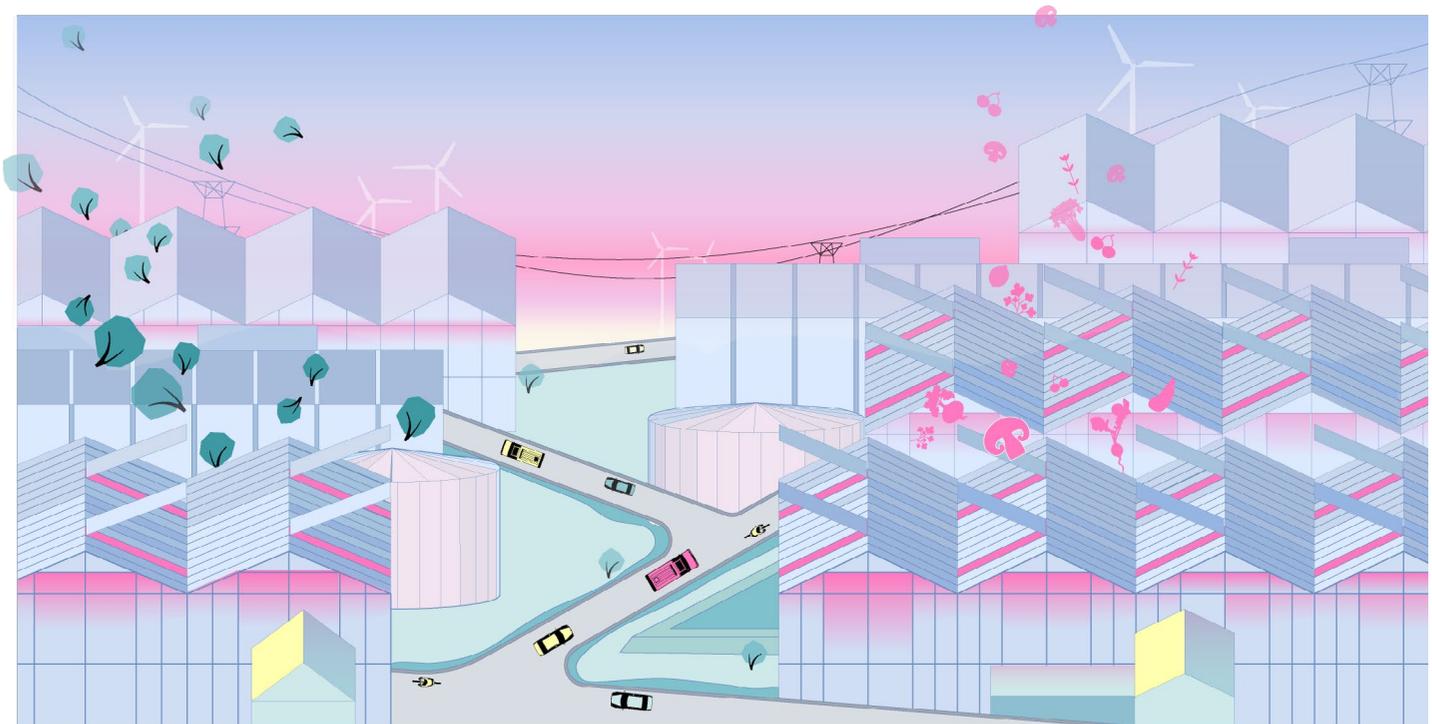


From Glass to Grove

Exploring Westland's Socio-Ecological Vision through Wooded Commons

Urban Forestry

Xinran Wang



Master thesis Landscape Architecture
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Xinran Wang

First mentor: René van der Velde

Second mentor: Daniele Cannatella

Exam committee: Mann Kanowitz, E.M.

Delft University of Technology

Faculty of Architecture and the Built Environment

Flowscapes Studio

Urban Forest- Forest Urbanism lab

Location: Westland, The Netherlands

Unless stated otherwise all pictures and graphics by author



Prologue



Westland Westland, oh... Westland
Joop Alleblas

Twenty-five hundred hectares of greenhouses, six, seven, eight meters high...!
Twelve hundred barns and warehouses, a thousand heat storage tanks
Five hundred rainwater reservoirs, three hundred sheds as extended farmhouses
Endless lines of trucks with coal-fired boilers on top of cabins
Everywhere paper is thrown away, or dust is avoided in this manner
In a haze of noise and smoke, where 'Golden Living' is
The Westland air is sharply filtered, through cables between high masts
With the Zweth Westland Mountains, eternally sealed with snow

Space is used optimally here, no roads, access prohibited
Between fences, no parking, forbidden to step onto green grass edges
In a few places, the main route overlooks soil torn up by a spade or shovel
A ditch is quickly deepened, a child's play area is quickly filled
We break down old cores, after all, historical heritage brings nothing to
Adopted minorities, build a new town hall
But temporarily keep five outer cores out of service, together divided into seven cores
Go garden in 'The Gardens,' a beautiful name clinging with nostalgia

And the water then, is it not terribly beautiful?
Its quality continues to deteriorate... bluer algae, duckweed, oil pollution, dead fish
The water lily is an endangered species. With towpaths and canal barges
We navigate en masse along drinking pipes and a hundred decibels of overwhelming noise
Endlessly walking against tall walls. On Sundays, no work is done
We play in inflatable pools or swim aboard

Everything is reduced to silence in our Glass City, sound is reduced here
Through the border heating system, where too warm is cooled
And too cold is warmed. Westland is beautiful for those who do not expect much

Acknowledgement

- First and foremost, I would like to express my heartfelt gratitude to my first mentor, René van der Velde, for his continuous guidance. His thoughtful and encouraging feedback has consistently sparked my reflection and passion, and I truly appreciate his warmth and patience throughout the process.

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To my former colleague and current teacher Matthijs Hollanders, thank you for your generous insights and expertise in nature-inclusive design and plant knowledge, which have inspired many ideas in my work.

I am especially grateful to Yvonne van Mil for gifting me her book *Atlas van het Westland*, which integrates the region's history with spatial analysis—it has provided me with great inspiration for understanding the Westland.

- A special thank to Jinsheng, whose encouragement always lifted me in times of difficulty and discouragement.

- Finally, I would like to thank my parents, who have always stood firmly behind me with unwavering support.

Abstract

As part of the Urban Forestry – Wooded Commons graduation lab, this thesis project focuses on the relationship between wooded public spaces and social interaction. In an increasingly interconnected world, it is becoming evident that many environmental issues are, in fact, manifestations of deeper social problems. To address these challenges, it is not sufficient to rely solely on ecological or technical solutions; instead, we must uncover the underlying issues within the socio-ecological system. This research explores forests as crucial ecosystems for maintaining biodiversity and spaces that carry social connections and cultural meanings, and offer opportunities for sustainable economic development.

The region of Westland is used as a location to investigate in this research. In Westland, an economically driven region, the disappearance of green public spaces exacerbates pressure on both social and ecological systems. The area faces social-ecological challenges, including a lack of green space, cultural decline, environmental degradation, and social isolation. These complex and interrelated issues demand an integrated socio-ecological systems (SES) approach to create equitable, resilient solutions rooted in Westland's unique context. However, Westland has a long-standing history of horticultural practices, where groves used for production and recreation form part of its cultural DNA. This landscape legacy plays a vital role in shaping Westland's future.

This has led to the main research question: **How to improve landscape quality and foster a resilient social-ecological system in an economic-driven region like Westland through redesigning wooded commons?**

The findings from the literature study on social-ecological systems provide angles to understand the site issues through the perspectives of key actors and their interrelationships. Additionally, the study of the adaptive cycle, combined with the ecosystem services approach and spatial analysis of the site, helped derive the design's spatial and temporal concepts.

The outcome of this thesis is, firstly, a spatial and temporal vision for Westland, illustrating spatial strategies for each phase in the transformation from glass to grove. This is followed by the design of a regional park that connects Naaldwijk, Monster, and the Natura 2000 area. The park not only enhances ecological diversity by introducing woodlands but also fosters cultural identity, strengthens social connections, and creates opportunities for a more diverse economy.

Key words: Social-ecological system, Wooded Common, Grove, Resilience

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Glossary

Social-ecology

Social ecology studies the interactions and reactions between individuals to the surrounding environment, and how these interactions affect society and the entire environment (StudySmarter UK, 2024). According to Krausmann and Haberl (2007), socioecological research addresses spatial scales from the local to the global and is concerned with the past, present, and future.

Social-ecological System

Social-ecological systems (SES) are dynamic, interdependent systems characterized by continuous interactions between people and nature. People modify and care for nature, which, in turn, provides both material and immaterial benefits. These reciprocal relationships occur within specific landscapes and across spatial scales, as human actions in one location influence ecological systems elsewhere, and vice versa (Reyers et al., 2018; Folke et al., 2016).

Resilience

Holling (1973, p. 14) distinguishes resilience from stability by defining it as the capacity of a system to endure disturbances and continue functioning without altering the fundamental relationships among its constituent populations or state variables.

Resilience from SES perspective

From the SES perspective, resilience is not limited to the capacity to absorb or adapt to change (Chen, D. 2020, Reyers et al., 2018); it also includes the ability to transform with change. Transformability is the capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable (L.H. et al., 2018, Reyers et al., 2018).

wooded common

Traditionally, wooded commons were public forests used by rural communities for timber, firewood, and grazing (Smith, 1998; Anderson, 2002). Their role shifted after privatization during the enclosure movements. Today, they serve mainly urban populations for recreation, ecological preservation, and social cohesion (Jones, 2010; Kohler, *The Forest and the City*; Davis, 2015; Taylor & Green, 2017).

Grove

A grove refers to a small group of naturally growing or intentionally planted trees. It is often associated with providing shade, forming pathways, or creating specific landscapes. In modern contexts, groves also refer to orchards. Historically, grove often bridging the sacred and the secular, yet with modern interpretations often viewing them through ecological and cultural lenses.

In this study, based on the Westland context, the grove concept will primarily focus on its role in social interaction, cultural, ecological, and economic value, with its sacred attributes considered secondary.

Culture Severance

Cultural severance is the disruption between local communities and their traditional environmental resources, often caused by social, economic, or land-use changes. It leads to the loss of both physical practices and spiritual connections to the landscape (Rotherham, 2013).

In Westland, cultural severance is reflected physically in the reduced diversity of horticultural work and spiritually in the weakening of horticultural practices as a link between family, community, and the familiar landscape.

Environmental justice

Environmental justice is not only about distributive justice (who gets what?); it is also about procedural justice and recognition justice—how people are being treated during the process of environmental challenges, other fundamental rights, local knowledge, and so on (Joern Fischer, 2021).

Social-ecological integration

Social-ecological integration describes a system's capacity to promote mutually reinforcing interactions while minimizing tensions between its ecological and social patterns and processes (adapted from Barthel et al., 2013).



1.1 Introduction



Wateringe
(Rijksmuseum, 2024)



De Poeldijker
(Koos van Leeuwen (n.d.). Een praatje bij een plaatje)



Today's greenhouse industry region

Loss of wooded landscape through time

Remarkably, what is now an industrialised landscape was once lush and green, with estates and orchards that shaped Westland's identity. Westland has experienced the disappearance of a woodland landscape that has evolved significantly over time. Despite the current government's push for urban greening and environmental improvements, limited public space is a major constraint. What does this loss of woodland mean and what are the reasons behind it? There is more to be concerned about than just the environment.



Unsustainable economy

(Google Earth)



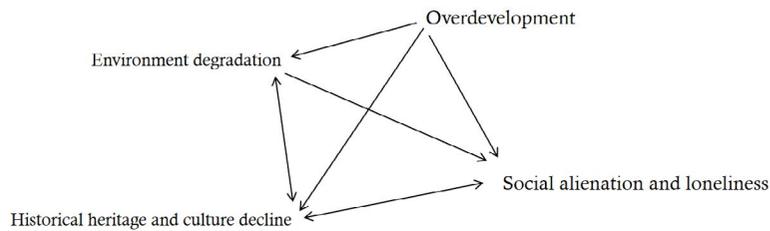
Culture decline

(foto:Historisch Archief Westland)



Environment degradation

(Gebruik van bestrijdingsmiddelen in een band, ANP)



Social isolation

Social-ecological Challenges

In the poem *Westland, Oh Westland* by Joop Alleblas, the challenges of this region come to life: sprawling greenhouse developments, environmental degradation, and a pervasive sense of social isolation. These words poignantly capture how urban and industrial growth have profoundly altered the landscape, disrupting its ecological balance and fragmenting its social fabric. This transformation highlights an urgent need for innovative solutions that reconnect people with their environment while addressing ecological and social issues.

Reflecting on the socio-ecology theory, I am reminded of how contemporary landscape projects sometimes prioritize ecological restoration and technological advancements but tend to overlook the intricate connections between social and ecological systems (Greet et al., 2018). Human-centered aspects, such as social inequalities and cultural identity, are frequently left unaddressed, leading to fragmented outcomes.

In Westland, an economically driven region, the disappearance of green public spaces exacerbates pressure on both social and ecological systems. The area faces mounting social-ecological challenges, including a lack of green space, cultural decline, environmental degradation, and social isolation. These complex and interrelated issues demand an integrated socio-ecological systems (SES) approach to create solutions that are equitable, resilient, and rooted in Westland's unique context.

