and other natural resources. However, two key periods—the agricultural crisis of 1875-1895 and the post-World War II intensification of agriculture—changed this relationship. Agriculture became an isolated economic production system, prioritizing efficiency over the health of ecosystems and shifting the relationship from working with nature to exploiting it.

This shift in agriculture coincided with rapid urban population growth. Though these developments occurred in parallel, they evolved separately. Cities increasingly prioritized industrial growth, housing, and infrastructure, while rural regions prioritized maximizing agricultural output. Lacking integration in their development strategies, this resulted in a fragmented and degraded landscape, where the urban and rural areas became increasingly isolated from one another. Urban and rural challenges—such as flood management in urban areas and drought adaptation in rural areas—are often handled in isolation, missing crucial opportunities for integrated solutions.

This separation is further reflected in the tension between urban-driven sustainability regulations and rural economic needs, sometimes even contributing to societal polarization. Urban areas push for stricter environmental protections, while farmers face economic pressures to maintain production and profitability. These differing priorities often result in contrasting political views, with urban and rural populations supporting opposing policies. At the same time, the lack of coordinated efforts toward nature restoration further contributes to landscape degradation and hinders progress toward sustainable development.

The Middengebied, located within the RZG triangle and Zuidvleugel, illustrates the difficulty of balancing urban growth with agricultural development and environmental sustainability. As a key site for regional housing development, driven by growing demand from nearby urban centres, the focus has largely been on housing, with agriculture treated as a separate concern rather than integrated into the overall design. The area's low elevation complicates housing plans, making it vulnerable to land subsidence and flooding, while nearby agricultural areas face waterlogging, saline seepage, and drought. Despite efforts to integrate nature into the plans, agriculture remains overlooked, further fragmenting the landscape and missing the chance for a more balanced and cohesive approach.
Given these challenges, there is an urgent need for a paradigm shift in the approach to landscape planning and development in Zuid Holland. This thesis addresses the growing gap between urban and rural landscapes, highlighting the need to reintegrate natural processes and agriculture into urban planning and landscape design. The goal is to develop a framework that connects nature, agriculture, and urban development, fostering nature restoration, local food production, and social services, while supporting a sustainable future for farmers. By exploring key guidelines and principles, this research aligns with Zuid-Holland's vision of a "metropolitan food region" and applies theory and practice through a case study in Het Middengebied.



Isolated agricultural and urban systems degrading natural systems

1.3. Scope and Relevance

Scope

This study focuses on the design and implementation of regenerative land use practices, particularly agroforestry, that foster mutual benefits between urban and rural areas. The theoretical framework is based on four key angles: spatial, environmental, social, and implementation. The spatial component examines the fragmented landscape and metropolitan design characterization methods, while the environmental aspect explores regenerative design principles and agroforestry practices suited to temperate climates with clay, peat, and marshy soils. The social dimension focuses on woodland structures, and the implementation aspect addresses strategies for practical application.

The study does not delve into the technical details of agroforestry technologies beyond their relevance to urban-rural interactions. Additionally, the stakeholder analysis is limited to two perspectives: the governmental/provincial level and the community/farmers level. These angles collectively support the development of a design strategies and principles toolbox, which is applied to the RZG triangle area. The analysis of implementation strategies provides insights into the phasing of the design. Ultimately, the study aims to develop a new design strategy rooted in whole-system thinking, emphasizing connectivity between urban and rural areas, ecological functionality, and the enhancement of social activity.

Relevance

Scientific Relevance

This thesis contributes to the scientific understanding of how regenerative practices, particularly agroforestry, can be spatially and functionally integrated into the urban-rural interface. It addresses gaps in landscape architecture literature by translating the guidelines of regenerative design into practical design strategies and principles, for connectivity between urban and rural environments. Through a research-through-design methodology, the thesis bridges theoretical frameworks with practical, site-specific applications, offering new insights into enhancing landscape connectivity, and regenerating land use in the urban-rural interface.

Professional Relevance

For landscape architects, urban planners, and policymakers, this thesis offers practical strategies for integrating food production and ecological sustainability into the planning of peri-urban areas. The findings are particularly relevant for regions facing challenges similar to Het Middengebied, providing a framework for designing landscapes that improve connectivity, functionality, and environmental resilience between urban, rural and nature environments. By showcasing the benefits of regenerative land use practices, the thesis aims to influence future development projects and policy decisions, advocating for a more integrated approach to landscape design that balances human needs with environmental sustainability.

Spatial isolation of the urban and rural landscape (Google Earth Pro)



2. Theoretical Framework

2.1. Research Questions

To address the research objective, three focus areas have been formulated to guide the study and provide a deeper understanding. Each focus area targets a specific aspect of the research—understanding, design strategies and principles, and design—that are interconnected. These primary themes are further divided into sub-questions to provide a structured approach for breaking down the research objective.

Research Objective

How can agroforestry be spatially operationalized to address connectivity between urban, rural and nature environments to enhance urban and rural connectivity, environmental functionality and social activity?

Sub-Questions

Understanding

1. How has the RZG triangle area evolved over time?
2. What are the defining characteristics of the landscape?
3. What factors contribute to the fragmentation of the area?
4. To what extent does the current land use align with the region's environmental and ecological conditions?
5. What roles and functions do the current land uses serve?

Design strategies and principles

6. What practical design strategies and principles, aligned with regenerative thinking, are capable of connecting urban and rural areas in the RZG triangle region?

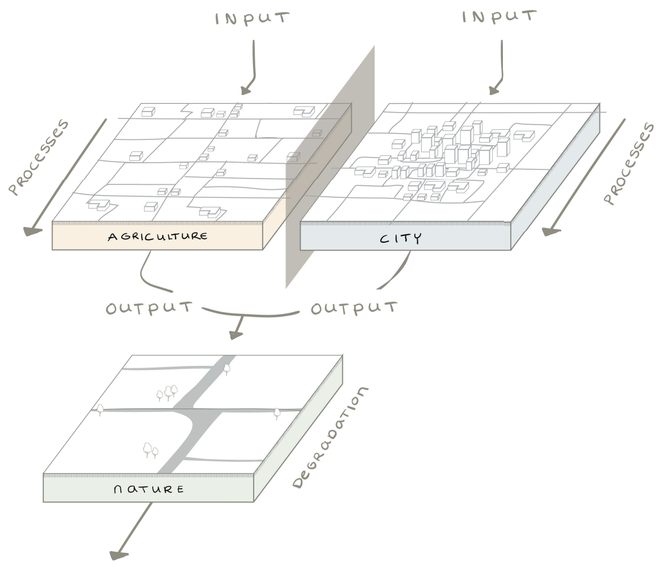
Design

7. How can the design strategies and principles be applied in the RZG triangle region?
8. How does this develop in het Middengebied?
9. How can farmers design agroforestry systems that promote social activity?

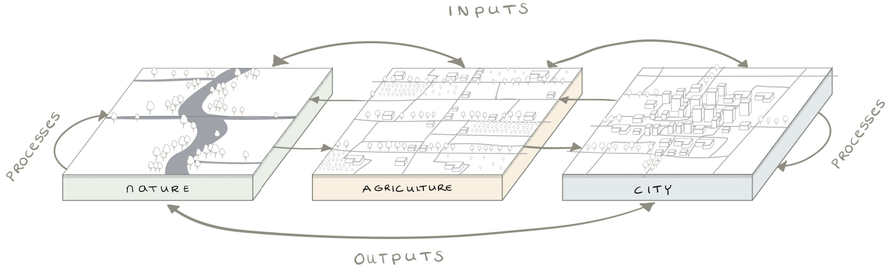
Reflection

10. What can be learned from this research?

From a degenerative & Disconnected system



Towards a regenerative & connected system



2.2. Methodology

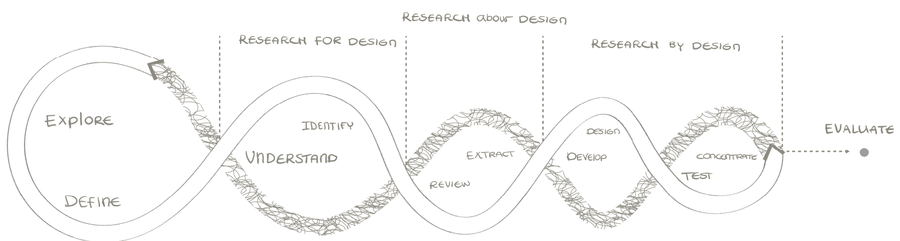
This thesis employs three research methods to ensure that the final design is both grounded in existing knowledge and tailored to the specific needs and constraints of the project.

The research for design method focuses on building a strong theoretical foundation through the analysis of prior research. This approach helps to understand the broader context of the design problem and identify knowledge gaps that need to be addressed. The literature review is structured into four angles: spatial, environmental, social, and implementation. Each is narrowed down to relevant literature, with an emphasis on the practical application of these concepts to enhance spatial connectivity, environmental functionality, and social activity. The analysis of implementation strategies further informs the phasing of the design. Together, these perspectives supported the creation of the design strategy and principles toolbox, applied in the research by design phase for the RZG triangle.

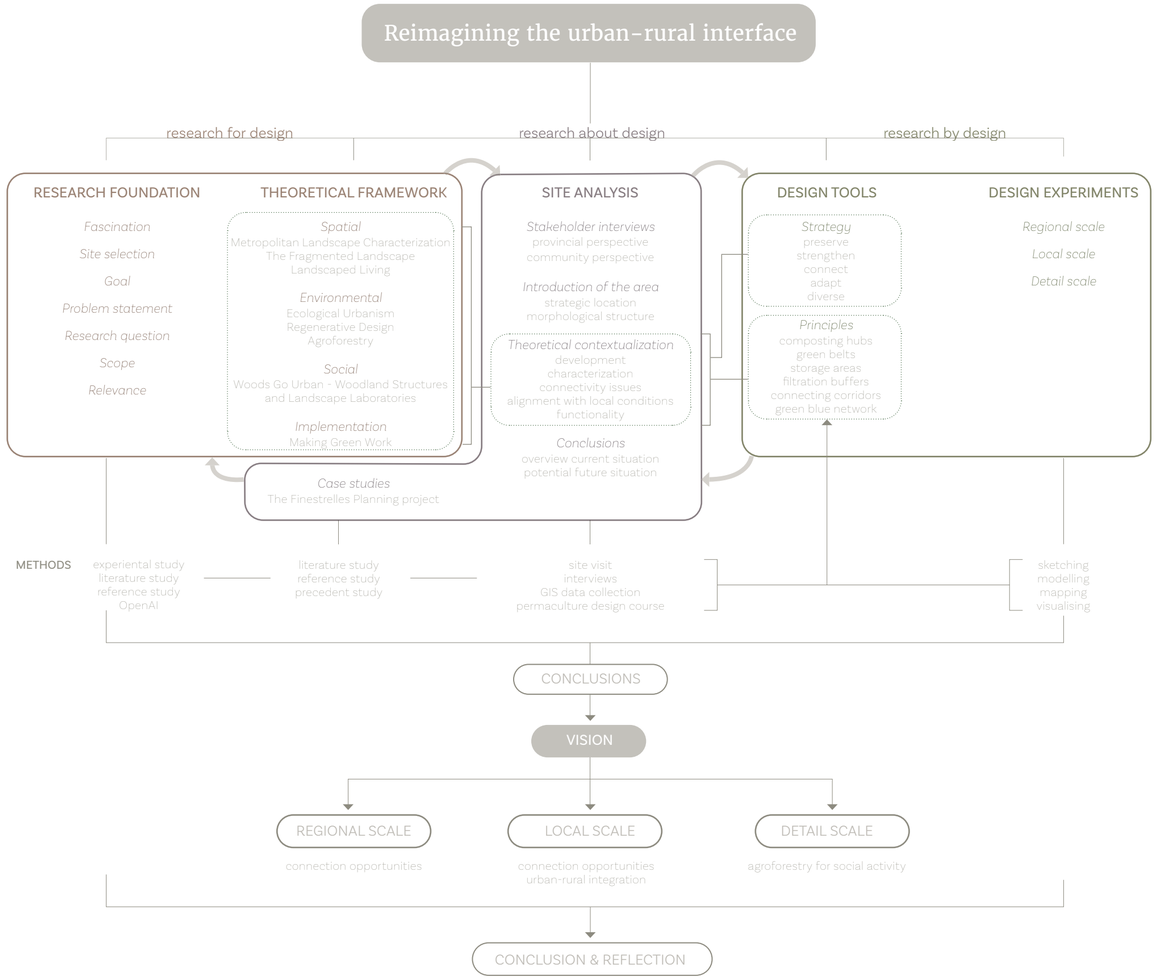
Research about design involves gathering information directly relevant to the specific design challenge, ensuring the design meets user needs and addresses the issues at hand. This was carried out through desk research, interviews, and field trips. The desk research included GIS analysis, zoning plans, and case studies. Two stakeholder interviews were conducted with a focus on the governmental/provincial and community/farmer perspective. Hands-on experience was gained through a permaculture design course, which involved designing a real-world water system, landscape analysis during excursions, and developing a small-scale regenerative land plot. Key insights from these activities were integrated into the toolbox and inspired the design process.

Research by design integrates the design process into the research itself, allowing for hands-on exploration and early identification of any overlooked or misconceived elements. The design in this study is developed at multiple scales, with a regional strategy proposed for the RZG region and a more detailed local-scale design centered on Het Middengebied. Additionally, a specific vision for multifunctional agroforestry is presented through a detailed design.

Throughout the process Open AI is used for brainstorming, refining design concepts, and enhancing the clarity and coherence of written content.



The design process



2.3. Theoretical Background

The purpose of this literature review is to establish a theoretical foundation for addressing the landscape challenges of the RZG region through a multifaceted approach that integrates spatial connectivity, environmental functionality, and social activity. These theoretical perspectives will be translated into practical guidelines, forming the foundation for designing rewltifunctional spaces.

2.3.1 Spatial connectivity for the exchange of resources

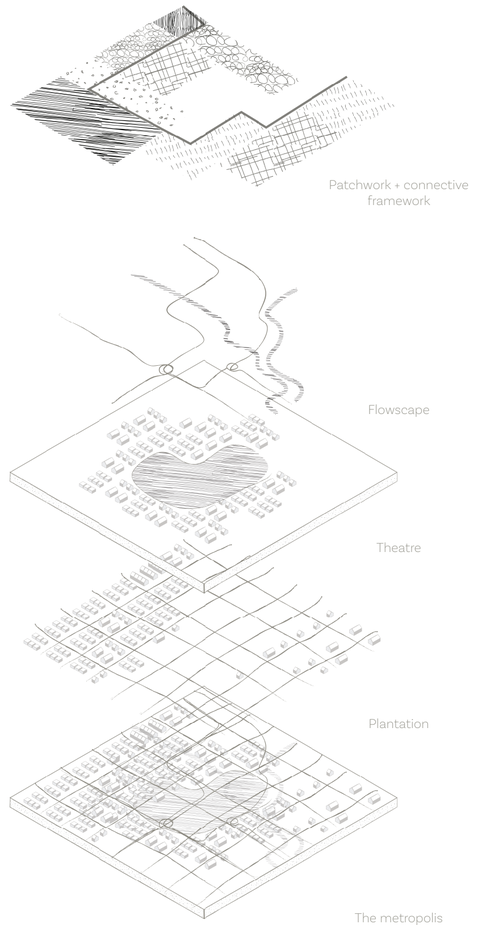
Spatial connectivity is a critical factor in regenerative development, facilitating the exchange of resources, people, and species across landscapes. This connectivity enhances ecological, social, and economic functions. Van Der Velde and De Wit (2009), in "The Landscape Form of the Metropolis," introduce three landscape-architectural archetypes: flowscape, plantation, and landscape theatre. These archetypes offer new perspectives on integrating movement, land use, and open spaces within regions, thus reinterpreting traditional urban forms.

The concept of flowscape refers to spaces of movement—highways, rivers, and pathways—which should not be designed solely for mobility but for enhancing spatial and visual experiences. These spaces create narratives as one moves through them(Van Der Velde & De Wit, 2009). This theoretical framework aligns with this research's objective to connect rural and urban landscapes, emphasizing transportation corridors, such as greenways and ecological corridors, which serve both functional connectivity and ecosystem health.

The plantation archetype refers to the structured arrangement of land uses within the urban grid. This approach advocates for integrating the urban grid into the landscape rather than allowing it to dominate, while respecting the landscape's historical structures and elements (Van Der Velde & De Wit, 2009). The archetype underscores the potential for blending urban and rural landscapes, respecting its historical structures and elements, by utilizing multifunctional spaces, such as agroforestry systems, which align with the project's focus on creating productive and resilient land uses.

The landscape theatre archetype highlights spaces where natural processes, emptiness, and silence dominate. These spaces present opportunities for community engagement, with open areas serving educational, ecological, and social purposes (Van Der Velde & De Wit, 2009). Designing such spaces within the project area is essential, as they can evolve into narrative-driven environments that immerse both residents and visitors in regenerative agricultural practices.

Neutelings' (1989) Patchwork Metropolis further conceptualizes the urban landscape as a mosaic of distinct 'islands,' each with its own program and spatial structure, yet interconnected within a metropolitan framework. This approach emphasizes the importance of a deliberate and structured arrangement of these diverse elements, ensuring they form a cohesive and unified whole (Pisano, 1989).



Representation of the theories for spatial connectivity

2.3.2. Environmental functionality for future sustainability

Environmental functionality is essential for ensuring that both urban and rural areas remain functional and productive to future climatic changes. The integration and connection of natural processes is a crucial aspect of this functionality. This can be facilitated for example by implementing green infrastructure, such as wildlife corridors and biodiverse water management systems that function as both water-capturing and water-providing spaces. In urban environments, it is important that these processes are made visible in spaces such as urban parks, wildlife corridors, and green spaces, which cater to both human and non-human species (Spirn, 1998).

Regenerative design

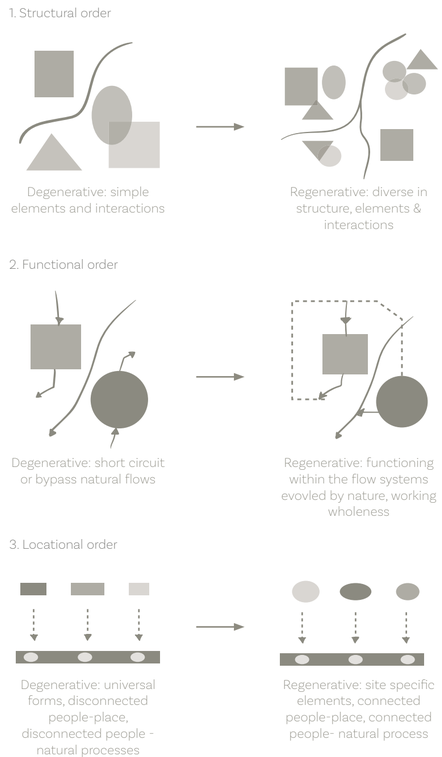
Regenerative design, as explored by Lyle (1994), extends beyond solely sustaining current ecological conditions; it aims to actively restore and enhance the ecosystems in which human activities are embedded. Lyle (1994) conceptualizes an ecosystem through three interrelated layers: structural, functional, and locational order.

The structural order refers to the physical organization and arrangement of elements within a system. In regenerative design, this involves creating a diverse and adaptable physical layout of structures and elements within a landscape (Lyle, 1994).

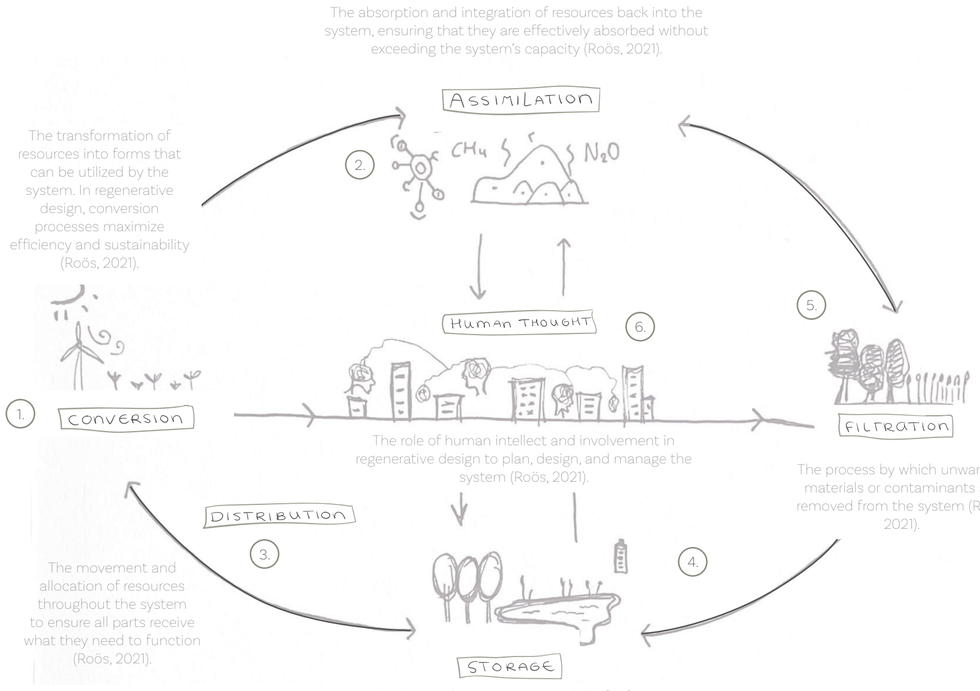
The functional order concerns the roles and interactions among various elements within the ecosystem's structure. Regenerative design aims to align human-made systems with natural processes to create a cohesive, self-sustaining system. This shift involves moving away from a linear, "one-way throughput" system to a circular system (Lyle, 1994).

In a one-way throughput system, resources are extracted, utilized, and discarded as waste, attached to a linear "take-make-dispose" model. Such systems often result in resource depletion and environmental degradation, as materials are not cycled back into the ecosystem (Roös, 2021). In contrast, circular systems are designed to mimic natural ecosystems, where waste is not an endpoint but a resource that reenters the system. Circular systems aim to create closed-loop processes that minimize waste, conserve resources, and support continuous regeneration. Closed loop systems can happen across various scales, and be categorized into six distinct phases (Roös, 2021)). These phases are illustrated in figure...

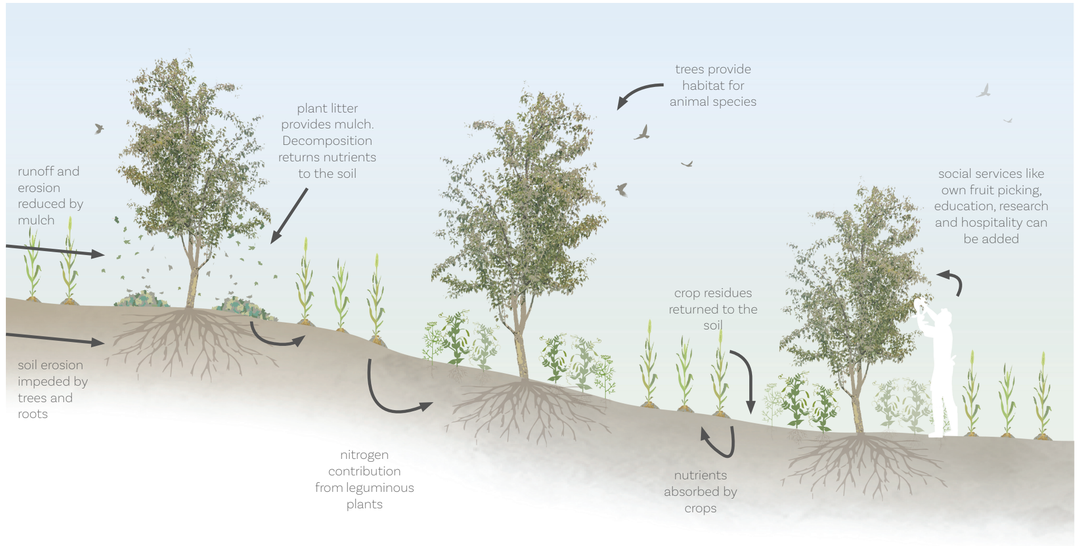
The locational order refers to the suitable placement of elements to the specific geographic and environmental variations on the site, such as solar radiation, wind patterns, water availability and soil type. Additionally, it considers the preservation of the genius loci—the unique spirit of a place—by respecting local biodiversity and cultural identity (Lyle, 1994).



Ecosystemic order according to Lyle (1994)



The phases of a circular, regenerative system (adapted by author based on Roos, 2020)



Benefits of agroforestry systems (adapted from Civilsdaily, 2022)

Agroforestry

Agroforestry, which is the integration of trees and shrubs into agricultural systems, plays a pivotal role in regenerative design due to its multifunctional and regenerating nature. Among the ecological benefits are biodiversity enhancement, soil health improvement, and carbon sequestration (Design Lab Agroforestry, 2023). On a social level, agroforestry fosters collaboration among stakeholders, including farmers, policymakers, and local communities. Also it can generate social services such as educational programs and recreational spaces (Dagar et al., 2023).

Economically, agroforestry may initially appear less profitable compared to conventional agricultural practices due to higher upfront costs and longer time horizons for returns. This can pose challenges to its implementation. However, in the long term, agroforestry proves more advantageous by restoring soil quality, enhancing biodiversity, and offering additional ecosystem services such as recreation and climate adaptation. While nature restoration projects are often dismissed because of perceived financial infeasibility, agroforestry presents a feasible alternative that not only promotes environmental health but also provides economic benefits.

Furthermore, numerous studies have demonstrated that tree-based farming systems significantly improve the productivity of salt-affected and waterlogged lands, help mitigate the spread of salinity, and contribute to the restoration of degraded areas (Dagar et al., 2023). As het Middengebied suffers from salinization, agroforestry can be a solution for this.

2.3.3. Social activity for landscape engagement

Enhancing social activity within the design is essential for fostering community interaction and encouraging people to engage with their surrounding environment. This engagement can cultivate a sense of environmental stewardship, fostering long-term care and consideration for the landscape.

Social activity can be promoted through various means, including the integration of social services such as education, research, and recreation. Additionally, creating an engaging and visually appealing environment plays a crucial role in encouraging social interaction. The potential for designing such environments through the differentiation of woodland structures is explored in the book Woods Go Urban, which examines variations in woodland structures as experimental landscapes, or “landscape laboratories,” where human activity and natural processes intersect (Gustavsson et al., 2023).

The following diagram illustrates the woodland structures identified and used in the design process.



Species complexity for productive, ecological and experiental diversity (Gustavson, 2022)

2.3.4. Strategies for a succesful implementation

The successful integration of agroforestry and regenerative practices into urban-rural landscapes requires well-considered implementation strategies. The case studies presented in Making Green Work (Sanz et al., 2022) provide valuable insights into how different approaches—top-down, bottom-up, or combined—impact project outcomes.

In Almere’s Utopiaeiland Food-Forest, a bottom-up approach led by volunteers, local communities, universities, and NGOs fostered a strong sense of ownership and community engagement. However, the absence of substantial institutional support created challenges for scaling the project and ensuring long-term sustainability (Sanz et al., 2022).

In contrast, the Madrid Metropolitan Forest project illustrates the benefits and limitations of a top-down strategy. This project, led by the municipal government, benefited from substantial funding and clear leadership. However, the lack of community involvement limited the project’s adaptability to local needs, which is critical for its long-term success(Sanz et al., 2022).

The Urban Forest Plan of Boston employed a hybrid approach, combining government leadership with consulting firms while engaging local communities and private landowners. This approach ensured alignment with city-wide goals while fostering public participation. However, balancing the diverse interests of various stakeholders has slowed decision-making processes and challenged the cohesion of the project(Sanz et al., 2022).

By reflecting on these implementation strategies, this research aims to connect the design with practical, on-the-ground actions and policy and implementation. The emphasis is on the need for a structured and cohesive approach, one that supports governmental leadership but remains flexible enough to adapt to changing environmental and social conditions. Involving a diverse range of stakeholders—such as local communities, farmers, universities, and NGOs—will be crucial for the agroforestry system to work.

2.3.5. Reference projects

The Finestrelle Planning project in Esplugues de Llobregat

The Finestrelles Planning Project in Esplugues de Llobregat, located near Barcelona, Spain, is an exemplary case of integrating urban, natural, and agricultural landscapes. The design establishes a green gateway that connects the city to the Collserola Natural Park, combining functions of housing, agriculture, and nature conservation. This green gateway is not only linked to the city but also strengthens urban connectivity by bridging fragmented green spaces and extending the green infrastructure within the urban fabric.

Despite financial constraints due to the project's large scale, the design has shown flexibility, evolving with new urban planning trends. For example, the integration of a bike path that connects to Barcelona and the use of green spaces for livestock grazing demonstrates the adaptability and multifunctionality of the design (Finestrelles Planning in Esplugues de Llobregat by Batlleiroig, 2023).

This reference project has informed my approach in two distinct ways: the creation of a multifunctional green gateway that connects the natural areas of the Krimpenerwaard and Bentwoud, and the enhancement of urban connectivity by bridging fragmented green spaces and strengthening green infrastructure within the urban fabric. The flexibility embedded in the Finestrelles project has been particularly influential in guiding me to design adaptable spaces that are capable of evolving with future challenges and opportunities. This is to make sure the design beholds long-term sustainability in a dynamic landscape.



Fragmented green spaces connected to the natural park by green corridors (batlleiroig, 2023)



Flexible green space occupied by cattle (batlleiroig, 2023)



The Alnarp and Snogeholm Landscape Laboratory in Sweden

The Alnarp and Snogeholm Landscape Laboratories in Sweden are experimental research sites focused on sustainable multifunctional landscape development. The concept combines environmental and production goals by designing woodlands with varying levels of species diversity. A monoculture (orange) consists of one tree species, while the 2-3 species model (yellow) introduces more complexity, offering better ecological resilience, productivity, and the creation of experientially diverse landscapes. This diversity in tree species not only supports ecological functions but also enhances the sensory experience for users, providing varied visual, tactile, and spatial interactions with the landscape.