How to improve landscape quality and foster a resilient social-ecological system in an economic-driven region like Westland through redesigning wooded common?



Flora Holland honsole



Canal in Greenhouses Area



Traditional westlanderschip as an exhibition piece



A family working under a vine in a greenhouse
(foto:Historisch Archief Westland)



Greenhouse Horticulture Industry in the Westland Region
(foto: Ter Laak Orchids)

Problem statement

Social-ecological systems (SES) are dynamic, interdependent systems characterized by continuous interactions between people and nature. People modify and care for nature, which, in turn, provides both material and immaterial benefits. These reciprocal relationships occur within specific landscapes and across spatial scales, as human actions in one location influence ecological systems elsewhere, and vice versa (Reyers et al., 2018; Folke et al., 2016). Such frameworks help to capture the complexity of human-nature interactions and emphasize the importance of simultaneously understanding localized and global ecological processes (Berkes et al., 2003, Douglas et al., 2021).

However, traditional approaches to studying SES often focus on surface-level events, such as natural disasters, species extinctions, or environmental degradation, as they are immediate and visible (Gunderson & Holling, 2002). These events are used, but they are underpinned by deeper systemic elements, including recurring patterns, underlying structures, and mental models that shape how humans interact with the environment (Meadows, 1999). For instance, patterns such as overextraction of resources or land-use change are rooted in mental models of growth-oriented economic systems that disregard ecological thresholds (Steffen et al., 2015). By addressing these deeper layers, researchers can move beyond symptom-focused interventions and propose transformative solutions that address root causes of ecological degradation (Folke et al., 2021).

In the 1990s, C.S. Holling's resilience theory brought a new dimension to SES, emphasizing ecosystems' capacity to absorb disturbances and reorganize while maintaining core functions. This idea influenced adaptive management strategies, which are pivotal in designing landscapes capable of coping with uncertainty and change (Folke et al., 2002). So, what would a landscape design that adheres to this design philosophy look like?

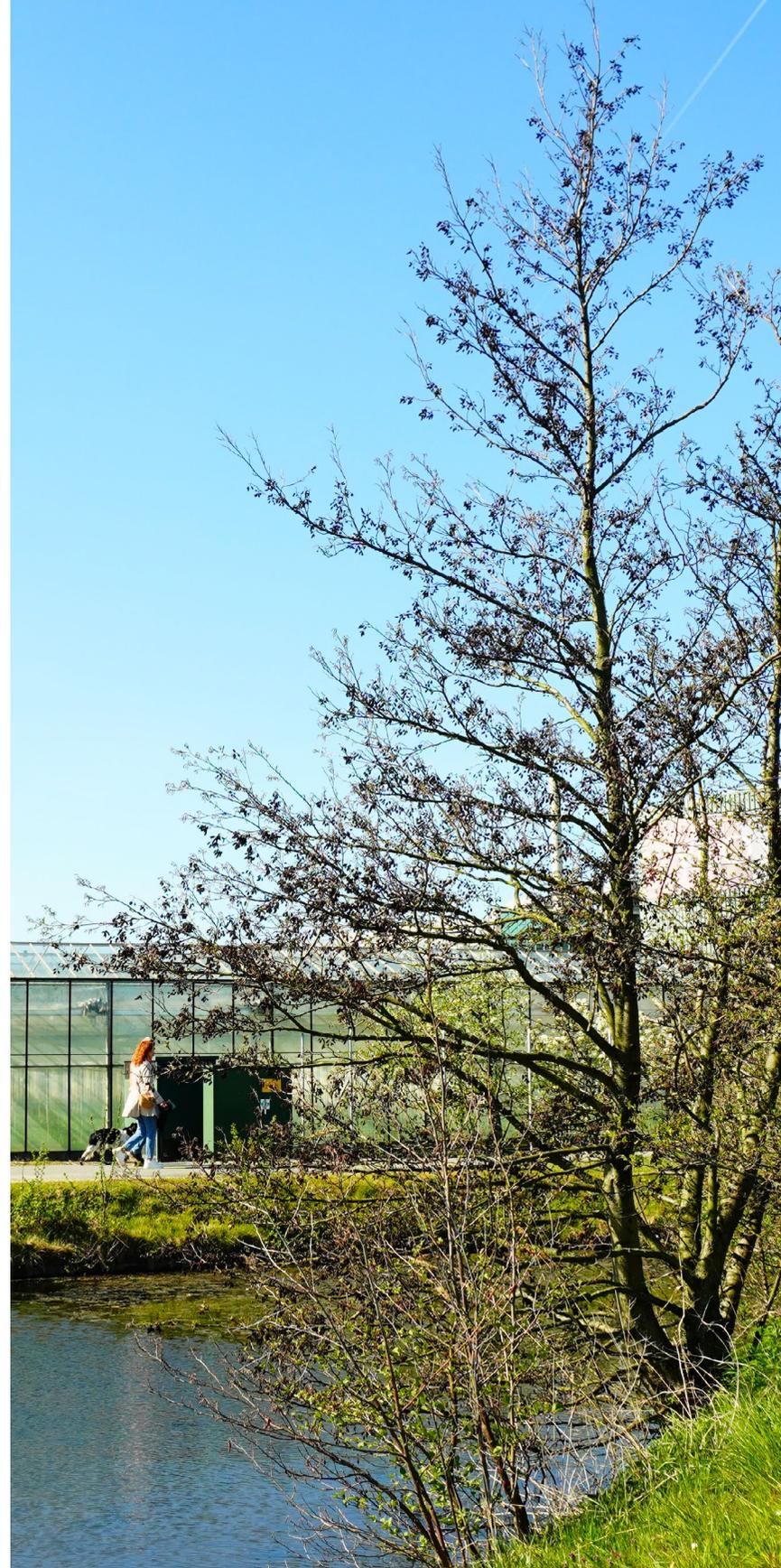
In cities, social-ecological integration aims to optimize the layout and makeup of urban areas so they simultaneously serve environmental functions and community needs (Ahern, 2013; Alberti et al., 2003). Yet, because urban environments vary so widely, some sites are inherently better suited to this dual purpose than others (Claudiu Forgaci, 2018). In this research, wooded commons are chosen as a focus because they refer to shared, often communal spaces with trees and vegetation, implying a multi-functional landscape that incorporates social interaction, ecological processes, and cultural heritage (Konijnendijk, 2019).

Westland exemplifies an economy-driven region, where green public spaces are rapidly diminishing under agricultural industrialization and urbanization pressures. The lack of green space, cultural decline, environmental degradation, and social isolation are key social-ecological challenges Westland faces today.

Nowadays, examining Westland's challenges from a socio-ecological perspective is crucial, as it connects social issues with environmental concerns rather than addresses them in isolation. This research explores Westland's future socio-ecological vision and how the physical spaces of wooded commons can be utilized to enhance social-spatial quality within this vision.

Wooded commons or groves serve as buffers that accommodate dynamic changes in urban environments, including the shifting dynamics of human activities, environmental changes, and the interactions and exchanges of diverse cultures. This design focuses primarily on the transitional spaces between urban and rural areas - the spaces between the 11 village centers in Westland. These areas are ideal for maximizing social participation across different groups and utilizing leftover urban spaces to create flexible spaces that integrate into agricultural and urban landscapes.

Current research primarily addresses the reflection and transformation of agricultural landscapes or systems in metropolitan areas and the social studies of farmers and seasonal laborers. However, relatively little exploration has been done on the integration of socio-ecological perspectives and landscape design in greenhouse-intensive urban areas like Westland. This gap is the focal point of this study.



Fascination

My fascination lies in the profound, socially charged interactions between humans and the environment. These interactions encompass both physical engagement with the natural world and the deeper, spiritual connections we form with it.

Many of my most vivid childhood memories are intertwined with forests and woodlands. I recall when my grandparents would take me to the end of a dike, where towering rows of poplar trees lined the way. Together, we would watch trains rush by, catch cicadas, and pick mushrooms. Their care for me, both tender and protective, mirrored the steadfastness of those towering trees.

As I matured, forests became a symbol of abundance and harvest. I remember autumn afternoons when my teachers would guide our entire class through the school grounds to gather ripe persimmons, relishing the season's fruits. In contemporary urban contexts such as the Netherlands, forests are no longer merely sanctuaries offering respite from the fast-paced city life. They are increasingly recognized as integral to addressing climate challenges, managing urban growth, and contributing to sustainable development. This insight has broadened my understanding of the possibilities for forest integration in urban landscapes.

Over time, forests have come to symbolize something deeper—memory. They always carry the traces of human activity and, over long periods, gradually become cultural symbols for specific communities. I believe that forests, in this way, can also influence social connections and cultural identity, and hold potential for addressing urban challenges. This is the direction I wish to explore.



(Generated by Midjourney)

Position

As a landscape architect, my role in this project is to serve as a bridge between social and ecological dimensions, addressing the challenges of creating a resilient and livable socio-ecological system in Westland. Landscape architecture uniquely positions itself at the crossroads of ecology, urbanism, and heritage, integrating these disciplines into cohesive, site-specific designs.

In this project, landscape architecture must go beyond ecological technicalities, deeply engaging with Westland's socio-political and historical context (Greet et al., 2018). It utilizes wooded commons to create physical spaces and spiritual places (Konijnendijk, 2019). These commons are envisioned as shared urban spaces that unite ecological processes, social interactions, and cultural heritage, fostering a sense of place and identity.

My stance is that urban commons, including wooded commons, are vital for combating "social fragmentation." They act as a "democratic idyll" (Van der Plas, 1991) and a "green island" (Reeder, 2006). These spaces have the potential to harmonize economy, ecology, and heritage while respecting the identity of the place, bringing together people from diverse groups. This approach emphasizes designing sustainable wooded commons that provide equal access to high-quality landscapes for all urban residents.

Ultimately, this project demonstrates how landscape architecture can address complex socio-ecological challenges, transforming economically driven urban regions like Westland into places where nature and culture coexist, and where green quality supports both community well-being and environmental resilience, offering a blueprint for liveability in industrialized cities.

Research Question

How to improve landscape quality and foster a resilient social-ecological system in an economic-driven region like Westland through redesigning wooded common?

Sub-questions:

- How to understand Westland's challenges in terms of its social-ecological systems?(Context analysis)
- How to design a resilience vision for the future of Westland based on ecosystem services and using adaptive cycle theory as a approach? (Approach)
- What is the potential for wooded common on temporal and spatial demision to foster westland 's more resilient social-ecological system? (Strategy and Design)
- Which models of governance and maintenance are most effective for sustaining this system?

Design assignment

The design aims to provide a vision that fosters a resilient and liveable social-ecological system for the future of Westland's region's well-being — a region rich in landscape history but poor and limited in green quality due to urban agriculture(glasshouse).

The hypothesis is that the theory of socio-ecology and specifically the wood commons model could provide principles for design.

Report Structure

Part A: Scoping

This section establishes the theoretical foundation of the study by reviewing socio-ecology and wood commons concepts, highlighting their relevance to landscape architecture. It defines the perspectives for understanding the issues in Westland and outlines the problem statement, research question, design assignment, and methodology.

Part B: Exploration of Ideas

Part B explores the site issues based on insights from the literature review. It defines the design objectives and scope, answering the question: What does a grove mean to Westland in the envisioned future? A theoretical framework combining adaptive cycles and ecological services is introduced, from which both temporal and spatial visions for the site are developed.

Part C: Landing

Chapter C synthesises the discussions in the previous chapters to develop a strategic framework. The framework will then guide the design of four scales, including the Westland area, the Gantel watershed, the regional park Green Vein, and the node design. It also speculates on the possibility of a spatial vision if there is active policy support or more funding.

Final Chapter: Conclusion

The final chapter draws conclusions based on the previous discussion and presents ideas for the management of the project as it relates to the project. The chapter also critically discusses the approach and possible design outcomes and explores potential areas for future research.

1.2 Intent



Why SES(Socio-ecology System)?

Westland’s peri-urban villages face intertwined challenges: shrinking green space, loss of local culture, environmental stress, and social fragmentation. Its hybrid landscape of intensive greenhouses and urban development blurs city–countryside boundaries, creating “frontlines of separation, competition and conflict between the urban and rural spheres” (Korthals Altes, W.K., Van Rij, E., 2013). Single-domain approaches cannot capture this complexity. For example, a purely economic lens might boost production but externalize environmental costs and overlook community values; an ecology-only perspective might protect habitat but disregard farmers’ livelihoods and cultural identity; a purely social focus might strengthen cohesion but ignore ecological limits. These narrow approaches may mitigate symptoms but often fail to address interconnected root causes.

The Social-Ecological Systems (SES) framework transcends these silos by explicitly linking social, institutional and ecological dimensions. Partelow (2018) characterizes the SESF as perhaps the most all-encompassing framework available for analyzing the interactions and results within social-ecological systems. and it remains one of the most cited and applied tools for analyzing coupled human–environment systems (Nagel & Partelow, 2022). By integrating ecosystem functions, land-use practices, governance structures, and cultural values, SESF reveals how ecological, economic, and social factors jointly shape outcomes. This holistic perspective is especially relevant for Westland’s eleven urban–rural transition villages, where land use, heritage, and livelihoods are tightly linked. SES-based analysis thus targets root drivers of change across scales, offering integrated insight and resilience not afforded by any single-sector framework.

Why wooded commons?

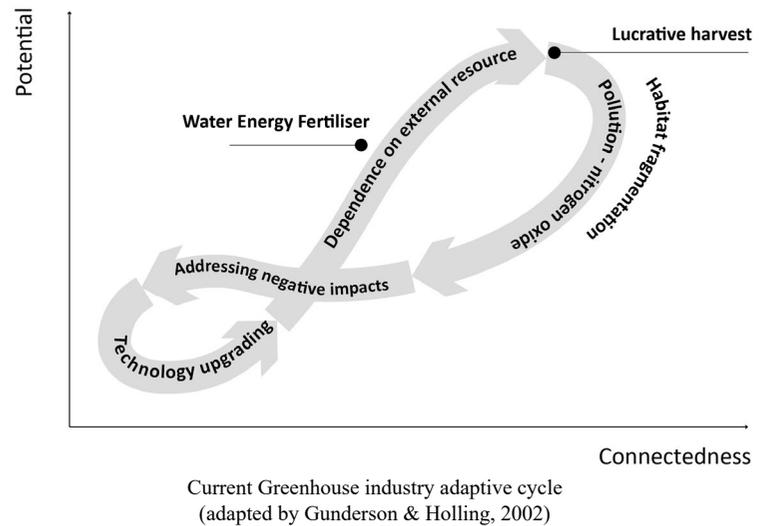
In urban settings, social-ecological integration aims to improve both the composition and configuration of spaces to simultaneously support ecological functions and social needs. The urban landscape is understood as a social-ecological system, where all spaces—at least to some extent—have the potential to foster this integration. However, due to the inherent spatial unevenness of cities, certain areas are more suitable than others for achieving such multifunctionality (Claudio Forgaci, 2018). In this thesis, wooded commons and urban forests are chosen as the primary focus, as they offer promising opportunities for fostering social-ecological integration and are closely linked to Westland's DNA.

Why Westland?

Firstly, I chose the Netherlands as my project location to facilitate fieldwork and better understand how projects are implemented in the Dutch context. Within the Netherlands, Westland stood out for its unique landscape dynamics, characterized by an extremely dense cluster of greenhouses and the lowest ecological quality in the country. This stark imbalance between social development and ecological health intrigued me, prompting further investigation into the deep interconnections between societal and environmental issues in the region.

I found Westland particularly suitable for applying the Socio-Ecological System (SES) framework. Analyzing the seemingly contrasting elements of "Glass"

Current Greenhouse industry Adaptive cycle



Planing Principle of Adaptive cycle

1. Effective feedback mechanism
2. Continuous cycle of optimization
3. Flexibility and Adaptability

future transformation. Greenhouses must address nitrogen pollution and associated urban social space challenges, while groves align with the government's 3-30-300 policy to increase tree cover. The question of whether these opposing elements can evolve into a mutually beneficial adaptive cycle under a shared vision is a compelling research focus. Thus, I believe Westland presents an excellent choice for this project.

From Glass to Grove

Westland is famously known as the "Glass City" or "City of Glass" due to its vast expanses of greenhouse complexes dominating the region's landscape. In recent years, the Westland government has been focusing on controlling the expansion of greenhouses. The number of companies in the greenhouse horticulture sector has been declining, dropping from 924 in 2010 to 583 in 2018. However, the total area covered by greenhouses in absolute square meters has remained almost unchanged, indicating fewer but larger horticultural enterprises.

Addressing the challenges posed by limited surplus space and the need to enhance well-being, Westland has adopted the 3-30-300 rule as part of its greening strategy (Cortese, Meliefste, and Kremer, 2024). However, its implementation has proven challenging in practice. In the same year, the government proposed initiatives aimed at creating more space for trees, improving the variety and quality of existing greenery, expanding natural areas, reducing paved surfaces, and encouraging residents to take an active role in greening efforts (Ruimtelijkeplannen.nl, 2024). These strategies highlight a shift in priorities that could redefine Westland's identity, fostering a motivation to integrate the image of "Grove" into the existing impression of the "Glass City."

Grove

The concept of "grove" was chosen because of its rich cultural, spiritual, and spatial diversity. A grove refers to a small group of trees, either naturally growing or intentionally planted. It is often associated with providing shade, forming pathways, or creating specific landscapes. In modern contexts, groves also refer to orchards (e.g., orange, olive, or nut groves) and single-species plantations. The concept of the "grove" encompasses diverse meanings across cultures, often bridging the sacred and the secular. In various societies, groves have served as places of worship, memorials, and community gathering.

The historical and contemporary meanings of "grove" are particularly well-suited to the context of Westland. Westland initially developed under church management of orchards and later evolved into a region characterized by horticultural family enterprises. The understanding of "grove" in this context extends beyond a productive space; it is also deeply tied to family memories, neighborhood interactions, collaboration, and knowledge sharing, embodying a strong social dimension. Therefore, "grove" has the potential to serve as a physical medium for addressing contemporary socio-ecological challenges in Westland, reconnecting with cultural heritage while fostering interactions among new social groups.

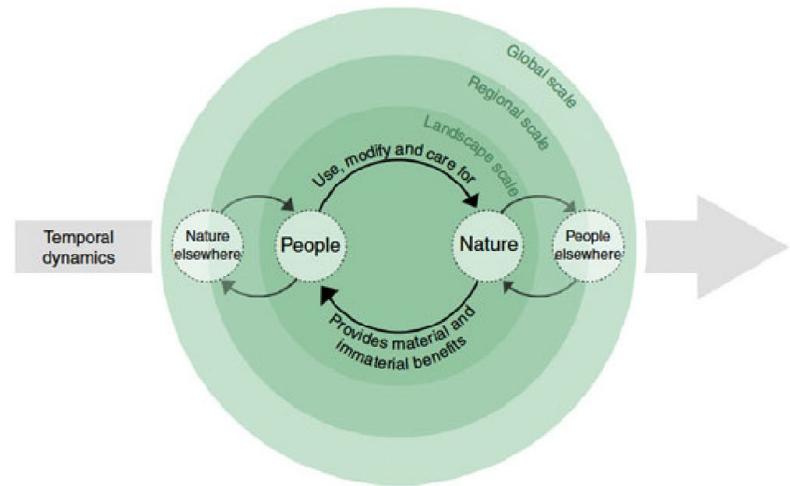
In this study, the concept of "grove" will primarily focus on its role in social interaction, cultural identity and creates opportunities for a more diverse economy, with its sacred attributes considered secondary.

1.3 Literature Review and theoretical framework

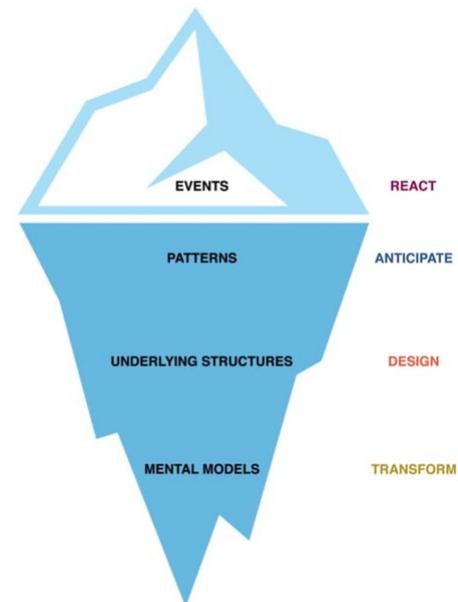
Social-ecological systems (SES)

The social ecological system (SES) is a dynamic and interdependent system characterized by the continuous interaction between man and nature. Human beings change and care for nature. In turn, nature also provides material and non-material benefits. These reciprocal relationships occur within specific landscapes and at different spatial scales, because human behavior in one place will affect ecosystems in other places, and vice versa (Reyers et al., 2018; Folke et al., 2016). This correlation highlights the global nature of SES, whose dynamic changes unfold with the passage of time and space. Such frameworks capture the complexity of human nature interactions and emphasize the importance of understanding both local and global ecological processes (Berkes et al., 2003).

However, traditional approaches often focus on surface-level events, such as natural disasters, species extinctions, or environmental degradation, as they are immediate and visible (Gunderson & Holling, 2002). Although these events have occurred, there are deeper systematic factors behind them, including recurring patterns, basic structures and psychological patterns that affect the interaction between human and the environment (Meadows, 1999). For example, patterns such as overexploitation of resources or land use change are rooted in the psychological patterns of growth oriented economic systems, which ignore ecological thresholds (Steffen et al., 2015). By solving these deeper problems, researchers can go beyond the intervention measures focusing on symptoms and propose innovative solutions to solve the root causes of ecological degradation (Folke et al., 2021).



(Current opinion in Environmental Sustainability, Fischer et al. 2015)



(Gürdür and Törngren, NordDesign 2018)

Development of Social ecological system (SES) Theory

Ecologists and social scientists recognise the interdependence between humans and the natural environment

1960c



Barry Commoner

Emphasising that 'everything is connected', i.e. that human activity is inextricably linked to the natural world.

Integration of development with multiple disciplines, especially economics, ecology and anthropology

1970c



Rachel Carson

Silent Spring (1962) exposes the harmful effects of chemical pesticides on birds and other wildlife, and reveals the inadvertent destruction of the natural ecological balance by mankind.

Beginning to incorporate adaptive management and ecological resilience theories.

1990c



Elinor Ostrom

It was found that in reality many communities were able to successfully avoid resource depletion through co-operation and collective decision-making.

- Dynamism in long-term planning
- Improving system resilience
- Participatory ecological restoration

This systematic perspective provides a more comprehensive method for SES research. **It encourages the integration of deeper dynamic factors into the analysis, and promotes the strategic transformation from passive response to active attack, so as to enhance the resilience and sustainability of the social ecosystem.**

The theory of social ecosystem (SES) is a bridge between ecology and Social Sciences, involving the intertwined relationship between human beings and their environment. This theory is increasingly prominent in landscape design, because it solves the urgent problems such as climate change, biodiversity loss and urbanization. Its development reflects the contributions of major thinkers over the past decades and shows the evolution of interdisciplinary views.

Foundational Contributions and Theoretical Evolution

The origin of socio-economic status theory can be traced back to the 1960s, especially Rachel Carson's *Silent Spring* (1962), which emphasizes the impact of human activities on the ecological environment. At the same time, Barry Commoner clarified the interrelationship of ecosystems and stressed that environmental damage directly affects human well-being (*The Closing Circle*, 1971). These early works laid the foundation for linking human behavior with ecological consequences.

In the 1970s, Elinor Ostrom advanced this discussion through the study of shared resources. Her pioneering work *Governance of Commons* (1990) clarifies the complex interaction between social systems and ecosystems, and puts forward the principles of collective governance and sustainable use of resources. Ostrom's view reveals that SES is influenced not only by biophysical processes, but also by institutional frameworks and communities.

Resilience

In the 1990s, C.S. Holling's resilience theory brought a new dimension to SES, emphasizing the ability of ecosystem to absorb interference and reorganization while maintaining its core functions. This view has an impact on adaptive management strategies, which are crucial for designing landscapes that can respond to uncertainty and change (Folke et al., 2002).

SES theory provides a framework for landscape designers to deal with various challenges. Inspired by Holling and Ostrom, adaptive management encourages an iterative design process that responds to environmental feedback. For example, wetland restoration projects give priority to ecological restoration capacity to ensure that the system recovers from floods and other disturbances, while promoting biodiversity. Similarly, the urban forest plan integrates the SES principles by creating multifunctional green spaces, strengthening ecological processes and meeting community needs (McPherson et al., 2018).

Participatory governance, rooted in Ostrom's research, also provides information for the common design of public green space and empowers local communities to manage their environment. These efforts have promoted social ecological resilience by combining ecological functions with human initiative.

SES theory has developed from ecological warning to a comprehensive and interdisciplinary framework to solve the dynamic relationship between man and nature. The contributions of Carson, commoner, Ostrom and Holling emphasized the progress from understanding environmental impacts to promoting resilience and adaptive management in design. By integrating these principles, landscape designers can create a space to coordinate ecological health and human well-being.

Resilience gained prominence through the work of ecologist C. S. Holling in his foundational 1973 article, Resilience and Stability of Ecological Systems (Claudiu Forgaci, 2018). Holling (1973) defines resilience as a system's ability to endure disturbances while preserving the fundamental relationships among its populations or state variables.

Later, Holling (1996) refined this concept by distinguishing two types of resilience: engineering resilience, which describes a system's ability to recover and return to its original equilibrium state after a disturbance, and ecological resilience, which emphasizes a system's capacity to maintain critical functions despite disturbances (Meerow & Newell, 2016). Holling (1996) defined ecological resilience as "the magnitude of the disturbance that can be absorbed before the system changes its structure". Unlike engineering resilience, ecological resilience recognizes that ecosystems may shift to a new state when thresholds are exceeded.