This method is useful as it supports the idea of integrating multifunctional land use. By incorporating diverse species, the design fosters both ecological and socioeconomic benefits while enriching the experiential quality of the landscape, making it more engaging and sustainable.



Top view of the Snogeholm Landscape Laboratory (Hedblom, 2010)



Integrated Environmental and Production Approach for Woodland Design: Complexity in Species Diversity, Alnarp left, Snogeholm right (Hedblom, 2010)



Investigative and educational space in the living laboratory (Gustavsson et al., 2023)

2.4. Concluding: Theoretical Design Guidelines

In conclusion, a theoretical foundation for designing regenerative and integrated urban-rural interfaces can be established through the literature on spatial connectivity, environmental functionality, and social activity. These concepts are outlined in the following table.

Integration of natural processes

Emphasize the incorporation of natural processes, such as water management, soil regeneration, and biodiversity, into the design to enhance environmental resilience and support ecosystem functionality.

Contextual sensitivity

Account for the historical, cultural, and ecological context of the landscape, ensuring that designs respect the local identity and build on past land use practices.

Multifunctional landscapes

Encourage the design of complex landscapes that serve multiple purposes—such as agriculture, recreation, and habitat creation—allowing for a blend of ecological, social, and economic functions.

Adaptive and flexible design

Promote design solutions that can evolve over time and adapt to changing environmental conditions, social needs, and technological advancements.

Facilitation of self-organization

Support the potential for landscapes to develop autonomously, where local communities and natural processes can shape and influence the evolution of the design.

Connecting framework

Use spatial structures (e.g., ecological corridors, greenways) as a unifying element to connect fragmented urban and rural landscapes, facilitating the flow of species, people, and resources.

Resource circulation

Encourage the creation of circular systems where waste is minimized, and resources—such as water, nutrients, and materials—are continuously cycled back into the system to promote sustainability

3. Introduction to the Study Area



Occassional barns and tree rows in the study area



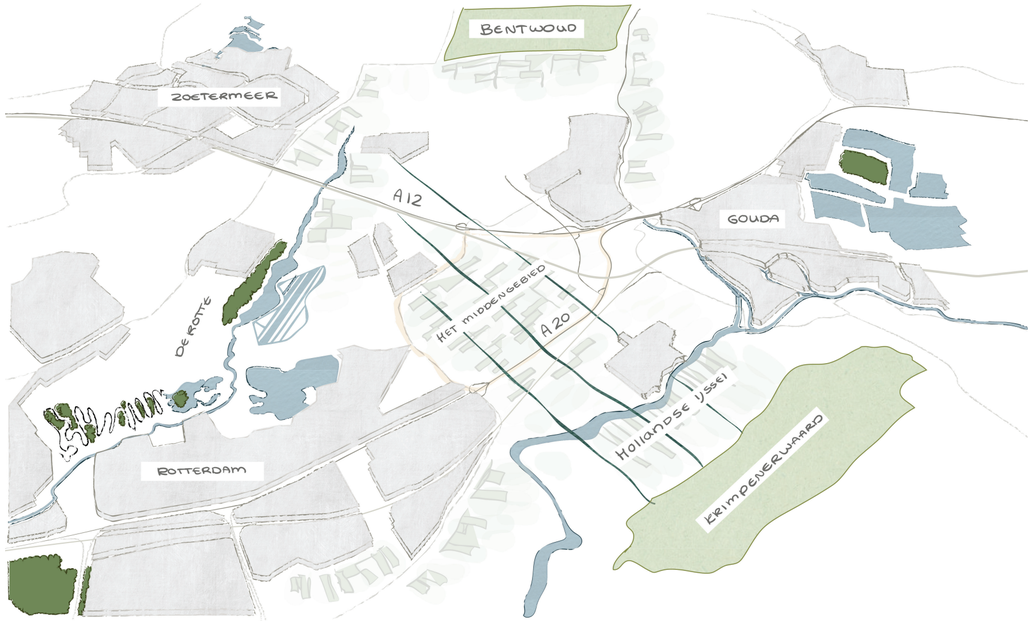
Vast major roads surrounding the study area

3.1. Location: Het Middengebied

Het Middengebied, situated at the heart of the Zuidplaspolder in South Holland, plays a crucial role within the RZG triangle and the Zuidvleugel of the Randstad, one of the Netherlands' most economically dynamic regions. Despite its rural, agricultural landscape, the area's central location between urban centres like Rotterdam, Zoetermeer, and Gouda has made it a focal point for regional housing development, driven by growing demand from nearby cities. This closeness ties the local population to the broader regional economy, as many residents commute to these cities for work.



Het Middengebied as focal point of the RZG region, within the greater economic region of the Zuidvleugel



Drawing of the structural pillars of het Middengebied

The area is framed by major infrastructural roads, railways and waterways that form the backbone of the landscape. The A20, A12 highways, and the Hollandse Ijssel river, form three dominant horizontal axes that shape transportation and water flow, acting as boundaries and corridors that connect the area to the broader region. The Rotte River forms a vertical structure in the landscape, which connects Het Middengebied to the Bentwoud nature reserve at North of the area, offering already existing recreational opportunities near Rotterdam.

The rivers are integral to the Zuidplaspolder's water management system, helping control and divert excess water, essential for preventing flooding, desiccation, and supporting agriculture.Complementing these primary elements are regional roads and waterways, which not only enhance local traffic and water management but also offer potential for improved ecological connectivity between the Krimpenerwaard and Bentwoud nature areas.

The landscape is characterized by flat, open terrain, primarily used for grasslands and crop cultivation. Occasional barns, houses, and rows of trees punctuate the horizon, while the area also provides habitat for diverse flora and fauna, including several protected species such as the water shrew, natterjack toad, grass snake, and weather fish (ATKB, 2024).

The integration of these morphological elements establishes a clear framework for managing movement, ecology, and hydrology, which guides the design and planning strategies for Het Middengebied and the broader RZG triangle. This research will primarily focus on the framework of movement structures within the landscape, as these linear elements offer significant potential to connect urban, rural, and natural areas. Leveraging these connections can serve as a foundation for regenerative landscape design.

4. Analysis



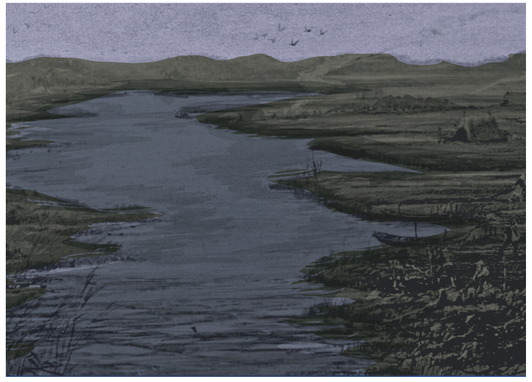
Small , scarcely vegetated canal, who got its shape by the historical movement and flow patterns that once defined the region



Big, scarcely vegetated canal, showing the historical movement and flow patterns

4.1. From Peatland to Urban Polder: A Millenium of Transformation

The landscape of the Zuidplaspolder has experienced four major transformations over the past millennium, each profoundly altering the landscape's physical and ecological structure.



The vast peat wilderness before human intervention (adapted by author, Knoester et al., 2023)



The big Zuidplas lake and smaller lakes after excessive peat extraction (Topotijdreis)

Peatland reclamation (10th-13th century)

Around a thousand years ago, the Zuidplaspolder was a vast, waterlogged peatland wilderness, dominated by swamp forests of birch, alder, and willow, alongside marsh grasses like cotton grass and peat moss. The area was largely inaccessible, with only small settlements along the Rotte river and higher ground near riverbanks. Early settlers lived simple, self sufficient lives on these patches, growing crops like emmer, wheat, spelt and legumes. Animals were kept in and around the house (Knoester et al., 2010).

In the 10th century, the Count of Holland began distributing land for reclamation. The first drainers worked from the Rotte and the Hollandse Ijssel, draining sections of the peat bog. They did this by using ditches and trenches perpendicular to the reclamation base. This allowed the water from the peat to flow away and be discharged into the Hollandse IJssel and Rotte rivers, lowering the water table by up to one meter. This drainage transformed the dense swamp forests into arable land and pasture. In 300 years, the natural vegetation disappeared, replaced by cultivated fields as the region shifted from wilderness to farmland (Knoester et al., 2010).

Peat extraction and water formation (16th-18th century)

In the 16th century, as Dutch cities expanded, peat became a crucial fuel source, leading to intensified large-scale extraction, known as "peat dredging." Farmers and workers dug deep below the water table, creating trenches that left the land waterlogged. Over time, these trenches expanded as they were not able anymore to drain the water effectively. Despite the introduction of new technologies—starting with horse-powered water mills, later replaced by windmills, and eventually by screw pumps—these efforts couldn't stop the land from gradually turning into large water bodies (Knoester et al., 2010).

By the 18th century, much of the Zuidplaspolder had transformed into expansive lakes which covered nearly 4,500 hectares. The largest of these was the "Grote Zuidplas". Vegetation was minimal, restricted to reeds and marsh plants along the lake edges, while the rich peatland ecosystems, including swamp forests, had almost completely vanished (Knoester et al., 2010).



Reclamation of the lakes after 1839 (Topotijdreis)



The contemporary urbanized and fragmented landscape (Topotijdreis)

Polder creation (1835-1839)

Recognizing the danger and economic loss of this situation, plans to drain the lakes and reclaim the land were proposed as early as 1697. However, it wasn't until the 19th century, under King Willem I, that the technology and financial support were available to carry out this ambitious project. Between 1835 and 1839, a system of steam-powered pumps and windmills was used to drain the Zuidplas lake, turning the waterlogged landscape back into usable farmland, making it one of the earliest large-scale state-funded land reclamation efforts in the Netherlands.

The farmland, characterized by nutrient-poor soil, was used primarily for grazing dairy cattle and some arable farming. This transformation resulted in a highly managed agricultural landscape of flat, open fields. The vegetation was mainly grasses for livestock, with only a few lines of tree species—such as willow, alder, and birch—that once thrived in the vanished wetland forests (Knoester et al., 2010).

Urbanization and industrialization (1960s - present)

The most recent transformation began in the 1960s when the Zuidplaspolder became an overflow area for urban expansion from nearby cities like Rotterdam and Capelle. As urban populations grew, much of the agricultural land in the polder was repurposed for housing developments, industrial zones, and infrastructure such as roads and canals. Greenhouses for horticulture also expanded into the area. This marked a shift from rural farmland to a more urbanized, fragmented landscape. The vegetation changed accordingly, with large areas of land converted to paved surfaces, while remaining agricultural fields were intensively managed, leaving little space for natural regrowth or reforestation. Some patches of green space, including planted trees and ornamental vegetation in urban developments, replaced the original natural forest cover. However, as they serve mainly health or recreational purposes, they do not fully restore the natural ecological balance that was lost with the original forest cover and remain fragmented (Knoester et al., 2010).

As a result of these transformations, the landscape of the RZG region has evolved into a fragmented area that can be distincted into three different types (differing in their way they impact the natural system and human activity): urban, rural, and network landscapes. The historical movement and flow patterns that once defined the region are still visible, particularly in the network landscape, where roads and waterways mirror the past. Understanding how these distinct landscape types function today is key to developing strategies for improving spatial connectivity, ecological functionality and human activity (Knoester et al., 2010).

4.2. Unfolding the Current Landscape: Urban, Rural and Network Layers

The RZG region's current landscape reflects the influence of both history and modern development. Old movement and flow lines can still be seen in the network landscape, while urban and rural landscapes have taken shape through more recent transformations. These three landscape types—urban, rural, and network—each have their own unique characteristics and challenges.

The urban landscape

The urban landscape is characterized by high-density development, including residential, commercial, and industrial areas. It features built environments such as housing blocks, office buildings, roads, and public spaces. Green spaces in urban areas tend to be fragmented and often serve recreational, aesthetic and health purposes rather than ecological functions. This landscape typically has limited natural vegetation and is heavily influenced by human activity, with a focus on housing, industry and services.

The rural landscape

The rural landscape is dominated by agriculture, with open arable fields, grass fields, and scattered farms. This landscape often features lower population density, with smaller settlements. While there may be some natural features like hedgerows and woodlots, there is little diversity in vegetation and has even a lower tree density than the urban areas. Human activity in this landscape is focused on large scale production of food.

The network

The network landscape connects the urban and rural areas through infrastructure like roads, railways, and waterways. It also includes ecological corridors and water systems that link habitats and manage water flow across the region. This landscape is critical for supporting human activity, managing water-related issues like flooding and drought, and maintaining biodiversity.

While the urban landscape is defined by housing, industry and services that support daily life, the rural areas are shaped by agricultural practices. The network landscape, meanwhile, continues to embody the region's historical roots, linking urban and rural areas through its system of mobility, water management, and ecological corridors. Therefor potential lies in the strengthening of this network while preserving its historical value.