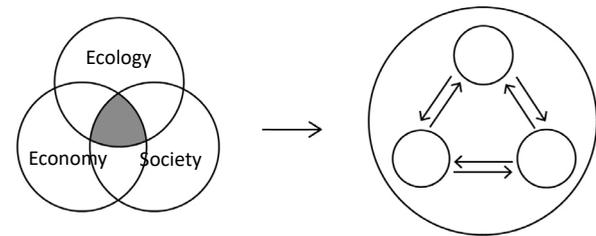
A third type of resilience, social-ecological resilience, was later introduced by Folke (2006) and further elaborated as evolutionary resilience (Davoudi, 2012) or progressive resilience (Vale, 2014). Davoudi (2012, p. 302) describes this capacity as the ability of intricate social-ecological systems to adjust, evolve, and undergo transformation when faced with different stresses and pressures. Social-ecological resilience builds on the earlier ecological perspective, where ecosystems are seen as dynamic, adaptive, and complex, extending these principles to socio-ecological systems (SESs) theory (Folke, 2006; Gunderson & Holling, 2002); cited in (Meerow & Newell, 2016)

Socio-ecological Resilience Principle In Landscape Architecture

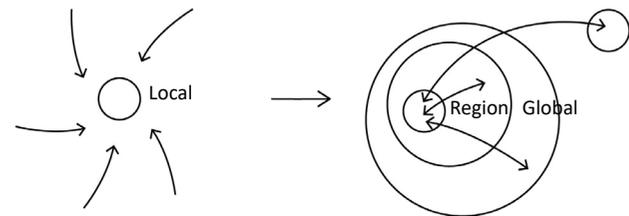
Building on the theories of their predecessors, later scholars have proposed a series of hypotheses and insights into socio-ecological resilience, which offer valuable guidance for understanding complex site-specific issues and designing lifetime projects.

Wilkinson (2011) put forward three foundational principles of social-ecological resilience: first, that social systems are intrinsically integrated with ecological systems; second, that SESs function as complex adaptive systems with inherently non-linear change; and third, that the primary aim of governance is to cultivate adaptive capacity to enhance resilience (Claudiu Forgaci, 2018).

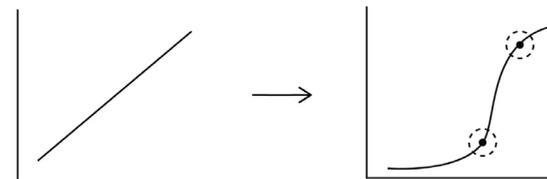
In recent years, some scholars have developed new insights into Social-Ecological Systems and Resilience in the context of the Anthropocene. In their article "Social-Ecological Systems Insights for Navigating the Dynamics of the Anthropocene," Belinda Reyers and colleagues articulate how insights from Social-Ecological Systems research can guide the analysis and understanding of the underlying causes behind complex phenomena, offering valuable directions for sustainable development.



1. From Interdependent Pillars to Inseparable Complex Social-Ecological Systems



2. From Local to Cross-Scale Dynamics



3. From Incremental Change to Systemic Tipping Points and Shifts

Insights of Social-Ecological Systems and Resilience
(adapted by Reyers et al., 2018, pp.270)

Insight 1: From Pillar Interdependence to an Indivisible Socio-Ecological System(adapted by Reyers et al., 2018)

Social-ecological systems research treats human and environmental components as fundamentally intertwined, arguing that any separation between them is artificial. This holistic view underscores society's place within the biosphere and the mutual evolution of human and ecological dynamics (Berkes & Folke, 1998), reflecting Wilkinson's premise that people, economies, societies, and cultures both shape and are shaped by ecosystems.

This perspective encourages a shift from viewing nature, economy, and society as independent domains for landscape design and planning. Instead, it promotes integrated approaches that consider cultural practices, community needs, economic production, and ecological processes as interconnected and dynamically evolving throughout the design lifecycle. Recognizing these dynamic relationships, Biggs et al. (2012) emphasize that resilience stems largely from the variety of actors, ecosystems, and institutions within social-ecological systems. Enhancing resilience therefore requires attention to response diversity, functional diversity, and redundancy. Such diversity enables systems to absorb disturbances, regenerate and adapt, and find pathways for transformation (Elmqvist et al., 2003).

Insight 2: From Site-Level Processes to Multi-Scale Interactions(adapted by Reyers et al., 2018)

SES research underscores the critical role of interactions and feedbacks that operate across multiple scales in both time and space. In the Anthropocene, these dynamics have become more complex and significant due to globalization, increased human influence across ecosystems, and the accelerated pace of social and ecological change. For landscape architecture, it is important to consider temporal and spatial coherence across different scales. At the management level, this may involve cross-regional coordination and collaborative governance strategies.

Insight 3: Shifting from Progressive Change to Critical Tipping Points and Reconfigurations(adapted byReyers et al., 2018)

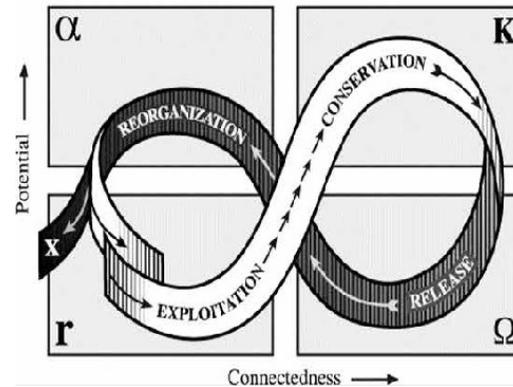
Social-ecological system dynamics are non-linear, meaning they do not always respond to external pressures in gradual or predictable ways (Scheffer et al., 2001). Instead, they often undergo systemic shifts driven by multiple interacting factors, such as human-induced changes to natural disturbance regimes and the loss of functional diversity (Folke et al., 2004; Rocha, Peterson, & Biggs, 2015). In landscape design, especially for long-term projects, it is important to consider the role of critical drivers—such as agency, organizations, networks, and institutions—to either prevent undesirable system shifts or facilitate transformative change. Actively promote Transforming for Change beyond incremental adaptation.

Adaptive Cycle

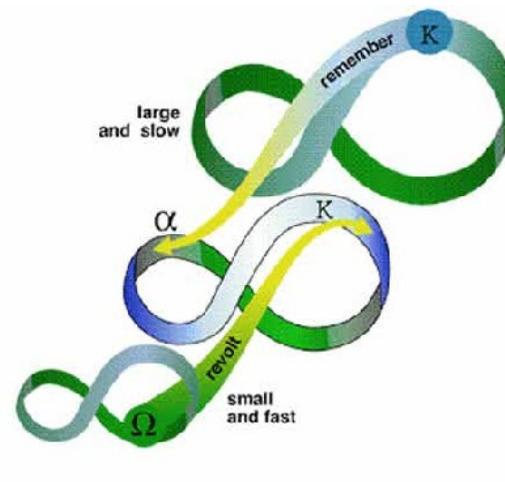
The adaptive cycle concept, an abstract model describing system development trends within the social-ecological resilience theory, is introduced here to further inspire the research methodology.

Holling introduced the Adaptive Cycle in 1986, and it was further elaborated by Gunderson and Holling in 2002, to depict the evolving patterns of change and resilience inherent in complex adaptive systems like social-ecological systems. It includes four recurring phases: exploitation (r), conservation (K), release (Ω), and reorganization (α)—capturing cycles of growth, stability, collapse, and renewal. The model emphasizes non-linear change, shaped by the interactions between resilience, connectedness, and potential. These dynamics occur across scales, as expressed in the panarchy framework, where cycles at different levels influence each other.

While widely used in fields like ecology, urban planning, and resource management to support resilience and adaptive governance (Folke et al., 2010; Davoudi et al., 2012), the model has been critiqued for oversimplifying real-world systems and underrepresenting social and political complexities (Cumming & Collier, 2005; Davidson, 2010). More recent developments have addressed these gaps by incorporating social dimensions and exploring how adaptive cycles contribute to transformative resilience, particularly in response to global challenges such as climate change (Walker et al., 2004; Allen et al., 2014). Despite its critiques, the model remains valuable for analyzing change and adaptation in SESs.



the Panarchy model. (Originally published in *Panarchy: Understanding transformations in human and natural systems*, Edited by Lance H. Gunderson and C.S. Holling 2002. Permission Island Press)



Panarchy connections. Linked adaptive cycles at multiple scales. (Originally published in *Panarchy: Understanding transformations in human and natural systems*, Edited by Lance H. Gunderson and C.S. Holling 2002. Permission Island Press)

Wooded Common

Wooded commons refer to public forests or woodlands traditionally used by communities for various resources, including timber, firewood, grazing land, and hunting. In Europe, these commons were initially crucial for rural farmers, who relied on the land for subsistence and survival. Over time, as European society evolved, access to these commons became more restricted, and control shifted to the aristocracy, particularly during the enclosure movements of the 18th and 19th centuries, when many common lands were privatized (Smith, 1998; Anderson, 2002). In modern times, the function of wooded commons has shifted again, with city-dwellers becoming the primary users, seeking these areas for recreation, environmental benefits, and social cohesion (Jones, 2010). This transition reflects broader societal changes, with wooded commons evolving from spaces of agricultural production to places of leisure and ecological preservation (Kohler, *The Forest and the City*). Their identity has also evolved, from symbols of rural subsistence to urban public goods that promote biodiversity, sustainability, and community engagement (Davis, 2015; Taylor & Green, 2017).

Wooded Common's Potential in SES

Wooded Commons of Power

The social reality of landscapes is deeply intertwined with power dynamics. Landscapes can be viewed as powerscapes—systems of norms and regulations that define how members of a society are expected to interact with the land (Konijnendijk, 2019). Power is manifested through laws, prohibitions, governance structures, and control mechanisms embedded within the landscape (Konijnendijk, 2019). In this sense, wooded commons are physical spaces and symbolic arenas where power is exchanged, represented, and exercised (Macnaghten & Urry, 1998; Mitchell, 2002).

In rapidly urbanizing contexts, land-use conflicts frequently arise, and wooded commons often become contested spaces. Fundamental questions—such as who owns them, who uses them, and who governs them—reflect deeper power distribution issues. When access and decision-making authority are concentrated in the hands of a few, the diversity of uses within wooded commons tends to diminish. This reduction in use diversity can, in turn, undermine the social-ecological diversity and resilience of the broader system.

This research emphasizes the social dimension of wooded commons. If power is redistributed to include diverse social groups—enabling equitable access, meaningful use, and participation in design and management processes—it can foster a stronger sense of public agency and collective efficacy. Such inclusive governance not only empowers communities but also contributes to the enhancement of social-ecological diversity and resilience.

Social Forest:

Konijnendijk (2019) notes that urban landless laborers historically had few recreational outlets, and they turned to peri-urban forests and natural areas—rather than formal city parks—to find greenery, a sense of freedom, and respite from urban social constraints. Examples such as Berlin's Tiergarten, Amsterdamse Bos, and Rotterdam's Kralingse Bos highlight how these spaces became essential for mass recreation. Improved access and infrastructure, combined with a growing consensus on outdoor recreation's "healthy" benefits, played significant roles in making these green spaces more inclusive and widely accessible. Sonsbeek Park in Arnhem is another notable example where green spaces were developed to accommodate recreational needs.

However, access to such spaces remains a challenge. In the Netherlands, 26 out of the 30 largest cities still include areas without proper access to public green spaces, exacerbating “social fragmentation”. Social forests thus play a critical role in providing recreational escapes and fostering social inclusion and well-being by addressing this accessibility gap.

Moreover, city forests play a vital role as elements of public open space, functioning as democratic idylls, green islands, and even fairylands within the urban fabric (Konijnendijk, 2019). These spaces serve as stages for social interaction, stimulating face-to-face contact and strengthening social bonds, essential for building a sense of community identity. Beyond their recreational value, social forests contribute to place-making by encouraging the involvement of residents in their planning and management, fostering a sense of ownership and pride in these shared spaces (Konijnendijk, 2019). Examples such as Britain's "Common Ground" initiative, New York's Central Park, and symbolic projects like "The Spiritual Forest" and "White Children's Forest" demonstrate how social forests can become powerful symbols of community cohesion and cultural identity. Through their unique blend of natural beauty, social accessibility, and participatory governance, city forests are instrumental in creating inclusive urban environments that support ecological and social sustainability.



(Berlin's Tiergarten, berlin.de)



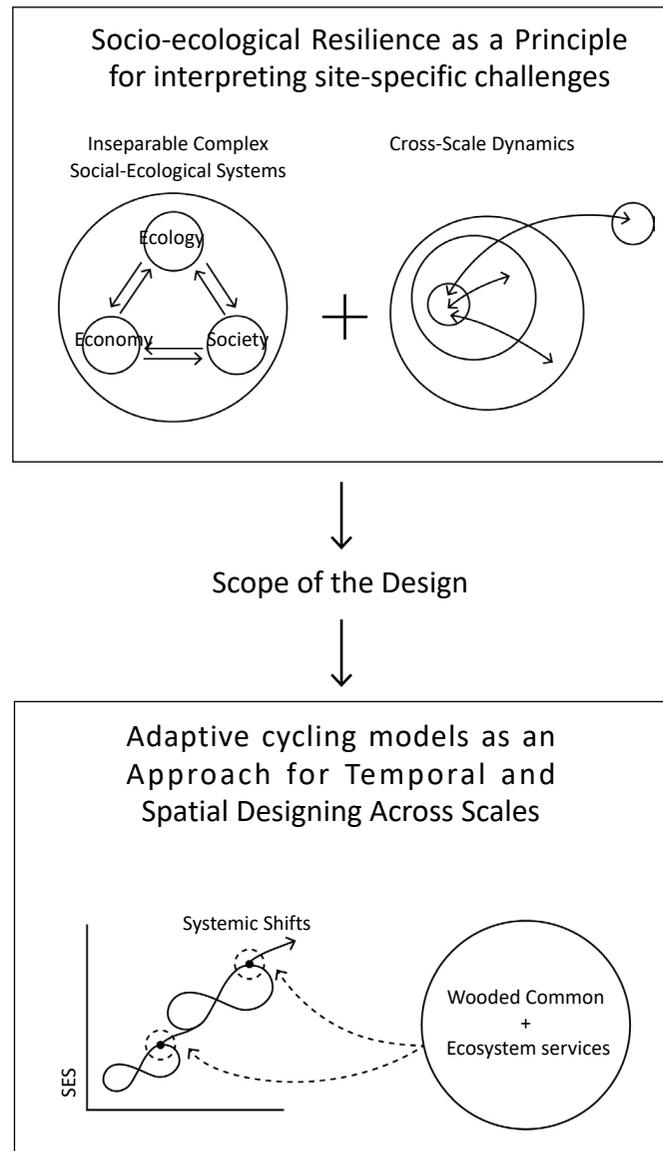
(Amsterdamse Bos, I amsterdam, 2024)

Grove

Historically, the sanctity of groves is deeply rooted in human history, and different cultures give these trees spiritual significance, which is usually consistent with rituals and myths. For example, in traditional Korean villages, the village grove or *maeulsup* is an important cultural symbol representing the sacred boundary between nature and the community. These groves are deliberately planted and managed in cooperation. They are not only spiritual shrines, but also social and resting places (Jung, 2023). In Chinese culture, the Feng Shui jungle garden, the sacrificial jungle garden, and the jungle garden often originate from myths and legends (Lei Gao, 2023).

However, people's understanding of small forests has changed. Modern explanations usually look at them from the perspective of ecology and culture. The "garden city" plan in Singapore is an example. "Grove" is metaphorized here as a green space providing ecosystem services (Patience, 2023). The change in the understanding of the grove -- from the sacred space to the symbol of ecological sustainable development -- reflects the extensive changes in social cognition of the interaction between nature and human beings. This evolving view of the jungle garden is significant to landscape architecture and urban planning because it challenges the traditional concept of separation between nature and human activities. Integrating a jungle garden into urban design provides an opportunity to combine cultural heritage with contemporary environmental goals and promotes the deeper connection between people and land.

Theoretical framework



Theoretical framework
(adapted by Reyers et al., 2018, pp.270)

Socio-ecological Resilience as a Principle for interpreting site-specific challenges

This theoretical framework adopts socio-ecological resilience as a core principle for interpreting site-specific challenges in highly dynamic landscapes. It acknowledges the complex and inseparable interactions between ecology, economy, and society, conceptualizing them as components of a tightly coupled social-ecological system (SES). Additionally, it highlights the importance of cross-scale dynamics, recognizing that landscape change occurs through nested interactions across temporal and spatial scales.

Adaptive cycling models as an Approach for Temporal and Spatial Designing Across Scales

The framework integrates the adaptive cycle model, a concept from resilience thinking that emphasizes growth, conservation, release, and reorganization phases. This model provides a lens for understanding systemic shifts and informs a flexible and responsive approach to temporal and spatial design. By applying this lens, the design process can support transformative potential within SESs.

A wooded common is proposed as a spatial strategy to foster resilience through shared stewardship and multifunctionality. It delivers ecosystem services while accommodating long-term change. This framework thus bridges theory and practice, positioning design as a tool for navigating socio-ecological transitions.



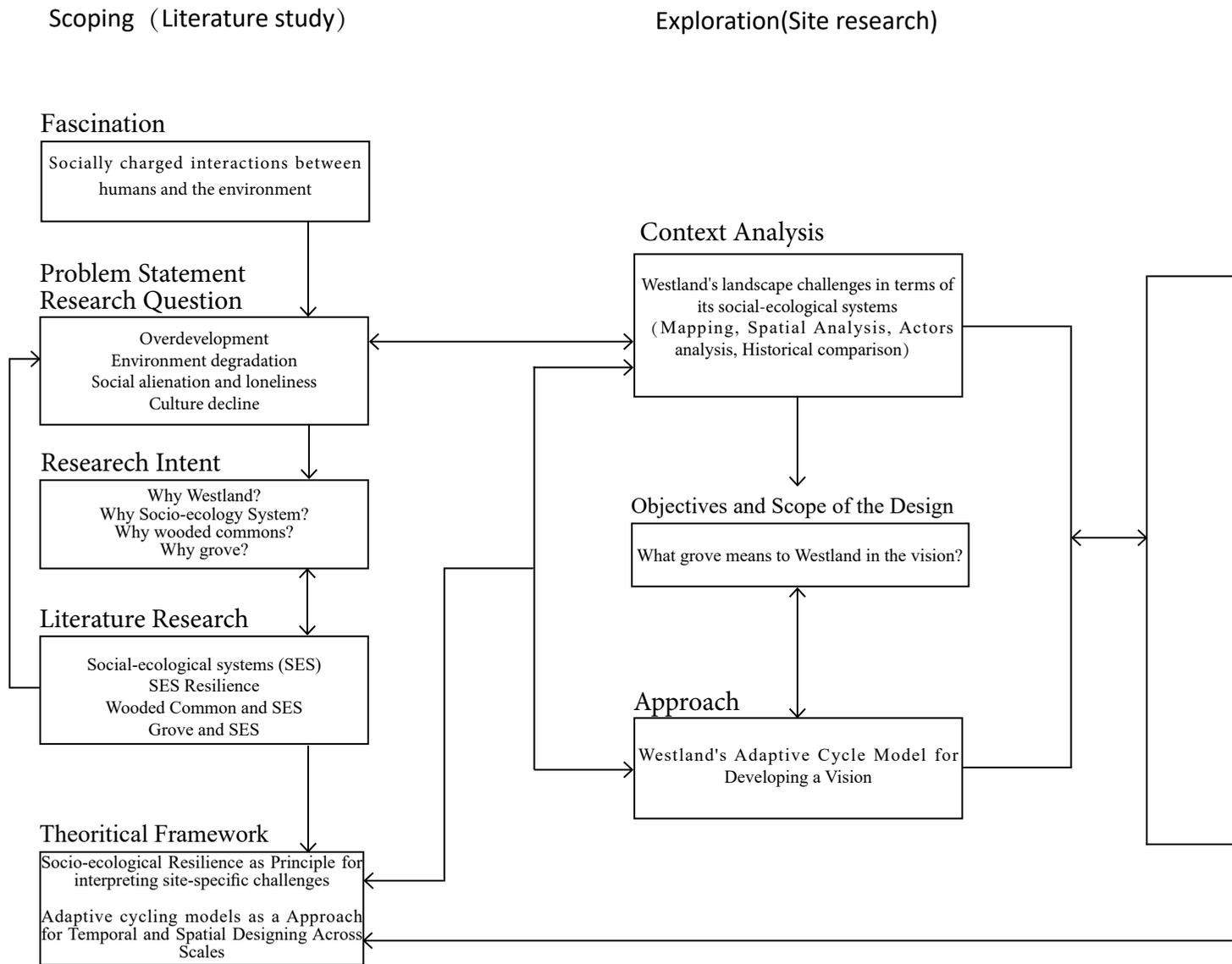
1.4 Methodology

The research methodology of this thesis project is structured around three main approaches: literature study, site research, and research-by-design. These approaches are embedded within a process framework divided into four main phases: Scoping, Exploration, Landing, and Reflection.

In the *Scoping* phase, the problem statement and research questions guided the selection of relevant theoretical concepts, particularly focusing on Social-Ecological Systems (SES), Socio-ecological Resilience, and the relationship between SES and Wooded Common and Grove landscapes. The main objective of the literature review is to develop the theoretical framework while refining the problem statement and research questions. Two theoretical perspectives are emphasized:

Socio-ecological Resilience as a principle for interpreting site-specific challenges, and the adaptive cycle model as a conceptual approach for temporal and spatial design across scales.

Methodology



Landing(Research by design)

Westland Vision

Temporal and Spatial Design Concept
Westland Vision through time

Regional Design

Spatial Analysis
Temporal and Spatial Strategy Cross Scales

Medium Scale design

Grove typology design
Zoom in plans through time: water
buffer and new connection
Management

Detail Scale design

Sensorial experiences through time
Technical Detail
Plantation

Reflection

Conclusion

Reflection

Reference

Appendix

The **Exploration** phase analyzes the social-ecological challenges of the Westland region, including its ecological habitats, hydrological conditions, urban development history, social tensions, and the loss of cultural and ecological heritage. Historical and current SES structures and trends are examined to extract concrete design goals. Based on these goals, with the aid of the adaptive cycle model and ecosystem services framework, a long-term development vision for Westland is formulated. In this phase, site research also contributes to the refinement and grounding of the theoretical framework by contextualizing it within the specific regional background.

The **Landing** phase corresponds to the research-by-design process. Combined with the theoretical framework, this method enables exploring multiple design possibilities across scales. Through a gradual zoom-in approach, the design process moves from strategic to spatial and detailed scales, allowing for critical reflection and iteration across different levels of intervention.

Finally, the **Reflection** phase evaluates and synthesizes the research and design outcomes. This stage is used to assess the effectiveness of the design in addressing the research questions and to further refine the thesis's conclusions and contributions.

Part B

2.1 Site context

How to understand Westland's challenges in terms of its social-ecological systems?

2.2 Objectives and Scope of the Design

What does grove mean to Westland in the vision?

2.3 Approach and Temporal Design Concept

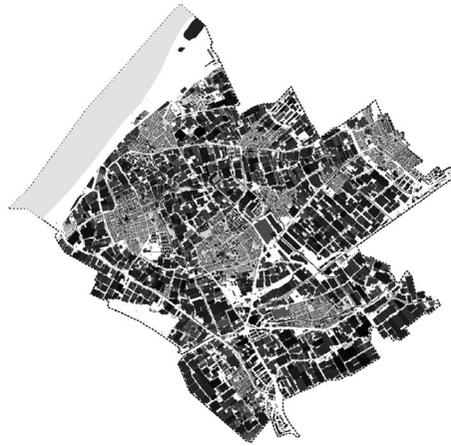
How can a resilience vision for Westland's future be designed based on ecosystem services and adaptive cycle theory?

2.4 Spatial Design Concept

Spatial design model - Urban Buffer - Inbetween area - Water Buffer



Netherlands



Westland region

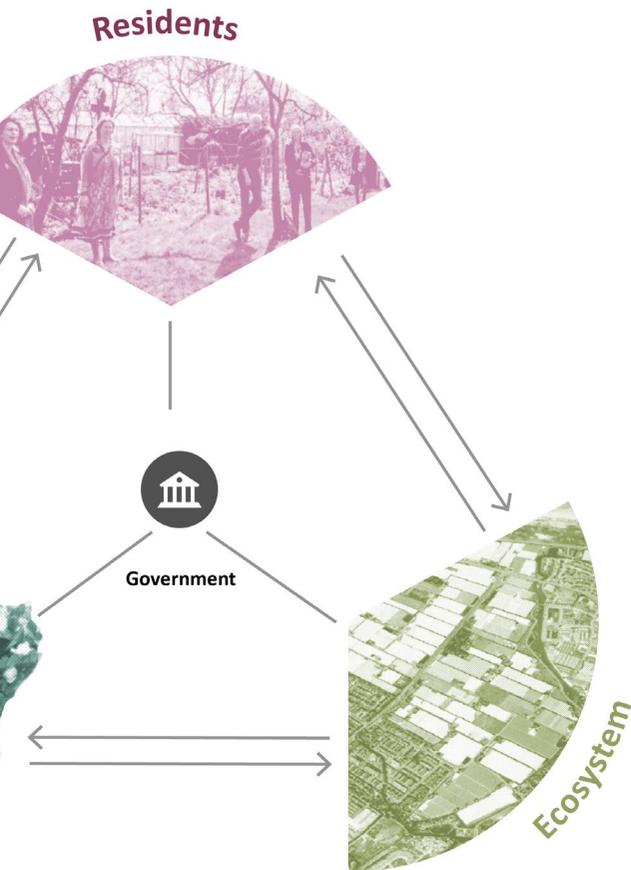


Design Focus
In-between (rural) Zone

2.1 Site context

Understand Westland's challenges in terms of its social-ecological systems.





Based on the methodology outlined in the theoretical framework -- socio ecological resilience is the principle of interpreting site-specific challenges -- this study first identified the main socio ecological participants in Westland and interpreted the complex relationships between them to reveal potential landscape challenges.

The analysis focuses on three interrelated aspects: economy, society and ecology. From an economic point of view, the greenhouse horticulture industry has received special attention, including land owners, entrepreneurs, technical experts, seasonal workers and other participants. According to the book horticulture in the Netherlands: an innovative industry facing the energy crisis and rising costs (2022), greenhouse horticulture is an important part of the Dutch economy, accounting for about 2.7% of the national GDP. In this industry, Westland is the core hub of production and innovation. Westland has about 2550 greenhouse companies (about half of the total in the country), and is one of the most concentrated horticultural areas in the Netherlands. The area has about 2750 hectares of greenhouse, which is the largest contiguous greenhouse area in the world. According to data from the Westland government, it is noteworthy that within a relatively compact area of less than 100 square kilometers, the entire greenhouse horticulture value chain is represented—from seed development and cultivation to packaging, logistics, and international trade. Nearly 50% of the local workforce is employed in this sector, underscoring its central role in the regional economy (Let's Grow New Opportunities, Let's Connect, 2025).