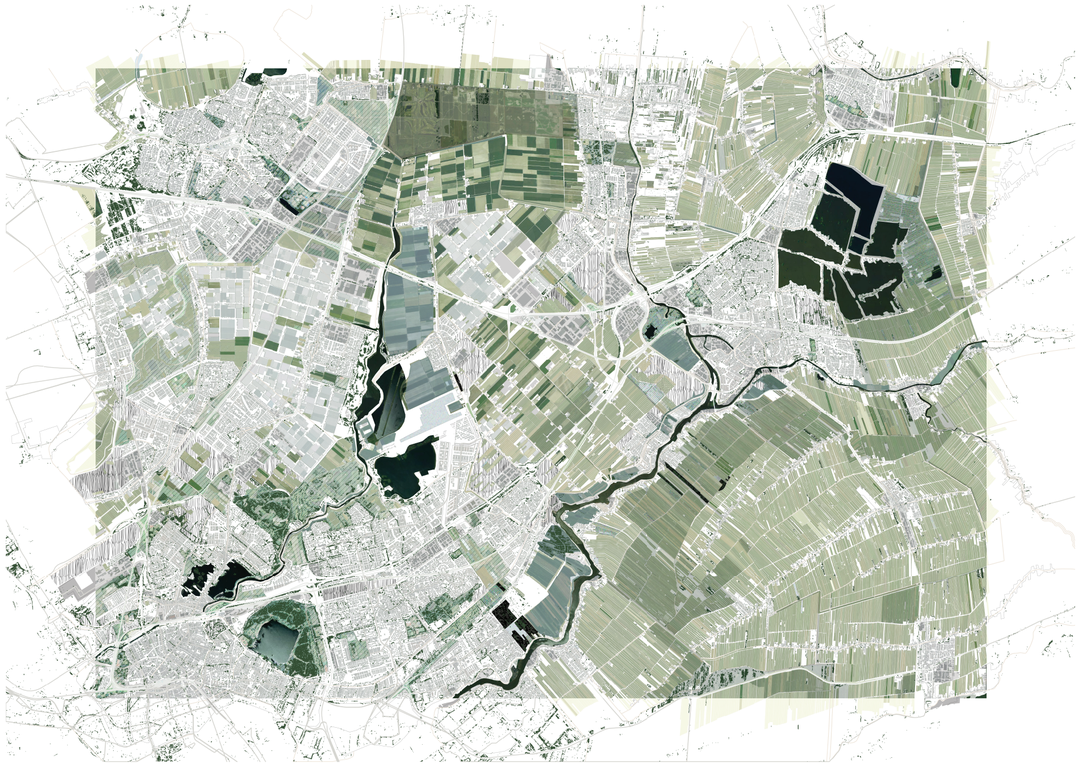
The network



The urban landscape

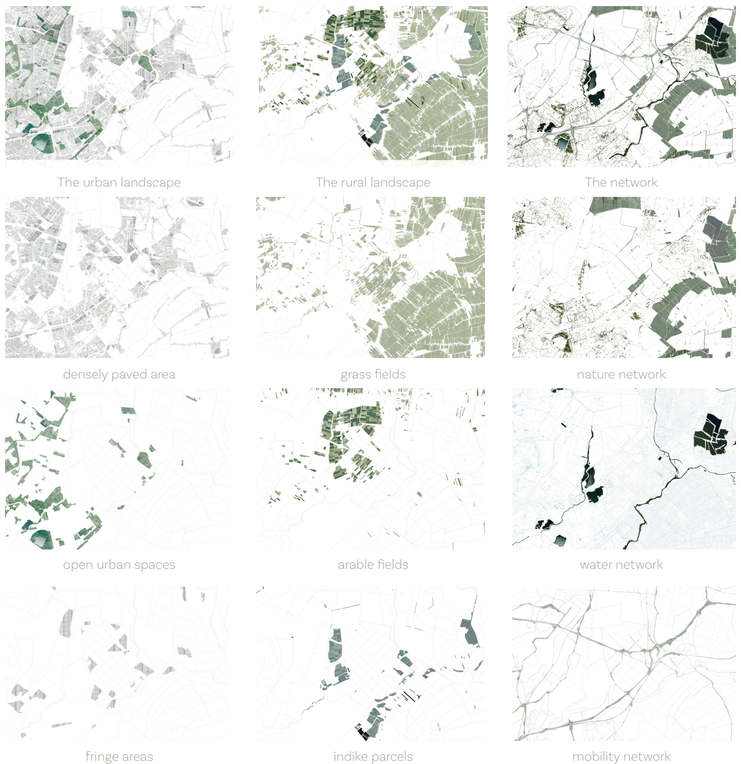


The rural landscape



The patchwork and its distinct subtypes of the RZG region

4.3. A Fragmented Area: Addressing Morphological and Functional Fragmentation



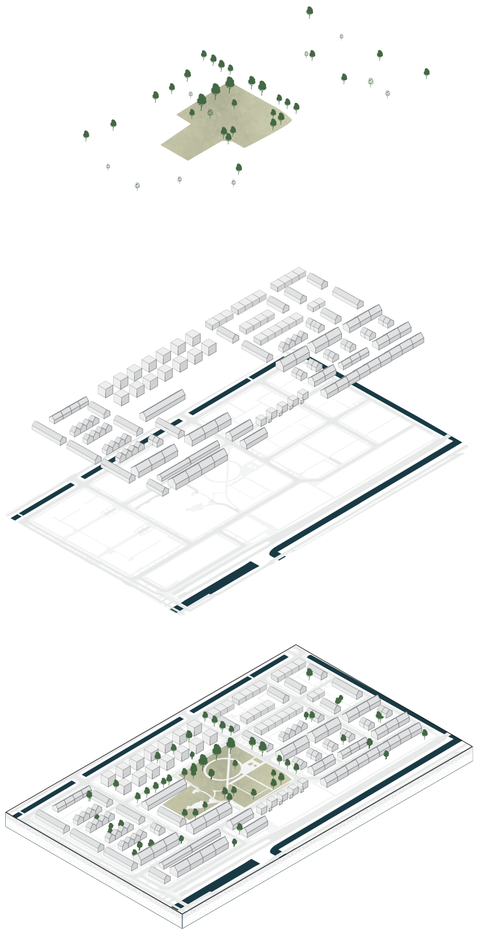
As the region developed, the interaction between these landscapes became increasingly fragmented. To better understand the sources of disconnection, the three landscapes—urban, rural, and network—are divided into subtypes (shown in fig...), each characterized in the way they are structured and impact natural systems and human activity. What can be seen is that there are two types of fragmentation in the area; morphological and functional fragmentation.

4.3.1. Morphological fragmentation

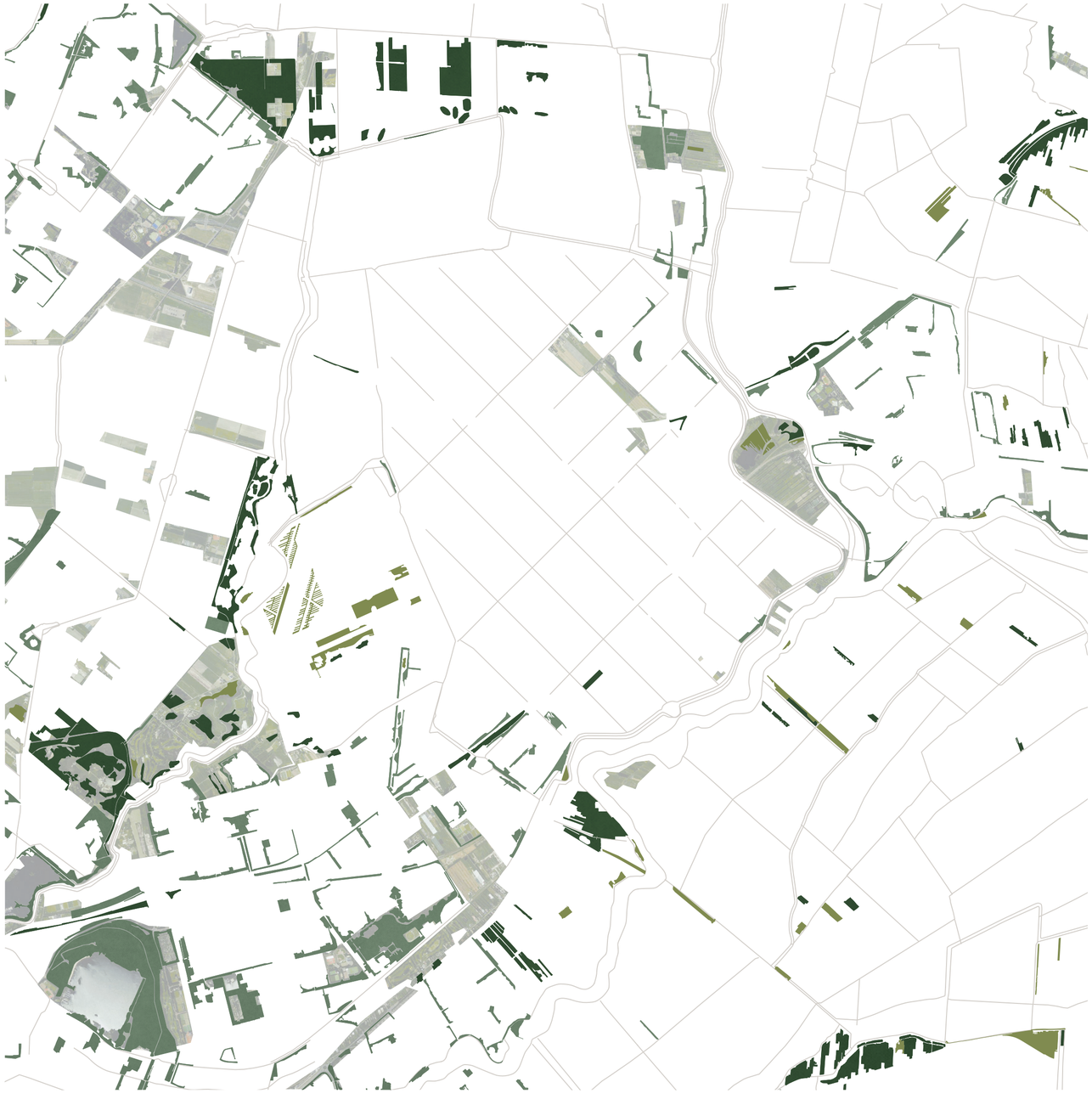
Each landscape sub type in the region presents distinct challenges. To understand these, it is essential to first analyze the fragmentation of its physical structure, or morphology, as this layout forms the foundation for ecological and social processes. By examining the spatial arrangement of elements, the barriers and disruptions to connectivity can be identified. This includes recognizing how the fragmentation of habitats, green spaces, and natural systems affects species movement, water flow, and human activities, ultimately influencing the landscape's overall functionality.

One notable subtype is the open green spaces in urban areas. These break the tension of the building blocks and are typically characterized by parks, public gardens, green plazas, and recreational areas. These spaces are often scattered and vary in size, providing vital areas for relaxation, recreation, and aesthetic value within the urban environment. However, their fragmentation within the urban landscape, causes limited connectivity to one another and to the larger natural systems and processes outside the urban environment. While they may support some vegetation and small-scale biodiversity, their primary role often leans towards human recreation and health benefits rather than serving as integrated components of a broader ecological network.

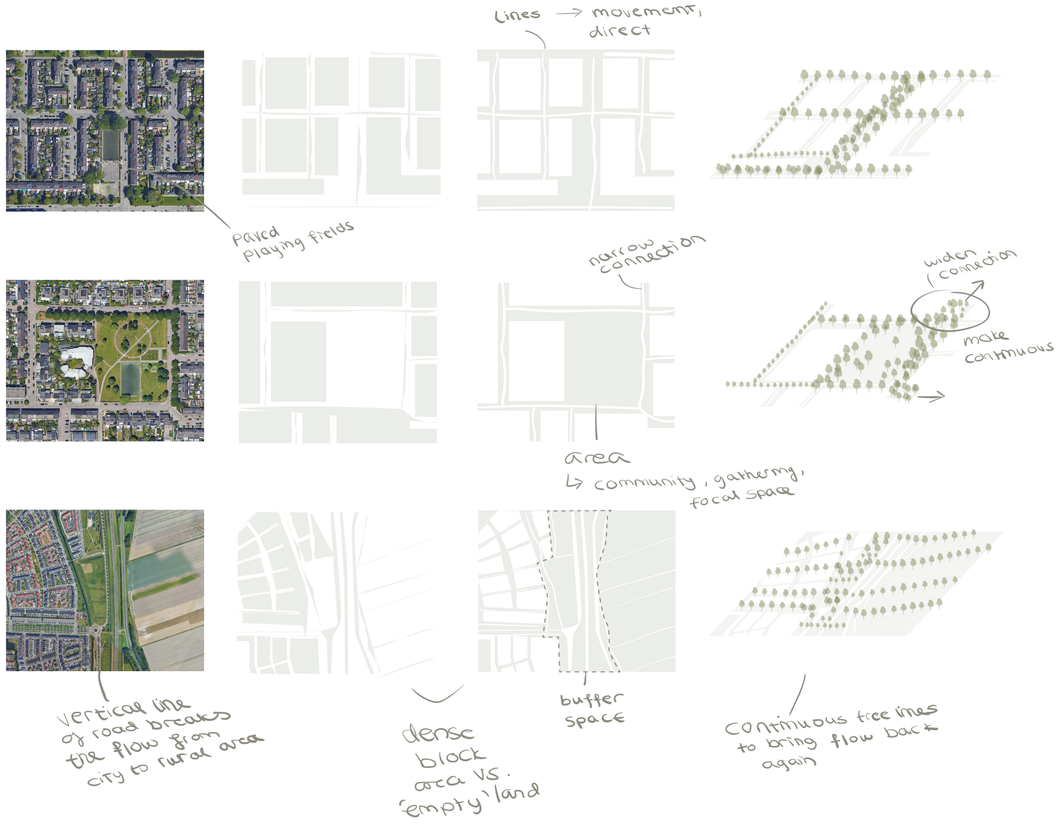
The potential for reconnecting these fragmented spaces is illustrated in the figure on page 47. It highlights how barriers shape the integration of trees across different zones. In densely paved areas, the rigid structure of blocks dictates linear tree lines between them. In contrast, the barriers in open spaces create room for trees to be arranged in area structures. In fringe areas, a road often separates the agricultural land, resulting in a parallel layout. Here, integrating perpendicular tree lines can re-establish a flow between these distinct landscapes. Thus, different forms of tree integration emerge depending on the area's morphological characteristics of the barriers. The ways in which these different tree configurations across various zones or subtypes contribute to distinct ecosystem and social services are analyzed at the local scale.



The morphological structure of the open green space

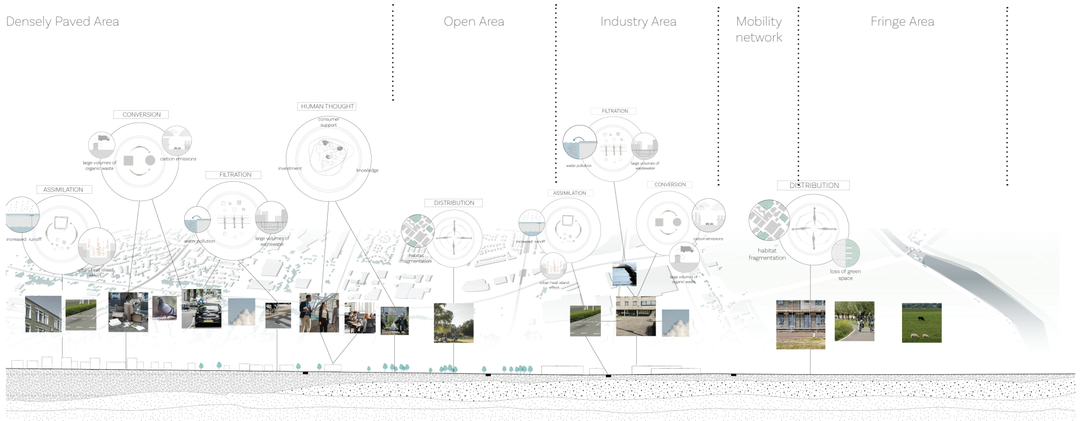


The spatial fragmentation of open green spaces in the urban landscape (Pdok, maptiler)

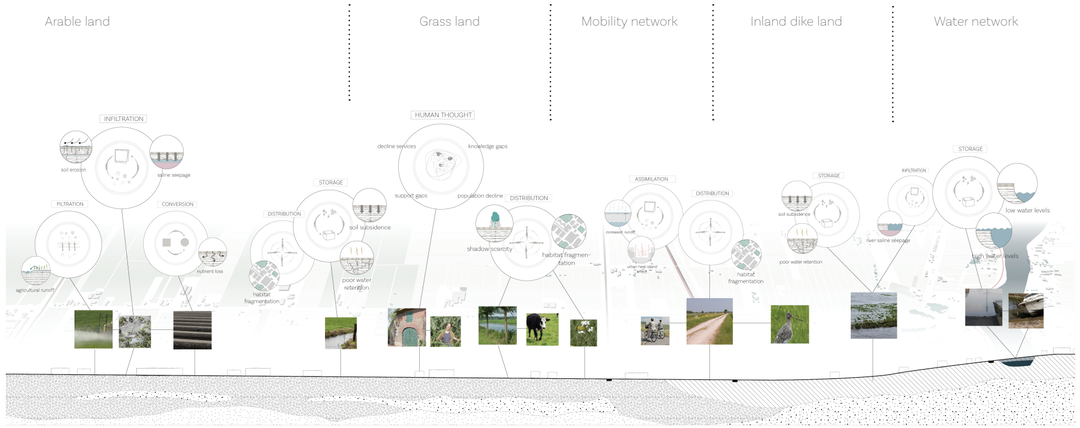


Barriers shaping the integration of trees across different subtypes

4.3.2. Functional fragmentation



The fragmentation of processes in the urban landscape



The fragmentation of processes in the rural landscape

In the urban landscape

The physical fragmentation of the landscape, with its scattered green spaces, disconnected agricultural fields, and disrupted networks, sets the stage for deeper systemic issues. The disconnection between these elements leads to a breakdown of ecological and social processes, highlighting the important link between structural order (morphology) and functional order (ecological and social processes), as discussed in the theoretical framework. In regenerative design, recognizing this connection is essential for developing solutions that address both spatial and functional disconnects, ultimately creating a more integrated and regenerative landscape.

The following figure illustrate the ecological and social processes within the morphological subtypes.

In the rural landscape

For example, fragmented urban green spaces fail to support continuous ecological corridors, resulting in biodiversity loss and a diminished ability to mitigate environmental challenges such as heat islands and stormwater management. In agricultural areas, the separation of arable fields from vegetation buffers and water reserves can accelerate soil degradation. By analyzing these functional breakdowns, it can be better understood how to transform these fragmented and problematic processes into integrated solutions that benefit both urban and agricultural typologies.

Having explored the link between structural and functional fragmentation, it becomes equally crucial to assess the locational order—whether the current land use is appropriate for local environmental conditions such as soil type and water quality and availability. Examining this alignment will help determine whether the existing landscape typologies and their uses are sustainable or if adjustments are necessary to better suit the region's natural characteristics. In the next chapter, we will delve into this relationship to ensure that design solutions are not only spatially and functionally integrated but also environmentally appropriate.

4.4. The Role of Contextual Misalignments

Underneath figures illustrate the most significant challenges the region faces due to the misalignment of land use with the underlying soil and environmental conditions. These mismatches create inefficiencies in agriculture, hinder water management, and contribute to environmental degradation. By aligning land use with the natural characteristics of the soil, the landscape can become more resilient, productive, and ecologically balanced. Below the four most significant land use problems and opportunities are explored based on soil types and environmental conditions. It prevails the need to better align land management with the natural conditions of the landscape.



Tilling and ploughing breaking up soil structure | Shallow rooted vegetation increasing waterlogging | Bare soil making it prone to erosion

Shallow rooted vegetation increasing waterlogging | Grazing animals compact the soil | Grassland not capable of water retention

Clay soil and arable fields

Clay soils are heavy, dense, and have fine particles. They have high water retention, which can lead to waterlogging but also makes them rich in nutrients. Clay soils tend to compact easily, reducing aeration and hindering root growth.

The current arable fields are not regenerating clay soils because of intensive farming practices, leading to soil compaction, waterlogging and erosion. Conventional tilling and ploughing used in arable land often break up the soil structure, leading to compaction and loss of soil porosity. This reduces the soil's ability to regenerate naturally. Also because of shallow rooted vegetation, the soil can easily become waterlogged, leading to anaerobic conditions, limiting the regeneration of healthy soil biota needed for recovery. At last when bare, soils are prone to erosion, as they lose structure and cohesion. Without cover crops or organic matter, the soil struggles to rebuild itself.

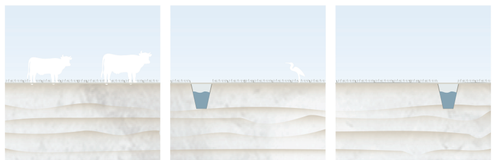
Examples of regenerating practices for clay soils are alley cropping, windbreaks and water storage ponds. The integration of trees with crops help to improve drainage, soil structure and fertility. Windbreaks help preventing erosion. Water storage ponds can collect excess water to prevent waterlogging and create backups in times of water scarcity.

Marshy soils and grass fields

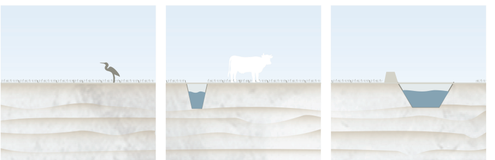
Marshy soils are typically water-saturated and have a high organic content. They often exist in low-lying areas and support wetlands vegetation. Poor drainage and anaerobic conditions make them difficult to manage for arable farmland, why they are often used for grazing fields.

Grassland is not regenerating marshy soils because of compaction, the drainage requirements and the grasses shallow root system. Grazing animals compact the soil, limiting water movement and air circulation. Grasslands also require drainage, which disrupts the wetland ecosystem, and grasses have shallow roots that fail to penetrate deeply enough to rebuild the soil structure.

To regenerate marshy soils, rewetting, saline agroforestry, and planting native wetland vegetation can help to restore the natural water balance, rebuild soil structure, and support the diverse ecosystem needed for long-term soil health.



Grazing animals compact the soil | Excessive draining leading to soil subsidence | Grassland not capable of water retention



Shallow rooted vegetation increasing waterlogging | Grazing animals compact the soil | Raised dikes prevent nutrient supply to soil

Peat soils and grass fields

Peat soils are highly organic, formed from decomposed plant material in waterlogged, acidic environments. Peat soils are typically found in wetlands and bogs and are important carbon sinks.

Like marshy soils, peat soils are highly sensitive to heavy grazing, which compacts the soil and restricts its ability to recover. Draining peat soils exposes them to oxygen, triggering decomposition and the release of stored carbon into the atmosphere. As the peat decomposes, the soil loses volume, leading to land subsidence. This collapse disrupts the soil's structure, further limiting its capacity to retain water and sequestering of carbon. This makes grass fields on peat soils, likewise to marshy soils, not a regenerating land use.

To regenerate peat soils, rewetting and minimizing soil disturbance are essential. Implementing silvopastoral systems, which combine livestock with tree cover, can help balance productivity and ecosystem health. It's important to use shallow-rooted trees that won't disturb the peat, conserving its carbon sequestration potential. Rewetting helps prevent oxidation and further decomposition, stabilizing the soil.

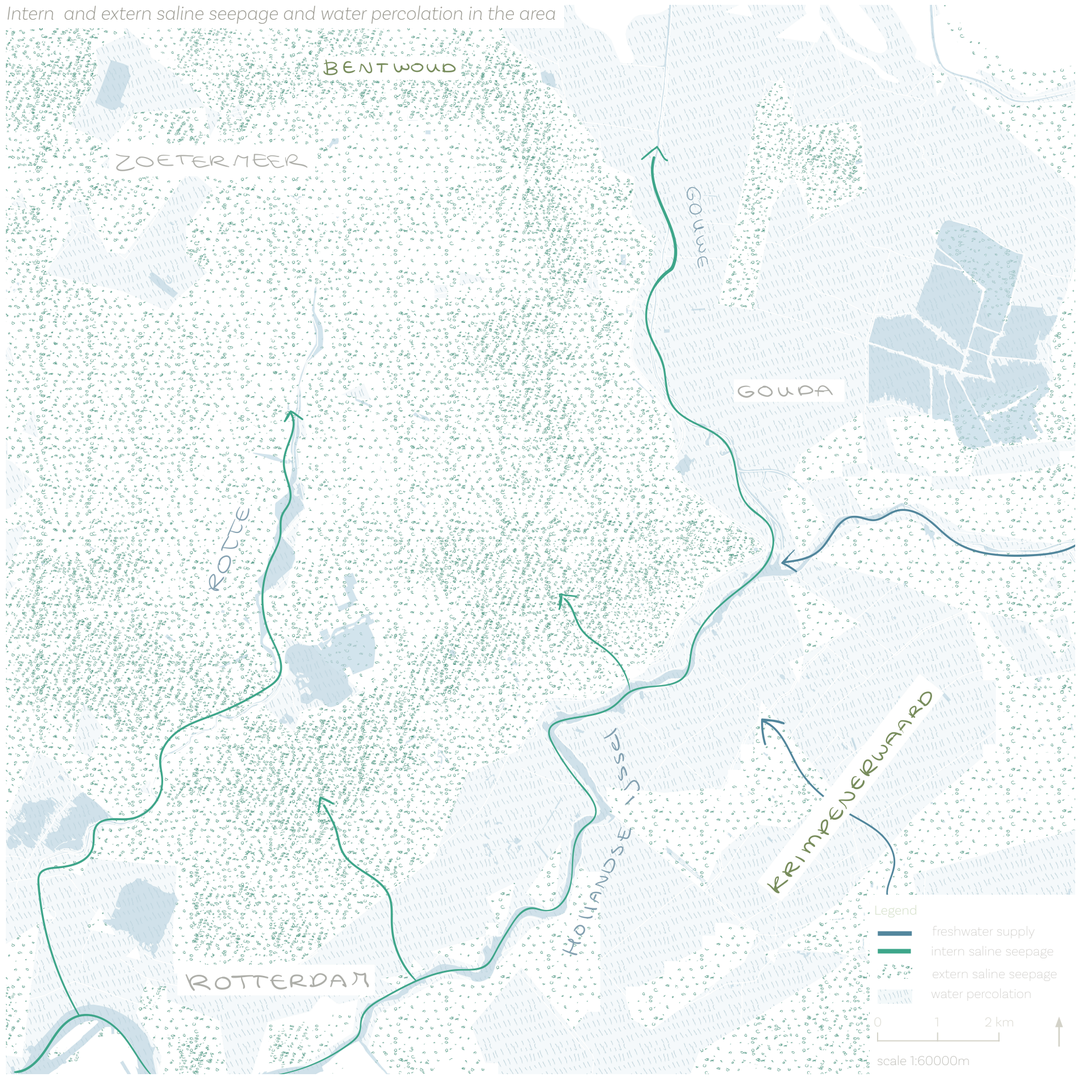
Alluvial soils and indike grass fields

Alluvial soils are nutrient-rich due to sediment deposition from rivers. While they are naturally fertile, the high water table and periodic flooding can lead to waterlogging.

Indike grasslands, however, are disconnected from these natural processes, as the raised dikes prevent floodwaters from replenishing the soil with sediments and nutrients. Intensive grazing further compacts the soil, reducing water infiltration and disrupting the balance between soil and river ecosystems.

To regenerate alluvial soils and its belonging river systems, floodplain restoration, riparian buffer zones, and silvopasture can help reconnect these fields with natural water processes. Riparian buffers stabilize soil and filter runoff, while integrating trees in silvopasture improves drainage and soil structure.

Intern and extern saline seepage and water percolation in the area



4.5. Stuck in Single Use

Currently, land use in the agricultural landscape remains predominantly monofunctional, with areas dedicated to singular activities like grazing or arable farming, often neglecting broader environmental processes and human needs. In contrast, the urban landscape is more multifunctional, integrating recreation, living, work, industry, and education. However, the social activity of urban dwellers rarely extends beyond city boundaries, as recreational routes tend to bypass rather than engage with these rural areas. To enhance economic profitability, support regeneration, and strengthen social connections between the two landscapes, it is essential to diversify land functions and create more integrated systems.



Monofunctional grassland in the project area



Degraded river edge in the project area



Monofunctional grassland 2.0



Degraded water in the canal



No access for recreators in the rural area



Waterlogged land

4.6. The need for a multifunctional regenerative approach

The analysis of the RZG region reveals issues such as morphological and functional fragmentation, contextual misalignment, and a predominantly monofunctional landscape. The divide between urban and rural areas is among the most critical barriers. If these challenges are not addressed, they could hinder sustainable development. A more holistic, multifunctional and regenertaive approach is necessary to better integrate food production, environmental resilience, and social well-being, creating stronger connections between urban and rural areas.

5. Strategy and tools

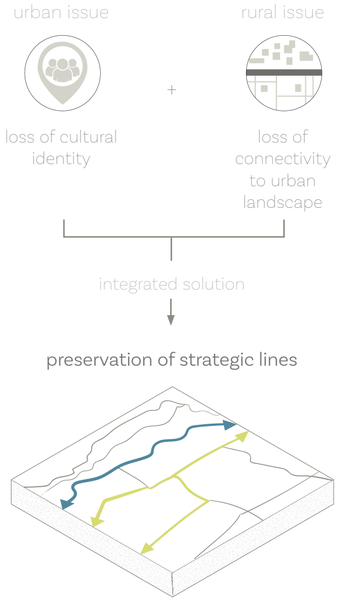
5.1. From fragmentation to integration: A strategic approach

Building on this analysis, it becomes clear that the monofunctional land-use system lacks the resilience and adaptability needed to meet future environmental, social, and economic challenges. The system can be considered non-regenerative, as it fails to sustain itself over time. To address these issues and foster a more integrated and regenerative landscape, five key strategies have emerged: preserve, strengthen, connect, adapt, and diversify. These strategies aim to enhance the networks between urban and rural landscapes, promoting regenerative development. The details of these strategies are illustrated in the following diagram.

5.1.1 Preserve

Preserving historical lines is essential for maintaining the landscape's cultural heritage and regional identity, as they reflect the history of land use. As seen in the analysis these lines are recognizable in the network landscape and form good opportunities to connect the landscape. They must be strategically selected for their function and significance within the wider region.

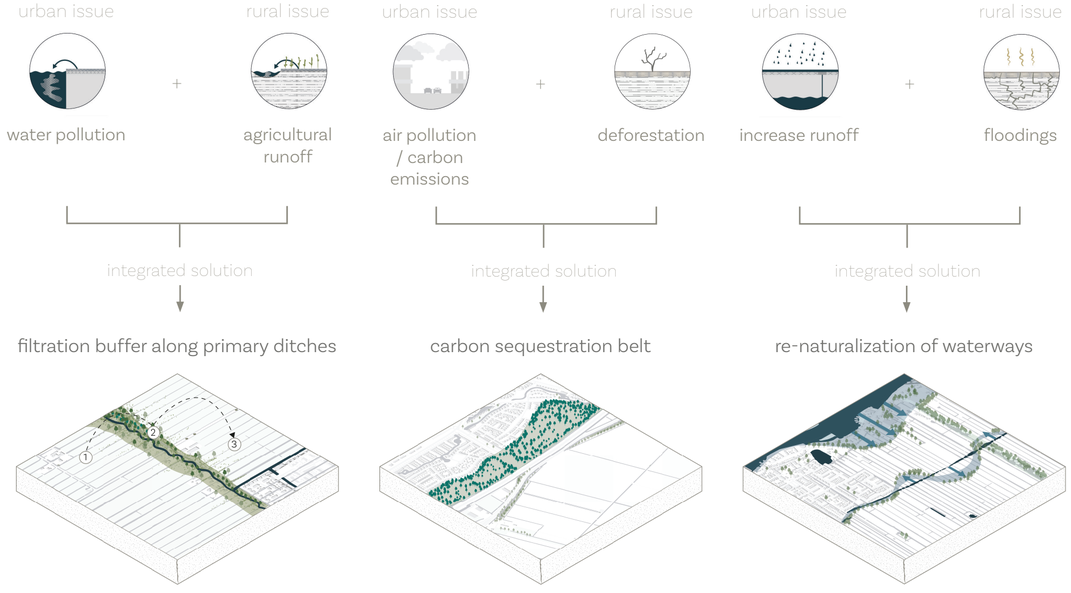




5.1.2. Strengthen

Strengthening the structure of historical lines is essential to ensure the structure's lasting effectiveness. This creates a guiding framework within the landscape that shapes future development, not only preserving and connecting key features but also enhancing their ecological, environmental, and social functions.