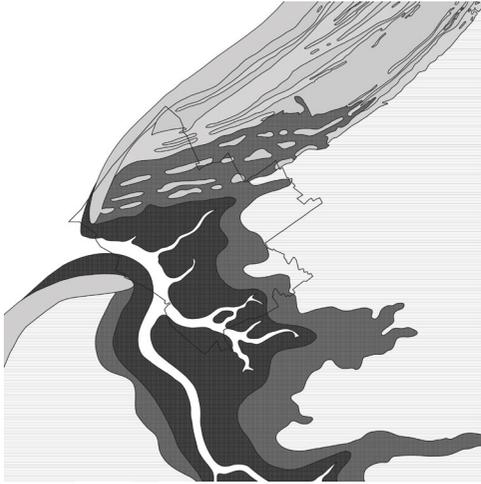
From a social perspective, the study considered different groups of residents, including Dutch residents living in Westland, immigrant communities and seasonal workers, as well as temporary visitors such as tourists.

From the ecological point of view, the research focus has shifted to the regional ecosystem and its restoration ability.

As shown in the left figure, the relationship between the three key areas of economic participants, social groups and ecosystems is overlapping and multifaceted. These complex links have laid the foundation for a more in-depth analysis, which will be described in detail below.

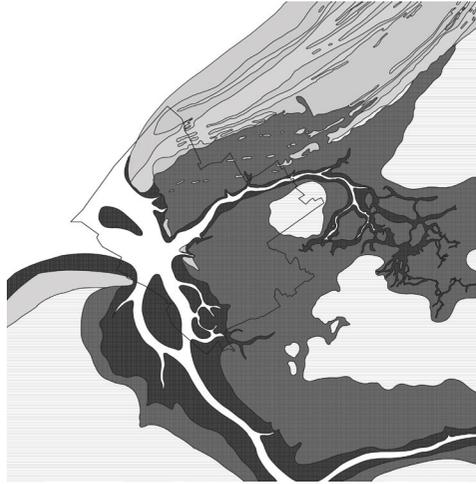
Landscape Development — Evolution of natural and cultural landscapes

A critical understanding of Westland's present socio-ecological landscape requires an exploration of its historical formation. The region's transformation illustrates the extent to which natural systems have been reconfigured through intensified socio-economic interventions.



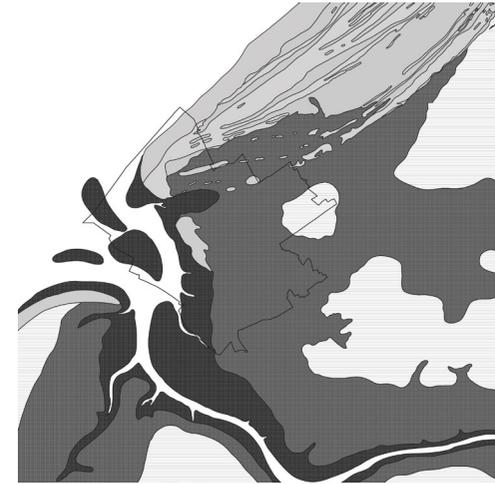
1500BC

Formation of Gantel channel tidal system



250BC

Habitats formed along gantel system



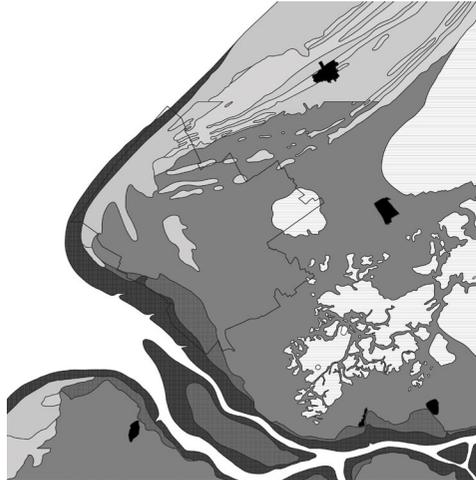
100AC

Sandy bank developed



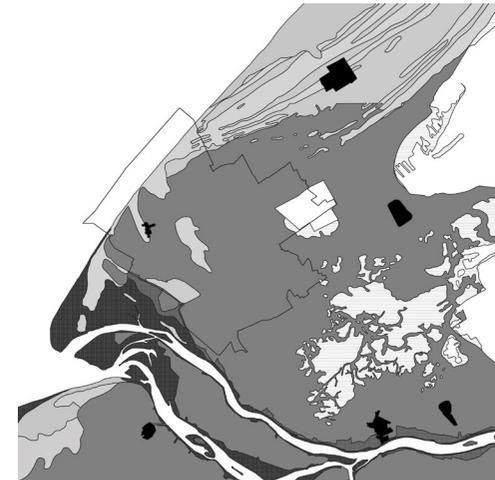
1250AC

Embankment and drainage caused shrinkage of peat



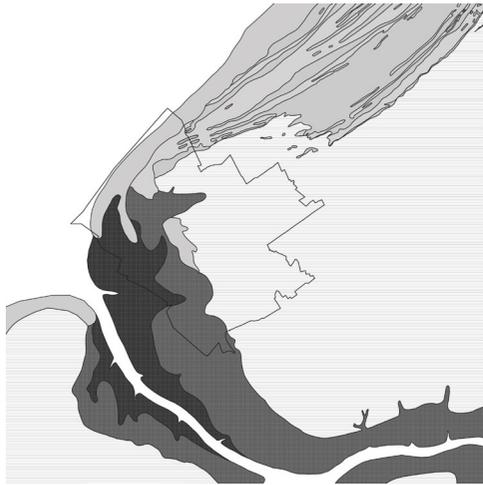
1500AC

Flood caused clay cover growth

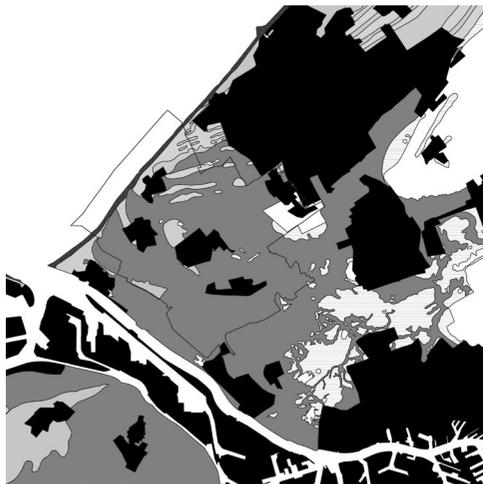


1850AC

Cities emerged on the sandy soil foundation



800AC
Peat growth



2000AC
The development and expansion of greenhouses shaped the landscape

The origin of Westland Landscape

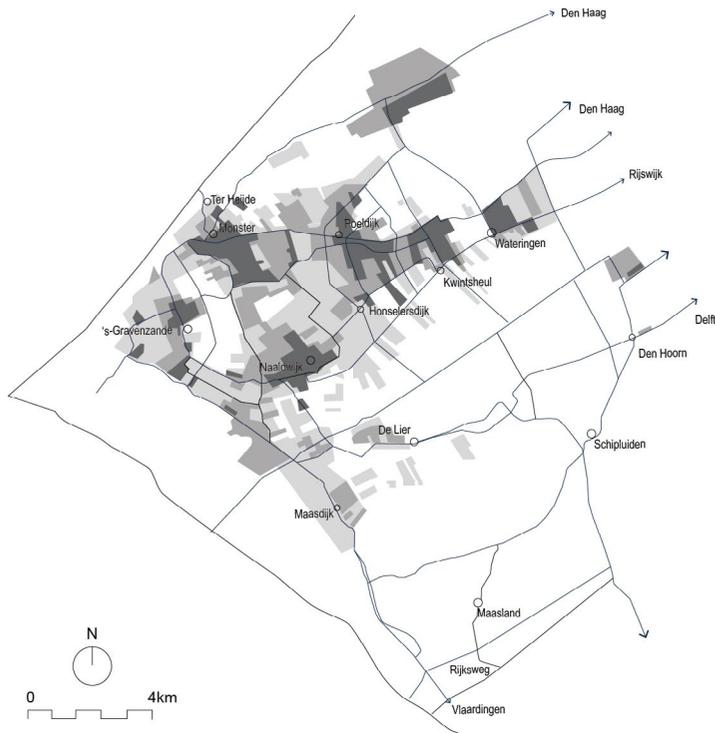
Map created by the author based on data from Erfgoed Delft Archeologie (<https://archeologie-delft.nl/opgraven-en-onderzoek/rapporten/bijzondere-rapportages/1524-dar130>) accessed November 2024

-  dune
-  tidal zone(wadden and mudflats)
-  high dune
-  embanked(embanked salt marsh and river plains)
-  salt marsh
-  low dune
-  urban
-  beach wall
-  peat

Historically, Westland boasted a rich natural landscape, with ecosystems shaped by the Gantel tidal channels. The relocation of these channels contributed to the development of the basin soils in Westland, consisting of marshes and clay, which supported the formation of diverse habitats. Subsequently, a sandy bank emerged at Naaldwijk due to the erosion and movement of mudflat sand, laying the foundation for the forests and cities that would later develop.

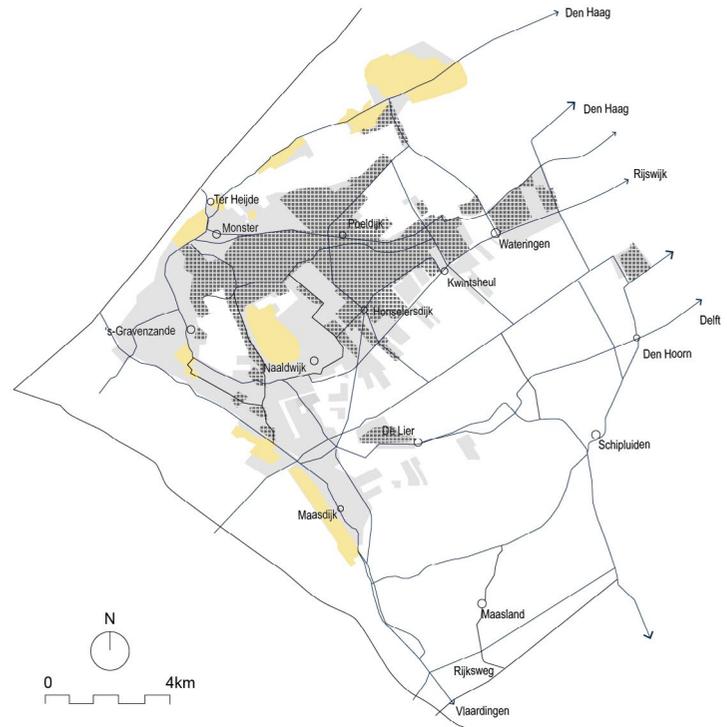
Around 1250 AD marked a significant transition from a natural landscape to a cultural one in Westland, driven by large-scale human interventions in the landscape, such as the construction of dikes, canals, and land reclamation. Cities gradually emerged on the sandy soil foundation. After 1900, advancements in glasshouse technology and trade with the UK further spurred the development and expansion of greenhouses, shaping the landscape structure we see today.

Agriculture Industry Development



- Main country roads
- Horticulture lands around 1850
- Horticulture lands around 1900
- Horticulture lands around 1935

Phasing of horticulture 1850 to 1935
(adapted by Yvonne van Mil, 2016, pp.123)



- Main country roads
- Horticulture lands around 1950
- Excavated soil
- Soil ascended

Excavated and ascended soil
(adapted by Yvonne van Mil, 2016, pp.123)

Viewed through the lens of social-ecological systems, Westland's horticultural history illustrates the intertwined evolution of its social structures, ecological modifications, and economic approaches.

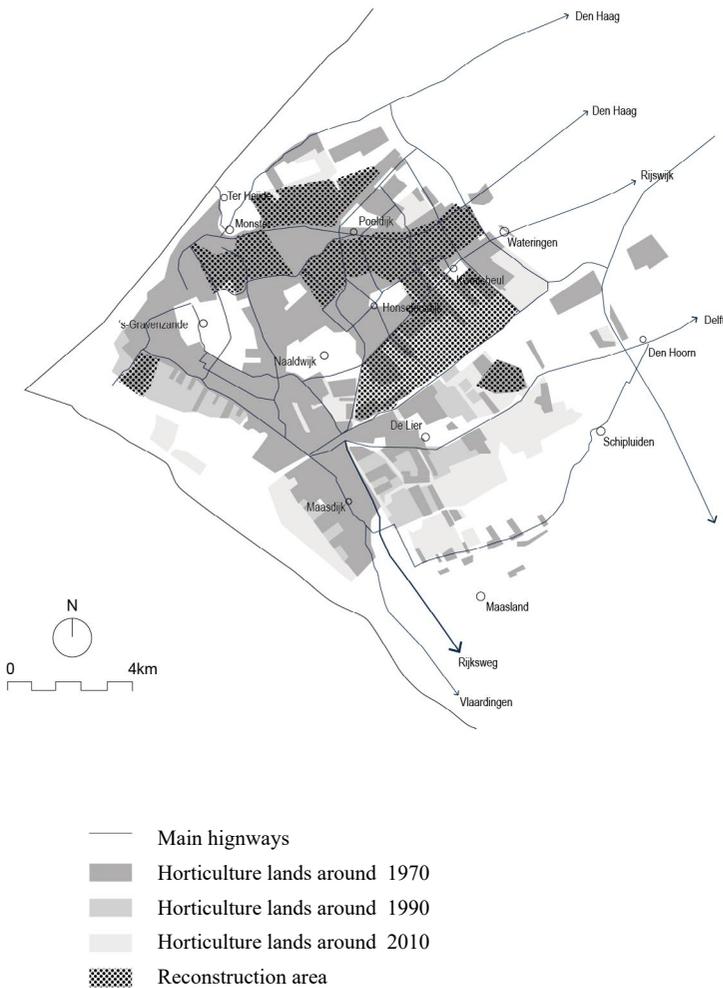
In the mid-19th century, horticulture was concentrated around village cores such as Loosduinen, Monster, and Naaldwijk, extending along key transport routes toward The Hague, Delft, and Rijswijk. These settlement-based nodes reveal the interplay between social organization, market access, and early economic specialization. As horticulture expanded to villages like Maasdijk and de Lier (1850–1900), a more continuous horticultural landscape emerged. Yet, areas such as Maasland and Schipluiden retained traditional rural practices, illustrating spatial unevenness in *socio-economic development*.