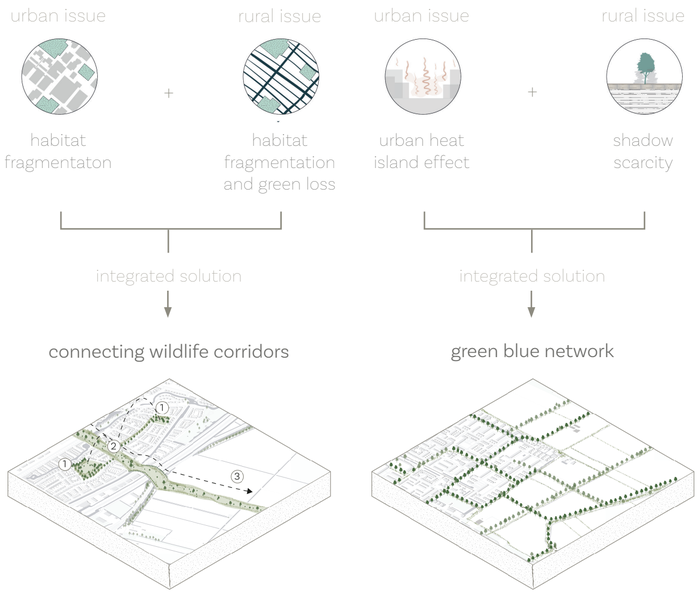




5.1.3. Connect

This strategy aims to connect the fragmented areas and disconnected land uses. Preserved historical lines serve as a backbone for creating those new connections. This enables the landscape to function as cohesive system for exchanging resources, knowledge, and services.

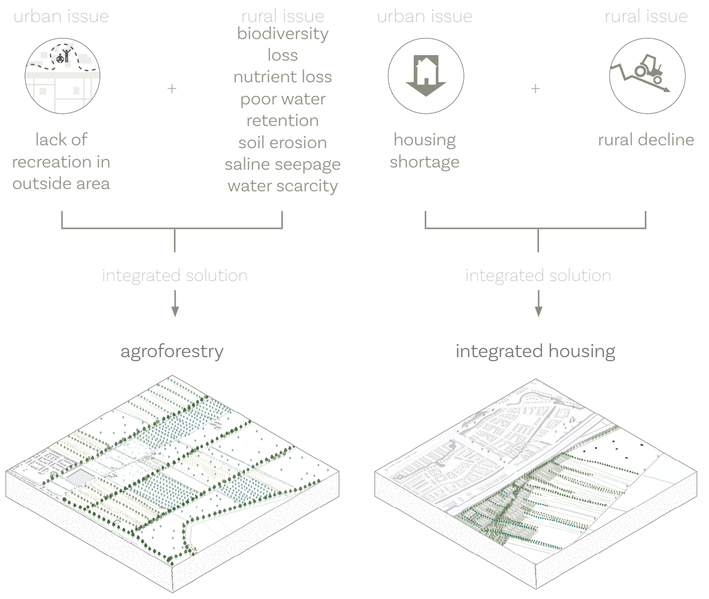




5.1.4. Adapt

Adaptation is essential in responding to changing environmental and socioeconomic conditions. This strategy focuses on aligning land-use practices with local soil conditions, ensuring sustainability against future environmental pressures while responding to the region's specific needs.

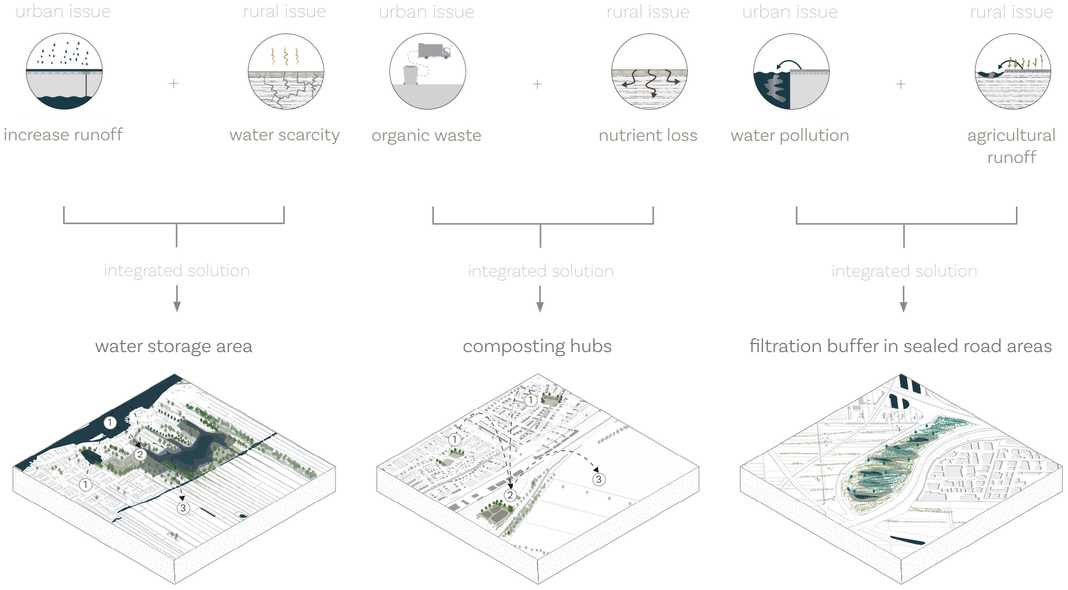


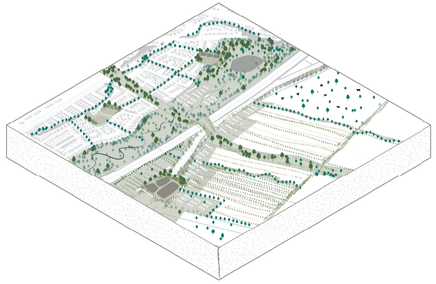


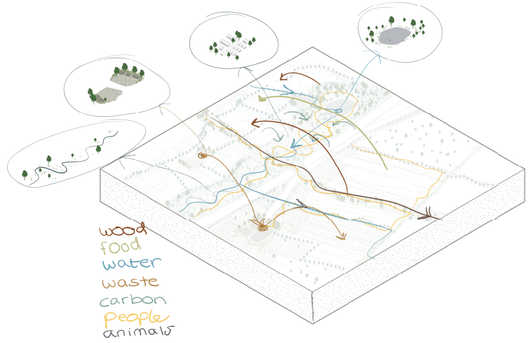
5.1.5. Divers

The monofunctionality identified in the analysis underscores the need for diversified land-use strategies, particularly through the integration of agroforestry with social services. Preserved and strengthened historical lines provide natural boundaries or frameworks within which new, diverse systems can be introduced. This approach optimizes land use and enhances the landscape's adaptability to change.









Connecting the processes through a diverse and multifunctional framework

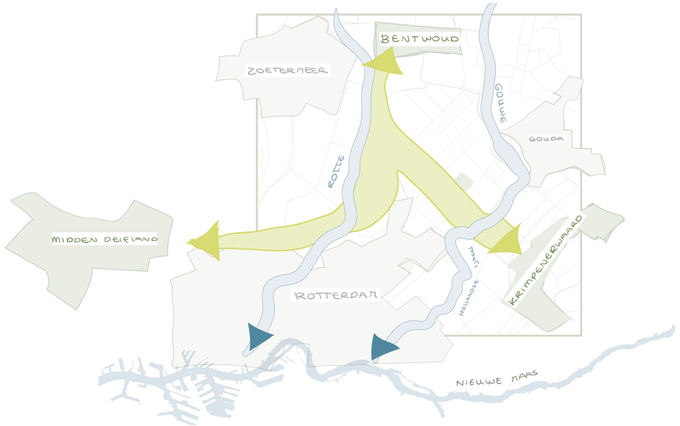
6. Design

6.1. Regional structure vision



Strategy Integration within the RZG Area

The historical lines connecting the Krimpenerwaard, Bentwoud, and Midden Delfland are selected for their strategic role in water management and connecting nature areas across the wider region. These lines are strengthened to enhance water regulation and ecological continuity through restoring waterways, adding greenbelts, and filtration buffers. Linkages, such as green networks and corridors, are established to ensure equitable and continuous green space. Agriculture and housing are adapted to align with the region's soil and hydrological conditions. Finally, the framework is diversified by incorporating functions like recreation, filtration, storage, and composting hubs, transforming these lines into spaces that support ecological health, food production, and social activity, while enriching the regional character and resilience.



1. Preserve



2. Strengthen



3. Connect



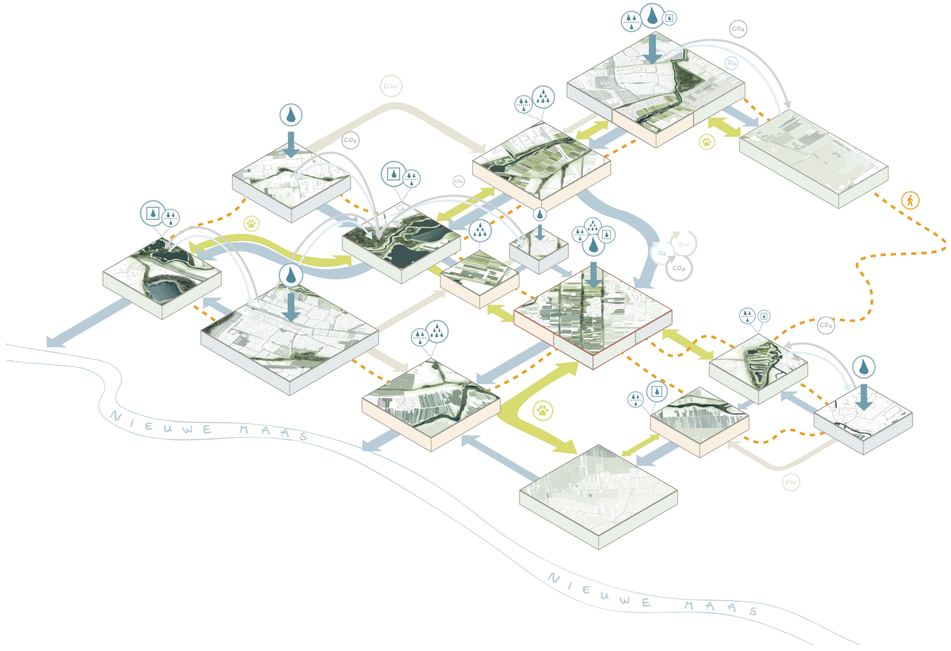
4. Adapt



5. Divers



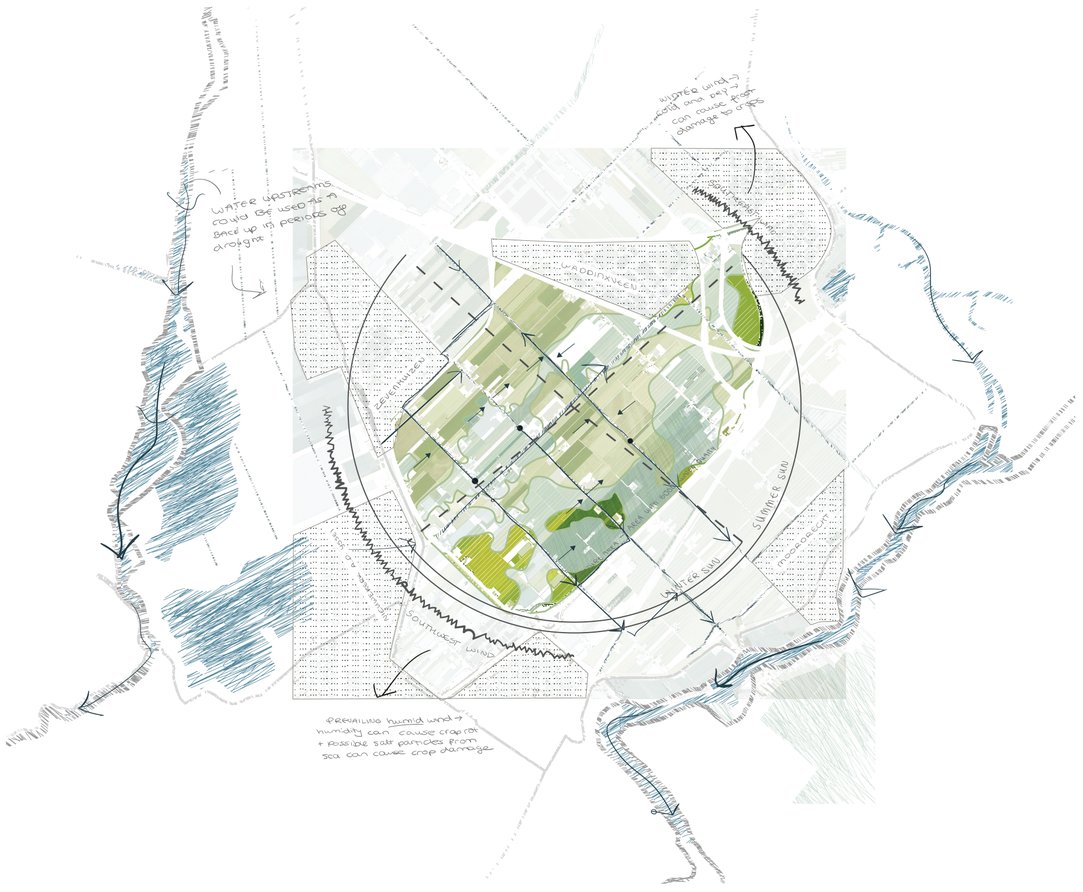
The flow and exchange of essential elements in the design



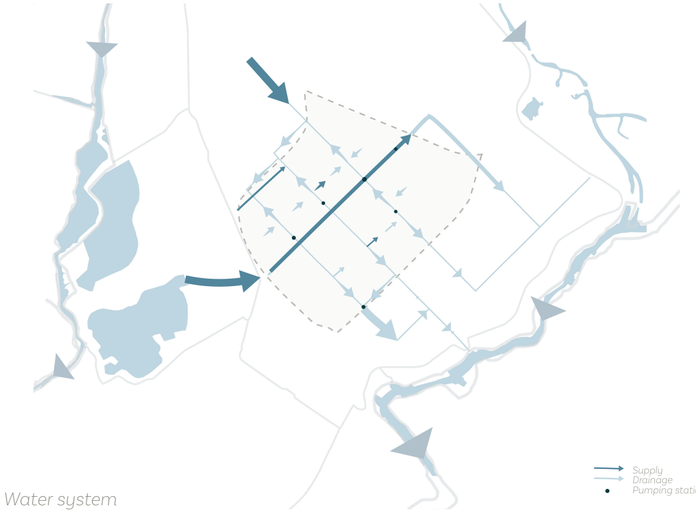
The map illustrates the dynamic interactions between urban, natural, and agricultural areas, emphasizing the flow and exchange of essential elements such as CO2, O2, water, biodiversity, human activities, and organic waste within the landscape. All three landscapes supply and receive for each other supporting the creation of a circular system.
It shows that integrating agroforestry into the design can turn the agricultural area into a crucial buffer space as it facilitates water distribution and purification, acts as a carbon sink, processes urban organic waste, supports wildlife movement, and boosts human activities.

A critical note is the need for carefully managing these flows to ensure they support rather than disrupt each landscape's functions. While agroforestry plays a key role in distributing and purifying water, absorbing CO2, processing organic waste, supporting wildlife movement, and enhancing human interaction, its success depends on maintaining the right balance. Overloading the system with waste, excessive water use, or poorly managed recreational activities can undermine its regenerative potential. Therefore, adaptive management and continuous monitoring are essential to optimize the benefits while addressing potential conflicts between urban, natural, and agricultural demands.

Conclusion map of analysis of Het Middengebied



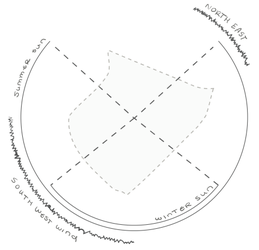
The conclusion map explained



Water system

The water system in Het Middengebied is overly dependent on pumping stations, making it energy-intensive and disrupting natural water dynamics. To enhance water quality, support biodiversity, and reduce maintenance costs, the system needs re-wetting and the re-naturalization of waterways, allowing for natural water retention and flow.

Sun and wind direction



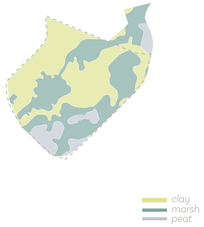
Mobility



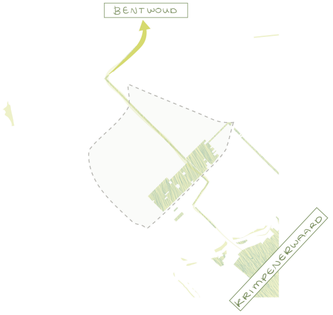
Surrounding villages



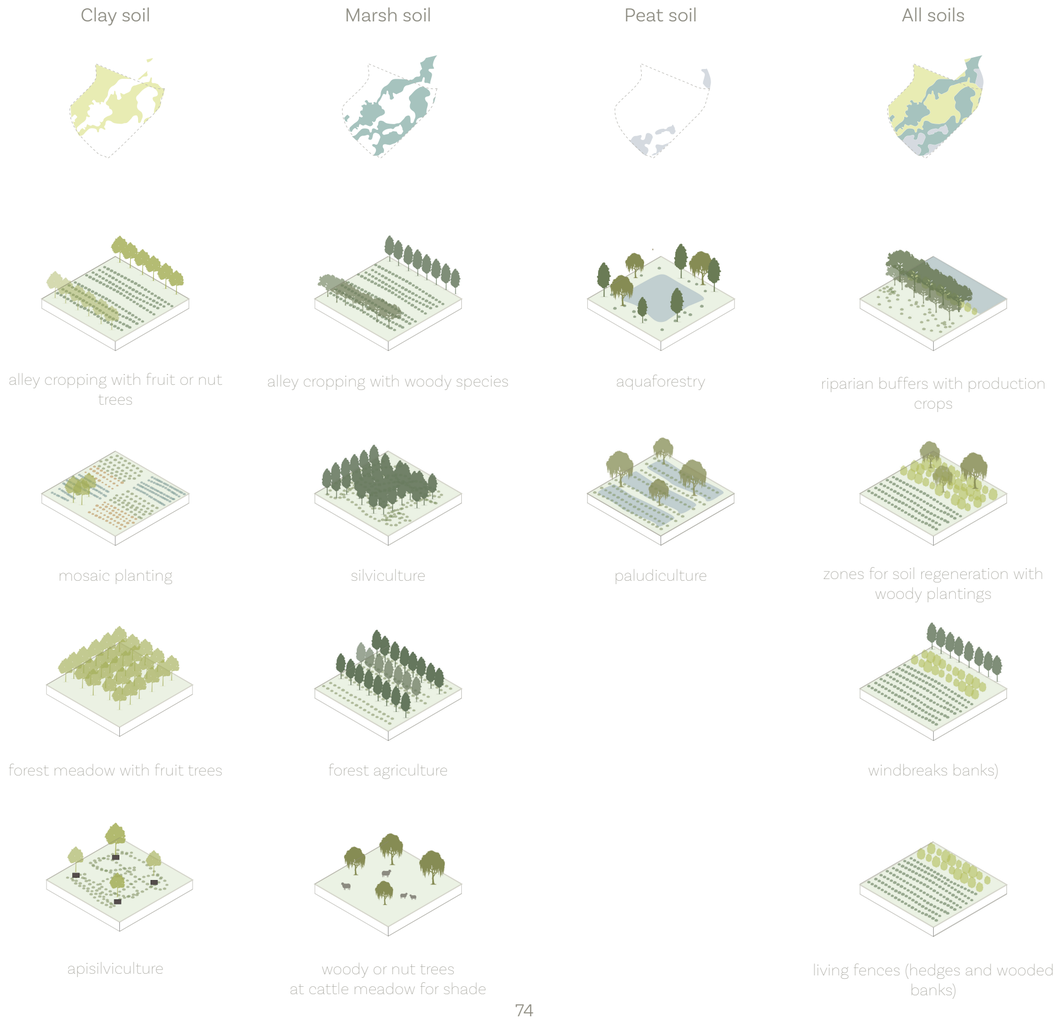
Soil types



Nature network

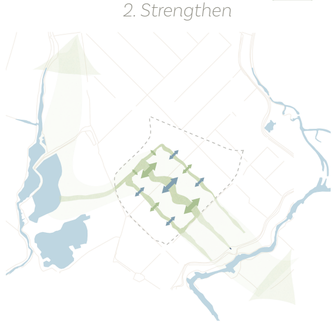


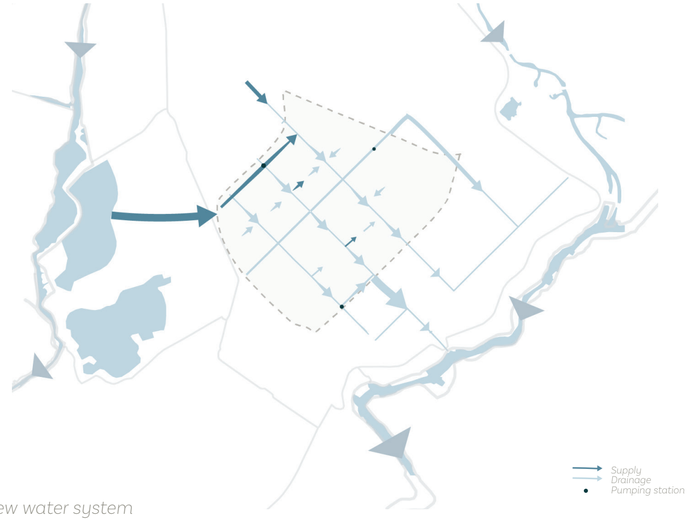
Soil-based agroforestry practices



Strategy Integration within het Middengebied



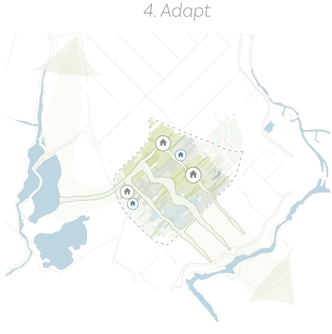


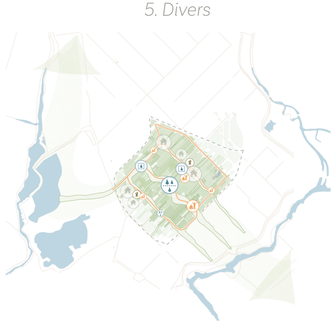


New water system

The new water system introduces a natural flow from higher to lower areas, allowing gravity to guide water movement across the landscape. This approach reduces reliance on pumping stations and makes the area more prone to climatic changes. In the lowest, flood-prone areas, rewetting will be combined with paludiculture and floating houses. In this way the design promotes regeneration by its ability to sustain and replenish itself.



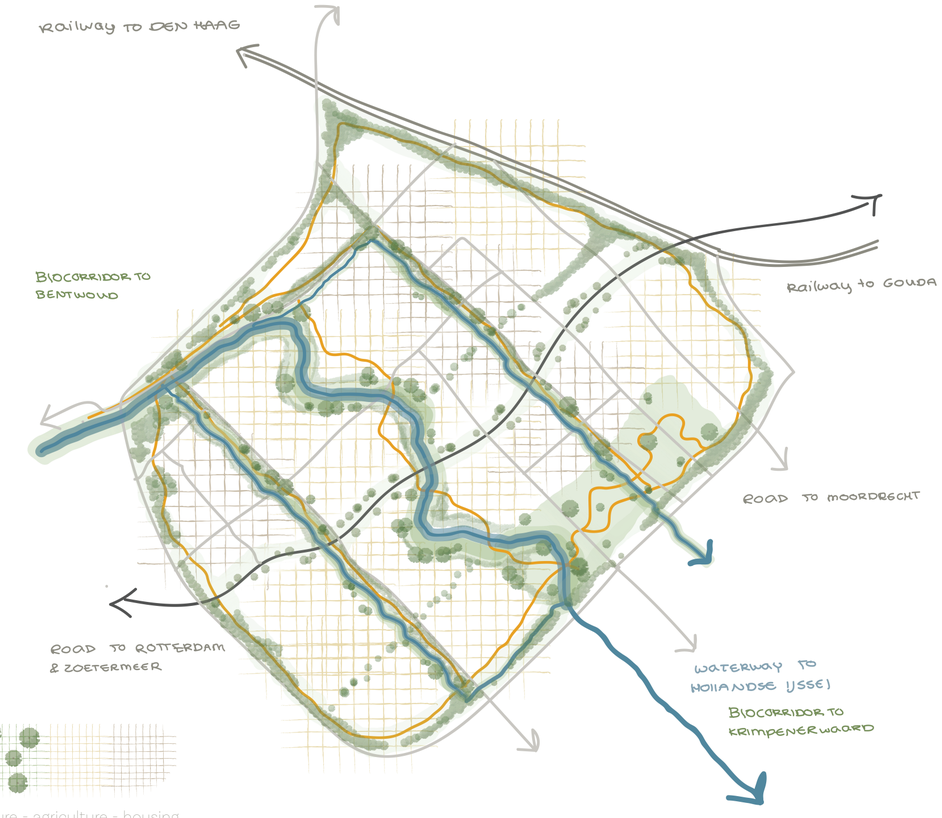




Local design



The structure – agroforestry as a buffer between nature and housing development



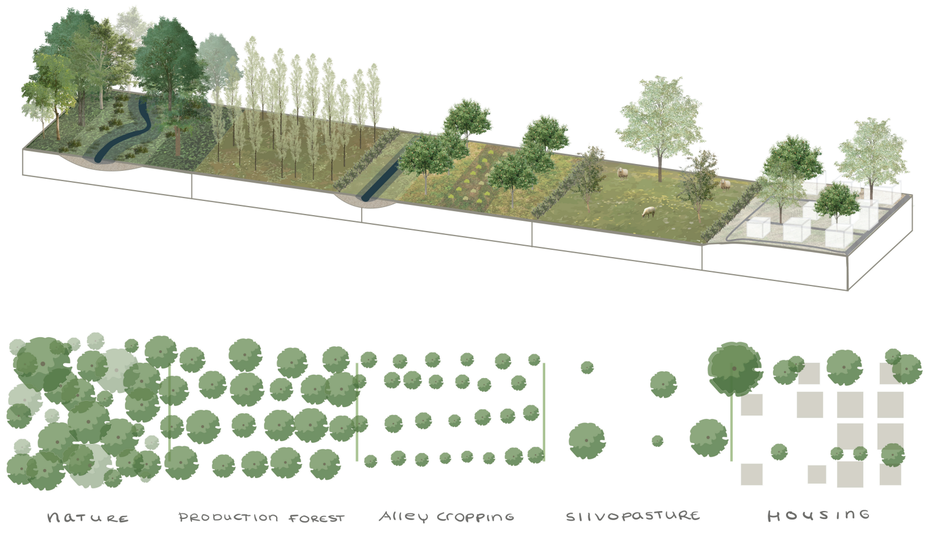
In the design, agroforestry acts as a buffer by creating a transitional zone between natural landscapes and housing developments. It integrates tree-based farming systems that enhance biodiversity, improve soil health, and manage water flow, thereby mitigating potential environmental impacts from urban areas. The vegetation helps absorb noise, reduce air pollution, and create visual barriers, promoting a more harmonious coexistence between human habitation and nature. This multifunctional landscape supports both ecological processes and recreational opportunities, making the buffer an active, productive space that benefits residents and wildlife alike.

Bird view of zoom in location



Diagrammatic representation of the gradience in density experience

These images illustrate the gradient of density in the landscape, transitioning from dense natural areas to more open spaces near housing. The progression starts with the natural forest, followed by production forest, then moves to structured alley cropping with trees, and finally, silvopasture adjacent to the housing. This arrangement maintains a sense of openness and unobstructed views for residents, while still providing ecological benefits and integrating diverse land uses.