Horticultural expansion was closely tied to *ecological modification* and land adaptation. From the 19th century, large-scale soil improvement projects were carried out to enable intensive cultivation. Favorable sandy soils in areas like Monster and Naaldwijk were excavated and redistributed to elevate low-lying clay plots, sometimes up to 100 cm, enhancing drainage and productivity. This landscape engineering reflects the synergy between ecological knowledge and economic ambition.

Although the total horticultural area remained stable after 1950, the region experienced significant *economic restructuring*. New enterprises emerged through village expansion and reconstruction of aging greenhouses, supported by technological advancements that reduced reliance on soil and transport conditions. By 1990, greenhouse cultivation dominated Westland's urban area, except in more agrarian towns like Maasland and Schipluiden.

From 1990 to 2010, greenhouse area declined slightly due to spatial reorganization rather than economic downturn. Enterprises relocated from constrained urban areas to better-connected sites, partly driven by national policies such as the Ministry of Agriculture's RROG program in the 1980s aimed at modernizing greenhouse zones.

Overall, Westland's landscape transformation reveals ongoing negotiations between ecological limits, economic modernization, and evolving patterns of land use—the core dynamics of a living social-ecological system.



Phasing and reconstruction of horticulture until 2010
(adapted by Yvonne van Mil, 2016, pp.181)

Habitat Fragmentation

From the perspective of SES, the ecological landscape challenge in Westland is not only the result of environmental degradation but also of complex and multi-scale interaction among social, ecological, and economic subsystems.



Ecosystem: fragmentation of blue green network

On the local scale, intensive and continuous greenhouse construction has greatly compressed the available green space, open water, and ecological buffer zone. Therefore, habitat patches become very fragmented, disrupting species migration routes and damaging the integrity of the ecological network. The land is highly industrialized and hardly multifunctional. In addition, the only canal between greenhouses is usually regarded as the source of irrigation water. However, it is often affected by the leakage of agricultural chemicals, posing a threat to soil and water quality.

On the regional scale, although there is a river and drainage channel network, it mainly serves the technical drainage function rather than the ecological connection. The current green corridor planning focuses on connecting Westland with the Hague and coastal nature reserves (Nature 2000) with het Staelduinse Bos. However, these connections are mainly concentrated in the periphery of the area, which makes Westland ecologically isolated. There is almost no continuous migration corridor or ecological gradient from coastal to inland or from urban to rural areas.

Social subsystem: institutional and behavioral constraints

At the institutional level, land is mainly privately owned, especially by greenhouse enterprises, so space for public green infrastructure is limited. Lack of intercity or interdepartmental coordination makes it impossible to carry out integrated blue-green network planning. At the actor level, economic actors (such as entrepreneurs and companies) tend to prioritize productivity rather than ecological connectivity. Residents' ecological expectations are limited, and vulnerable groups such as seasonal workers are often restricted in using green space, resulting in an uneven distribution of ecological benefits.

Economic subsystem: spatial pressure from the greenhouse economy

The greenhouse horticulture industry dominates the economic subsystem, which has caused enormous spatial pressure on the landscape. The highly compact agricultural structure pushes ecological functions to the edge to improve productivity. Land use is highly intensive, with little ecological redundancy or buffer space. Policy concerns focus on technological innovation and energy efficiency (such as smart greenhouses), while ecological restoration capacity has not been paid enough attention.

Green and Blue

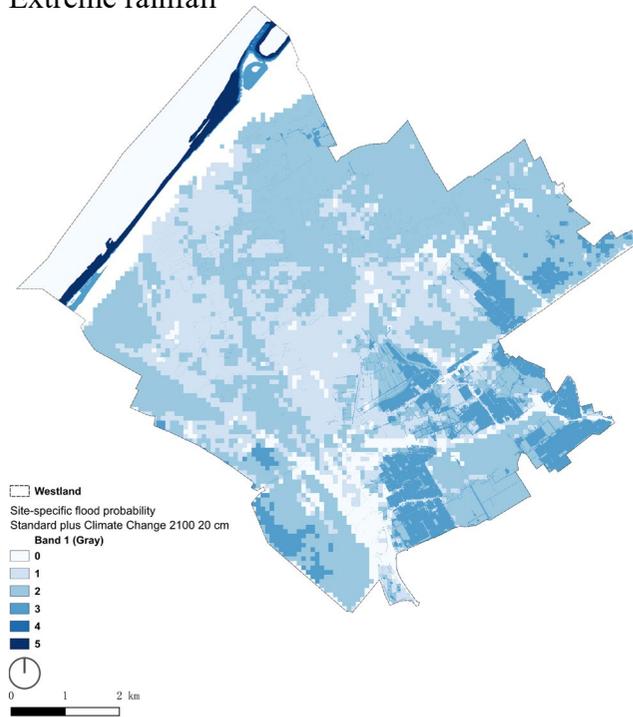
-  Forest
-  Nature reserve
-  Grass
-  Water
-  Industrial or commercial land
-  Recreational green
-  Residential Area
-  Westland

Water-related Risks

Historical waterways
superimposed on the current
water system



Extreme rainfall



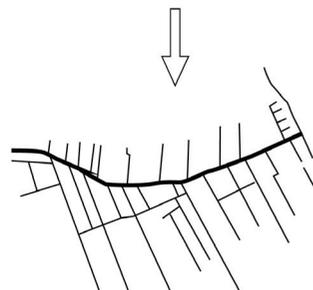
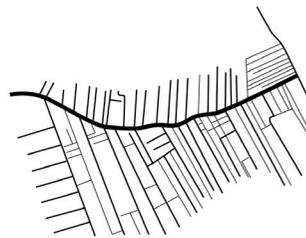
1950



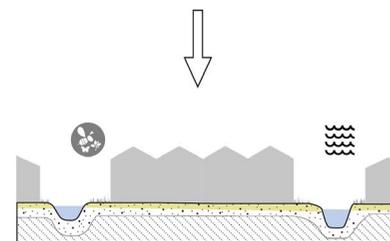
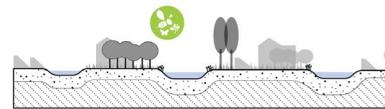
2022



(nationaalgeoregister, 2022)



Watercourse reduced and narrowed



Decrease in ecological diversity

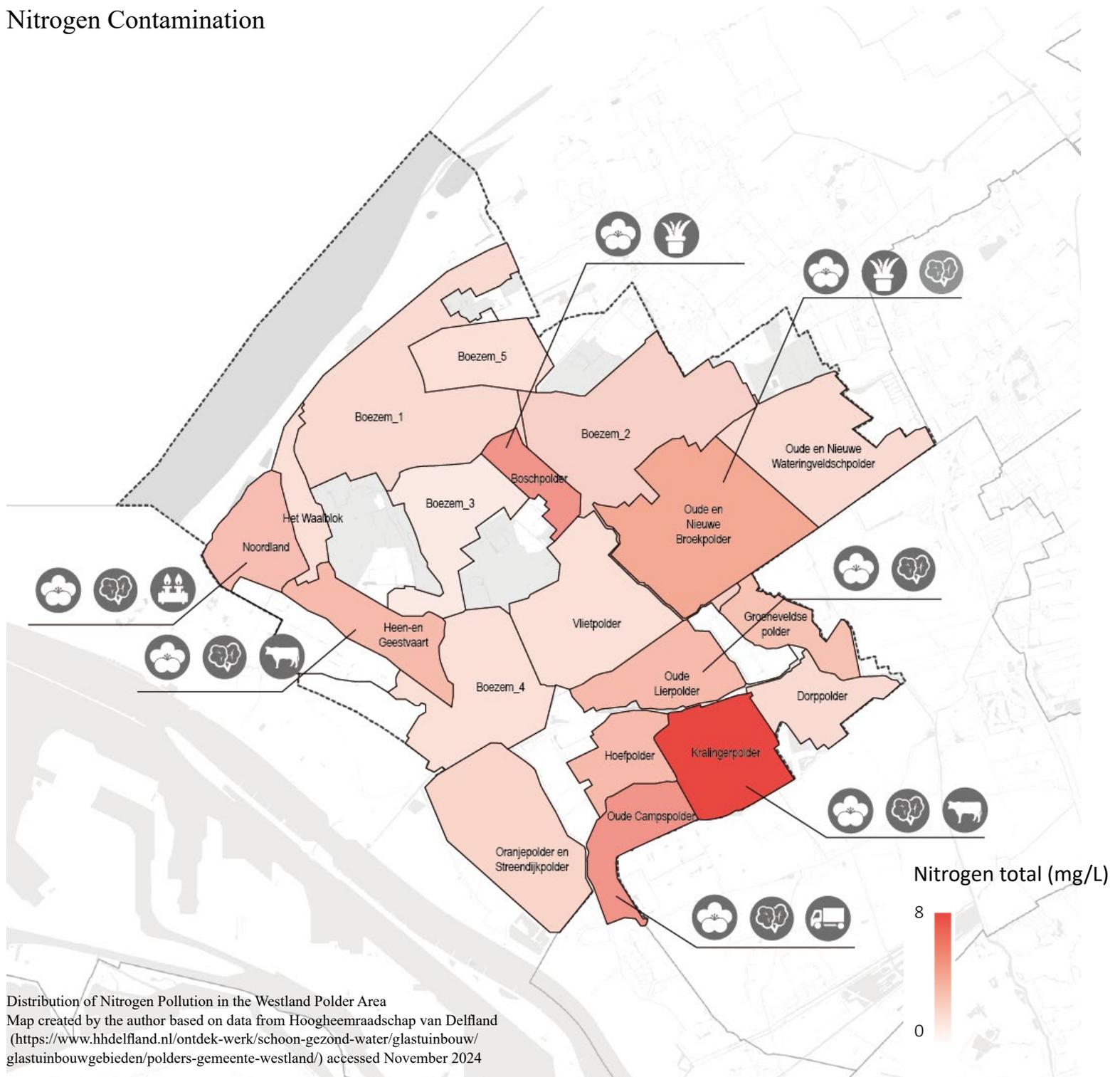
There is a particular lack of space for aquatic plants to grow. As many organisms live among aquatic plants, they are not yet fully developed. Therefore, the expansion and improvement of coherent aquatic natural networks is still necessary.

Historically, Westland has a rich and diverse water system, mainly composed of a series of tidal ditches, the most famous of which is the Gantel River, a naturally formed tidal drainage ditch. As shown in the left figure, historical waterways are superimposed on the current water system, showing that some tidal waterways still exist. In addition to these natural features, there are artificial canals and drainage networks, some of which can be traced back to Roman times.

At the early stage of horticulture's development, waterways played a central role in the transportation of goods, and ships were usually used to transport agricultural products in this area. Westland's dense water network greatly contributed to the local biodiversity and rainwater retention capacity at that time. However, with the development of greenhouse agriculture and road infrastructure construction, water transport has been eliminated. As a result, many canals have been filled or narrowed to make way for other land uses.

This local-scale intervention has gradually upgraded to the regional level, reducing the region's ability to absorb rainwater in extreme weather events and increasing the risk of urban floods. At the same time, the loss of aquatic habitat also negatively impacts local biodiversity. This change shows how changes in economic activities and lifestyles continue to reshape and interfere with the landscape over time.

Nitrogen Contamination



Distribution of Nitrogen Pollution in the Westland Polder Area
Map created by the author based on data from Hoogheemraadschap van Delfland
(<https://www.hhdelfland.nl/ontdek-werk/schoon-gezond-water/glastuinbouw/glastuinbouwgebieden/polders-gemeente-westland/>) accessed November 2024

Soil and water pollution in Westland is closely related to local economic production activities, especially greenhouse gardening. Westland's water quality index score in the 2018 sustainable development balance sheet is relatively low, mainly due to the discharge of waste rich in phosphorus and nitrogen (Omgevingsvisie, 2025). The greenhouse industry is an important reason for this problem. Crop protection chemicals and nutrients are often detected in surface water, which enters surface water through greenhouse emissions and leakage. This leads to the deterioration of water quality and poses a serious threat to aquatic organisms.