6.3. Detail Design Section A - E



C

D

biodiversity

agricultural products

wood for building materials / fuelwood or community products

wood for fencing material

biodiversity

agricultural products

water retention by tree roots

manure

10 m

3. water storage

walk & bike path
4 m

bioswale
5 m

car and bus road
6 m

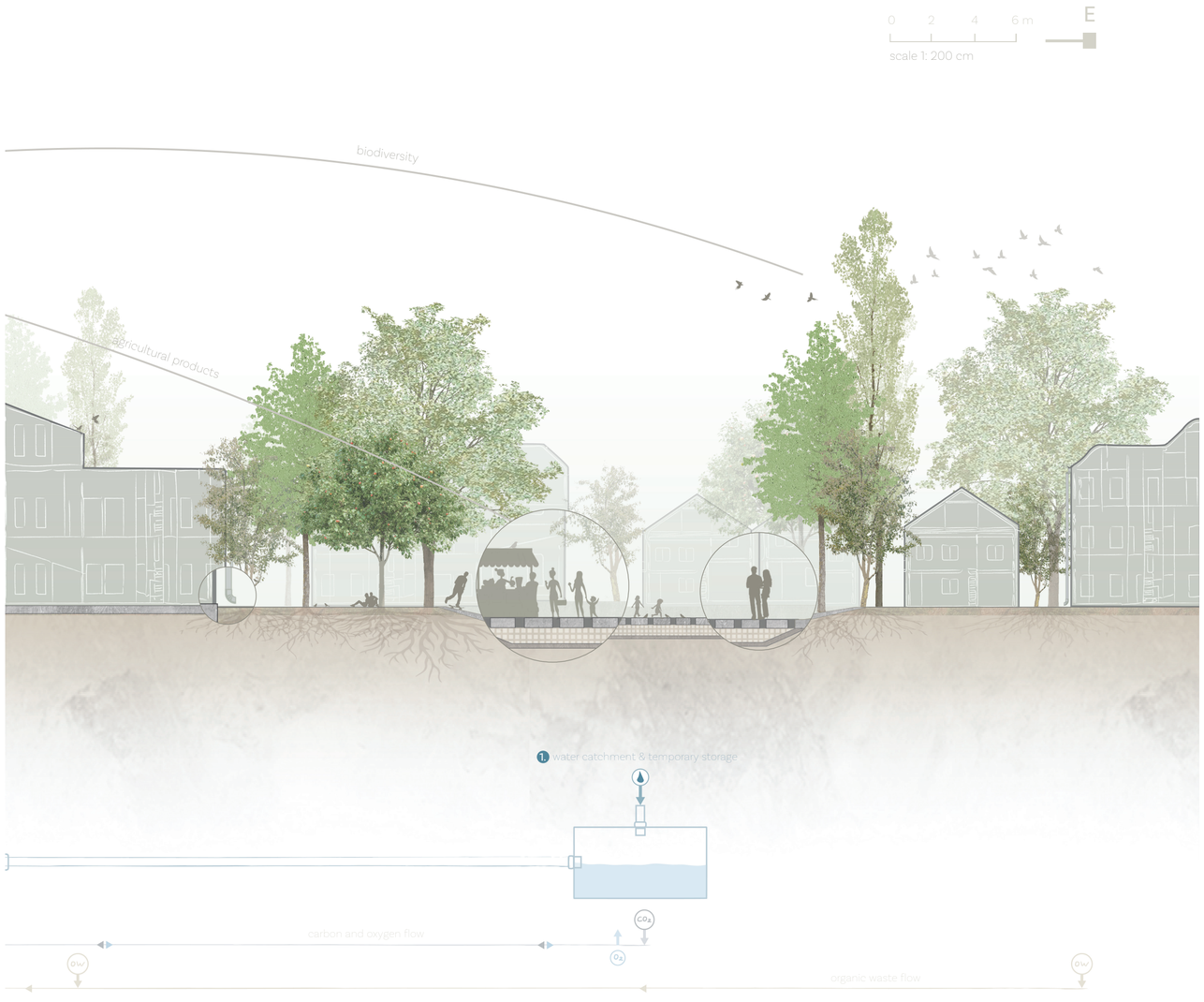
2. water filtration and drainage

carbon and oxygen flow

organic waste flow

carbon and oxygen flow

organic waste flow



Flexible squares for adaptive land and water management

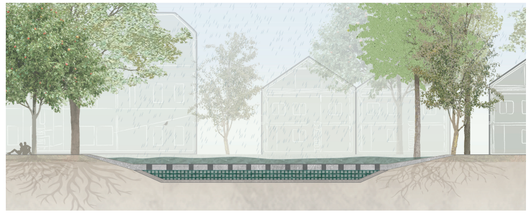
Food markets



Playing fields



Water catchment and temporary storage area



Flexible squares for adaptive land management introduce multifunctional spaces that can dynamically respond to changing needs. The design envisions a square that primarily functions as a water plaza, 1 capturing and temporarily storing excess rainwater to mitigate flooding during heavy rainfall. The collected water is directed to an adjacent bioswale, where it undergoes natural 2 filtration before being channeled to a 3 storage area. From there, the filtered water is 4 distributed for irrigation in nearby agricultural zones, supporting sustainable food production. Any excess water is 5 discharged into a natural canal in the surrounding nature area. When dry, the square transforms into a versatile space for community activities, such as food markets, sports, or events.



Atmospheric impression of the recreational route where the natural and agricultural area meet

Atmospheric impression of the integration of trees among cattle and the housing area in the background



Atmospheric impression of villagers picking their own fruit and vegetables at the farmers place

6.4. Phasing of the design

The image illustrates the phased development of a multifunctional landscape over a 25-year period:

0 Years (Existing Conditions): The site begins in its current state, with its conventional land uses and minimal interventions.

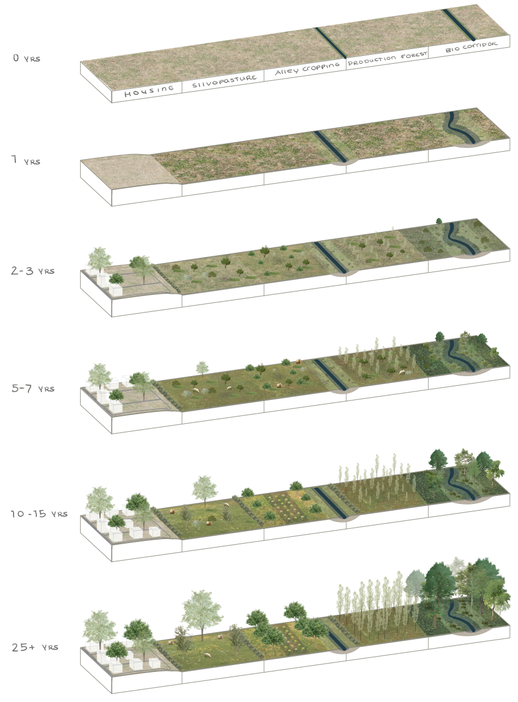
1 Year (Initial Development): Planting begins alongside the widening of ditches. Excavated soil is used to elevate the ground for future housing.

2-3 Years (Establishment Phase): Early growth of plantings and the construction of essential buildings occur.

5-7 Years (Growth and Integration): Plantings mature further, allowing the introduction of cattle for manure, benefiting the orchard, production forest and nature area. Additional non-essential structures are built.

10-15 Years (Early Productivity): The landscape reaches limited productivity, with housing more established. Cattle are now confined to the silvopasture, while other areas focus on alley cropping, wood production, and natural habitat expansion.

25+ Years (Full Productivity): The site achieves full productivity, with mature ecosystems supporting diverse agricultural, housing, and natural functions.



7. Synthesis

7.1. Conclusion

The objective of this research was to explore how regenerative design with a particular focus on agroforestry can be spatially operationalized to address the connectivity between urban, rural and natural environments in the RZG region. This was done with the aim of enhancing spatial connectivity, environmental functionality, and social activity across these landscapes.

The historical evolution of the RZG area highlights how the landscape transformed from a diverse peat wilderness with swamp forest into a fragmented, monofunctional region shaped by urban expansion, agricultural intensification and infrastructure development. Over time, clear boundaries were established between urban, rural and network landscapes, which led to disconnections between natural processes, human activities and landscape functions.

Currently, the landscape can be categorized into three main types: urban, rural, and network landscapes. Each type includes distinct subtypes that vary in their impact on natural processes and human activities. A key example is the fragmented open green spaces in urban areas, which have limited connectivity both to each other, and to the natural systems outside the urban environment.

This fragmentation is further shown by the misalignment of land use with environmental conditions such as soil type and water availability, which hinders the regenerative capacity of the landscape. This is especially apparent in arable fields, grasslands, and in-dike grasslands, where intensive farming practices lead to further soil compaction, subsidence, and increased saline seepage.

While urban areas tend to be multifunctional—integrating services such as housing, work, recreation, and education—agricultural lands remain largely monofunctional, focused on production alone. This lack of diversification limits the adaptability of the landscape to future changes and reduces its overall resilience.

In response, this research identified practical design strategies and principles aligned with regenerative thinking that could address these issues. The five key strategies include preserving historical landscape features, strengthening this structure to incorporate natural processes and human activity, connecting fragmented areas to the strengthened framework, adapting land use to local environmental conditions, and diversifying land functions to enhance future flexibility and social engagement. Practical interventions at the regional scale—such as composting hubs, carbon sequestration belts, water storage areas, filtration buffers, and a green-blue network—provide integrated solutions that serve urban, rural, and natural environments, and are essential for regional regeneration. At the local scale, the combination of agroforestry systems with social services such as recreation, community engagement, research, and education offers opportunities to restore degraded landscapes and foster social activity within the rural-urban interface.

For this design to work, implementation must be phased and a balance of top-down and bottom-up approach. This will help with the long-term success of the proposed design framework, ensuring that it remains adaptive to environmental and socio-economic changes.

In conclusion, this research demonstrates that agroforestry provides a practical, regenerative solution to the fragmentation and monofunctionality of the RZG region's landscapes, including het Middengebied. By reconnecting urban and rural areas through the integration of natural processes and agroforestry, alongside social services, a more regenerative landscape can be established—one that enhances spatial connectivity, improves environmental functionality, and promotes social activity across urban, rural, and natural environments.

7.2. Reflection

The purpose of this reflection is to asses the research and design process undertaken in this thesis, focussing on how regenerative design, with a particular focus on agroforestry, can be spatially operationalized to address the connectivity between urban, rural and natural environments in the RZG region. The research sought to develop practical design strategies that integrate spatial connectivity, environmental functionality, and social activity across these landscapes.

Motivation and evolution of the project

Initially, the project's motivation was to explore how landscape architecture could contribute to mitigating tree scarcity through agroforestry. The aim was to add an economic dimension to address this issue. However, upon deeper investigation, it became clear that the problem was not solely economic; the scarcity of trees was also related to the disconnection between land uses and landscape fragmentation in the RZG region. As a result, the original design brief was broadened to focus on connecting these fragmented landscapes through agroforestry. But after participating in a permaculture design course to get practical experience with agroforestry systems, I realized that agroforestry alone was insufficient unless integrated within a functioning regenerative system. This insight shifted the project's focus toward a more holistic approach: reconnecting urban, rural and natural landscapes through regenerative system thinking, with agroforestry as a central feature.

Research methodology

The research process began with a combination of literature review, GIS analysis, and reference studies, focusing on the regional scale. The literature review was structured into three core topics: spatial connectivity, environmental functionality, and social activity. This division ensured that besides environmental functionality, which is quickly main topic in regenerative thinking, the design would also be responsive to social dynamics and enhance spatial connectivity.

Initially, I planned to use the regenerative development methodology from the article Designing from Place: A Regenerative Framework and Methodology by Pamela Mang and Bill Reed. However, since this methodology focused on stakeholder integration, which was limited in my project, I adapted it for a regenerative design approach instead. While stakeholder engagement was minimal at the beginning, the recommendations from desk research, such as those from het Waterschap (water authorities) and local residents, helped provide an alternative form of stakeholder input. This inspired me to conduct two interviews with two missing key stakeholders, including the provincial municipality of South Holland and a farmer involved in the Boer and Buurt association.

The talk with Albert from the municipality provided insights into how the government could rent plots for regenerative practices, while the interview with Liesbeth, a regenerative farmer, underscored the importance of regenerating the system. She also emphasized that regenerative farming relies on active community engagement, highlighting the need for accessible connections between cities, markets, and farms.

Site visits and reference studies

Exploring reference studies revealed that few large-scale projects fully integrate landscape architecture with agroforestry and production landscapes. To address this gap, I studied individual practices from various projects, each contributing valuable insights to the research.

The site visits to Het Middengebied were instrumental in gaining a true sense of the area's scale and character. The project area initially appeared convivial, visiting the site revealed a different reality. The proximity of recreational paths to busy roads felt disruptive, which informed my design for creating more pleasant, peaceful, routes that support social activity throughout the area.

Design process

The iterative nature of the design process allowed for continuous feedback between research and design phases. Early stages focused on mapping theoretical and spatial insights, evolving toward more refined strategies as the research deepened. Eventually the strategies and principles of regenerative design became more tangible as the process continued. At first it was sometimes a bit challenging as the strategies for regenerative design were somewhat philosophical initially, not clear how they were developed at different scales.

Reflecting on these operational strategies and principles there can be said that they work as a regenerative system by giving back more to nature and the region than taking. However they do not cover all what regeneration beholds, this will be explained in more detail in the reflection on success and limitations of the design.

Going trough the scales, the design framework showed to be flexible enough to address the systemic issues at the regional scale, while being adaptable at the local and detailed scale. Zoom ins at the local level were necessary to demonstrate how these multifunctional spaces of agroforestry could be experienced. Keeping the broader vision in mind while working on detailed aspects was critical to ensuring cohesion and continuity across scales.

Reflection on success

The design was successful in integrating strategies and principles focused on connecting urban and rural processes, demonstrating how landscapes and functions can complement and elevate each other. However, for a landscape to be fully regenerative, it requires more than just the integration of natural elements such as trees and water elements, which were my focus points in the creation of design interventions. The people and services in the area must also become aware of how their resource use can contribute to a circular system. For example farmers may produce waste that could be used for instance by a beer brewer in the region, if only they knew that. While this aspect of resource flow was outside the immediate scope of my research, it remains an area where future policy development and administrative strategies are essential.

Agroforestry proves to be a powerful potential tool for addressing the fragmentation of the RZG region's landscapes. By integrating agroforestry systems with social services like recreation and education, the design can have the ability to restore ecological processes while also providing spaces for human interaction, thereby strengthening urban-rural connections. However, ensuring that agroforestry systems align with local conditions, such as soil types and water management, required thoughtful consideration to guarantee their long-term success.

Additionally, not all types and spatial structures of agroforestry (point, line, or area) are equally suited for integrating social services. It is essential to carefully consider which areas are intended for social engagement and fostering community interaction, and which should be dedicated exclusively to agricultural production. This balance ensures that the design supports both functional productivity and social cohesion, without compromising the specific needs of each space.

Reflection on academic and societal value

This thesis advances the scientific understanding of how regenerative practices, particularly agroforestry, can be spatially and functionally integrated into the urban-rural interface. It addresses gaps in landscape architecture literature by translating regenerative design principles into practical strategies that enhance connectivity between urban and rural environments. Through a research-through-design methodology, the work bridges theoretical frameworks with site-specific applications, offering new insights into landscape connectivity and the regeneration of land use in these transitional areas. Additionally, careful consideration was given to the suitability of agroforestry types and spatial structures (point, line, area) for different social services, ensuring that spaces are thoughtfully designed for either social engagement or productive use.

Opportunities for Future Research

There are opportunities for further research into maximizing the productive potential of agroforestry systems while maintaining their social and ecological benefits. Exploring how these systems can be scaled and integrated into larger landscapes and production systems could provide more robust solutions. Additionally, future research should focus more on resource flow, policy integration, and stakeholder engagement to ensure full regenerative capacity.

Conclusion

This reflection highlights the challenges and successes of integrating agroforestry into a regenerative design framework for the RZG region. The iterative process of design and research helped ensure that the project was responsive to both environmental and social needs. While the project successfully addressed landscape fragmentation and promoted connectivity, there is still more work to be done to achieve a fully regenerative system. The research demonstrates that agroforestry can be a practical, long-term solution to reconnect urban and rural landscapes, but it must be part of a larger regenerative framework that includes social engagement, resource awareness, and policy support.



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