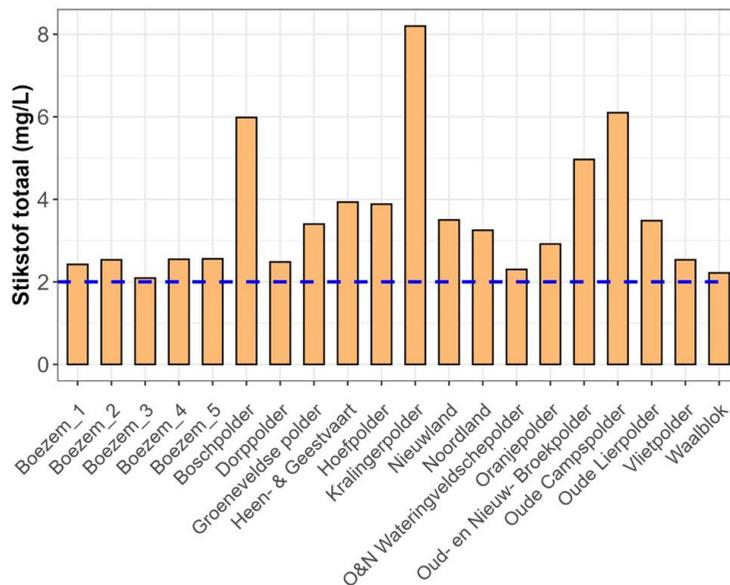
High levels of nutrients such as nitrogen and phosphorus will lead to excessive growth of algae and duckweed, leading to turbid water quality and making it difficult for many aquatic species to survive. Predatory fish such as pike are particularly affected because they need clear water to prey. Among these pollutants, nitrogen and phosphorus need to be controlled the most.

At the local level, greenhouse water management is restricted by laws and regulations, requiring the use of closed soilless cultivation systems. In the Netherlands, this is the only method allowed by law. Although most of the drainage in such systems is reused, 5-10% of the water supply is still discharged into the environment (OS&J. Balendonck, 2020). In addition, during the production process, nutrients may penetrate soil and groundwater through the surface cracks of the greenhouse floor.

In addition to surface water and groundwater pollution, soil pollution in Westland is also a significant problem. Nitrogen oxides (NOx) and ammonia emitted from intensive industrial and transport activities are released into the atmosphere. These compounds are deposited in natural areas, leading to soil acidification. This process leads to the consumption of essential minerals such as calcium, potassium, and magnesium, as well as the excessive supply of nitrogen. As a result, plant species diversity is reduced, negatively impacting bird populations and other animal communities.

Looking forward to the future of Westland, it is essential to strengthen the supervision and monitoring of pollutant emissions. In addition, when introducing green public space, it is necessary to solve the problem of soil and water restoration before planting vegetation or restoring habitat. Many of the available open spaces are the residual land left after the removal of the greenhouse, and usually have the problem of soil hardening, which is also an important factor that must be considered in the landscape redevelopment strategy.

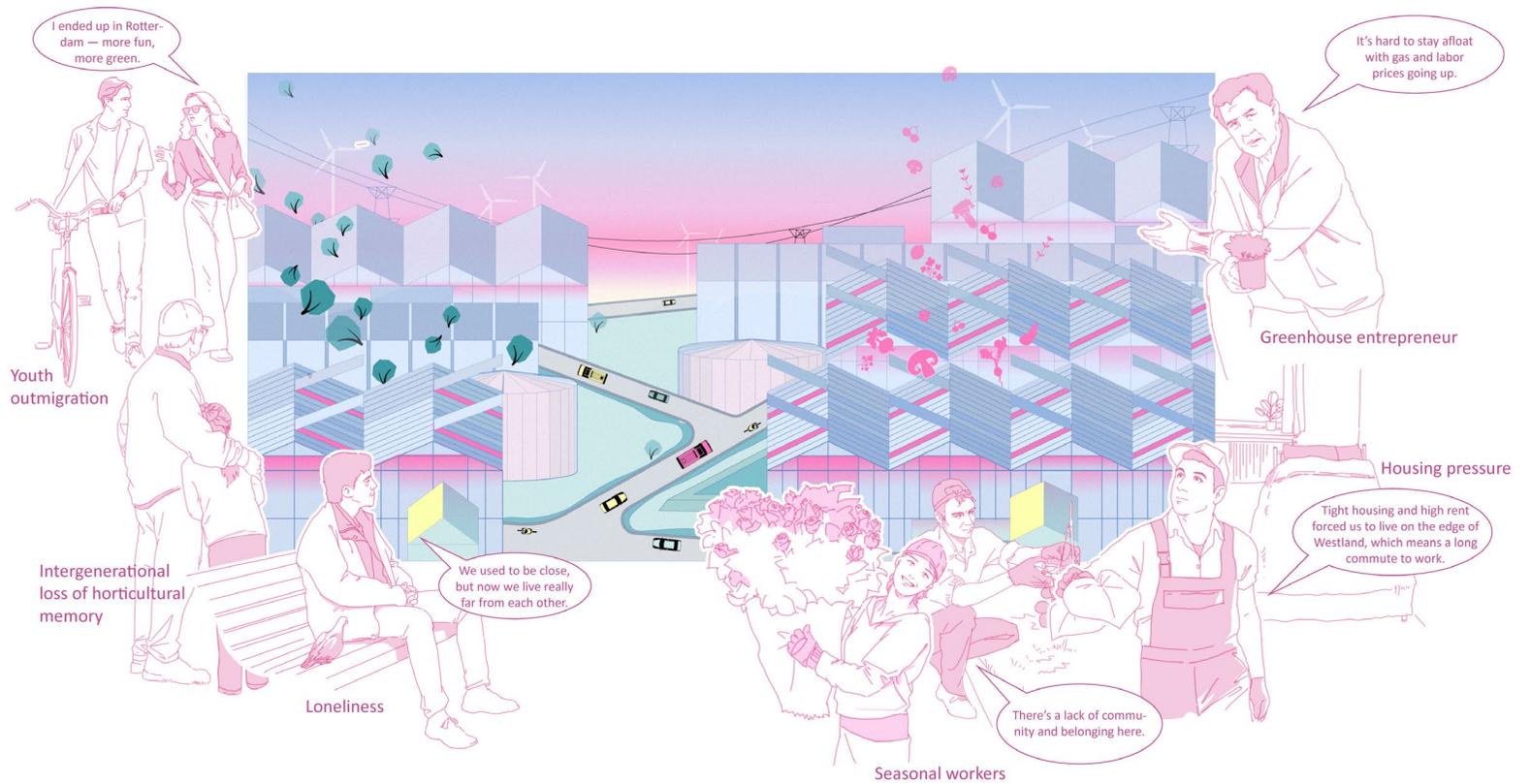
Nutrients (Polders in Gemeente Westland, 2025)



The graph shows the average results for nitrogen for the year 2023. The nitrogen standard for Westland is 2.0 mg/l. No areas are meeting the standard; some areas are close to the target, but others are not meeting the target at all.

Social isolation and loneliness

Demographic Analysis



The population of Westland is overwhelmingly working-age, with nearly 60,000 residents between 25 and 65 whose presence is closely related to its greenhouse agriculture industry, underlining the need for affordable workforce housing, reliable public transport and vocational training facilities. More than 30,000 young people under 25 suggest that expanding schools, playgrounds and youth-oriented community centers will be essential to support future growth; however, Westland's share of young residents is lower than the national average, while its proportion of elderly people—23,480 aged 65 and over—is higher, suggesting a youth outflow possibly driven by limited local opportunities or high housing costs and pointing to rising demand for healthcare services, day centers and senior-friendly public spaces.

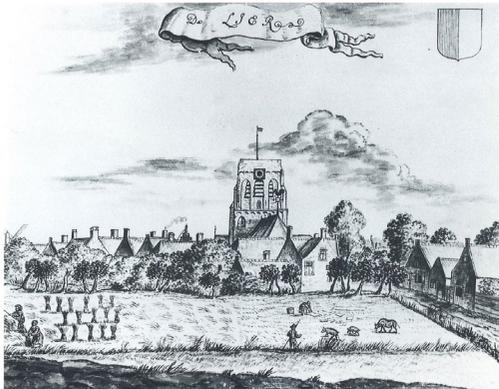
As non-Dutch residents—particularly Moroccans—and seasonal workers (many from Poland) form an increasing share of the population, Westland will also benefit from multilingual community hubs, integration programs and temporary worker accommodations to foster social cohesion and ensure everyone can access local services.

Seasonal workers account for many of Westland's population and social structure. Most of the informal labor force -- mainly seasonal workers -- is active in the horticultural industry. In 2020, the informal employment in this industry provided nearly 26000 full-time jobs, accounting for 87% of such jobs in the agricultural sector (Statistics Netherlands, 2020). In greenhouse vegetable farms, seasonal workers account for the vast majority of labor input (nearly 60%), exceeding the number of long-term employees. This group includes local students as well as a large number of temporary migrant workers. Seasonal workers account for about 19% of Dutch farm labor(Statistics Netherlands, 2020).

Although seasonal workers play a vital role in the regional economy, they often encounter social isolation and have limited integration into local communities. Between 12000 and 16000 migrant workers work in Westland at different times of the year. However, only about 4600 people live in the city, and the rest live in the surrounding towns (NOS, 2024), mainly due to the higher housing costs in Westland compared with the marginal areas of Rotterdam or The Hague. Therefore, many workers have to endure long commutes every day.

Language barriers, especially the lack of Dutch language ability, further hinder their ability to integrate into local society and communicate with residents. Seasonal workers are treated differently from Dutch citizens and have limited access to public places and social infrastructure. Their working time arrangement, living arrangement, and marginalized legal and social status rarely allow them to communicate meaningfully, aggravating their sense of disconnection with community life in space and time. This has formed a scene of social exclusion. In this scene, migrant workers exist materially, but are invisible in society. They are excluded from the belonging and support network of urban life.

Culture Decline



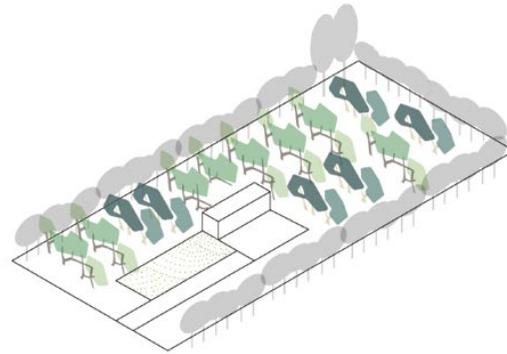
De Lier, print by G. van Giessen from 1729. Tower of the Cathedral (not yet leaning) with agriculture in the foreground (Photo: Historical Archive Westland)



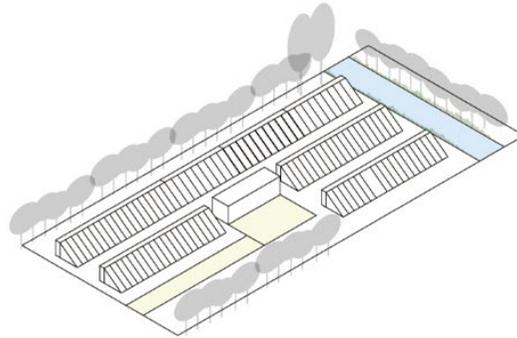
Glasshouse along canal and forest 1950c. Koos van Leeuwen (n.d.). Een praatje bij een plaatje. De Poeldijker.



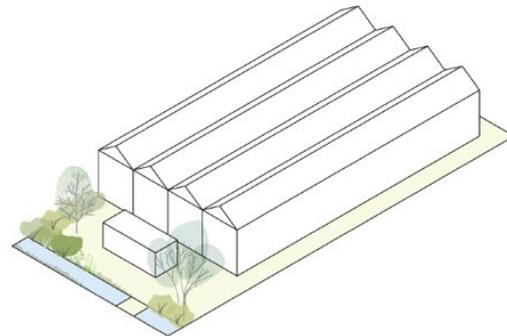
Horticultural company



Warmoezerij



Country estates



Horticultural company

?

Future

To understand the coupling between economy, ecology, and landscape in Westland, it is insightful to begin with the changing relationship between horticultural culture and everyday life. Westland's history reveals the culture of gradual separation between gardening and gardener's life - not only in physical space, but also in identity and meaning.

Remarkably, what is now an industrialized landscape was once lush and green, shaped by estates and orchards that formed the core of Westland's cultural identity. The horticultural grove was more than a means of production; it brought both material prosperity and a sense of spiritual and communal richness. Grove farming tightly connected families and neighbors: they worked the land together, shared knowledge, and supported each other through hardship, such as during times of crop failure or famine. This fostered a collective identity grounded in mutual support, diligence, and a strong entrepreneurial spirit. At that time, individual gardeners were responsible for their own orchards or nurseries. Linear rows of trees were commonly planted to define plot boundaries and to serve as windbreaks, and the front or backyards of many homes were densely planted with groves.

.However, the smallest unit of orchard cultivation has undergone significant typological transformation since the 18th century. As greenhouse horticulture became increasingly integrated into global markets, technological advancement led to the expansion of greenhouse scale. Greenhouses evolved from being part of a family's backyard

into large-scale industrial enterprises. Driven by profit and efficiency, many traditional groves were removed to make room for bigger greenhouses and loading zones. The workforce shifted from neighbors and family members to hired laborers. Horticulture, once deeply embedded in daily life, was transformed into a business model emphasizing technological innovation, scale, and output. This cultural shift has reshaped not only social relations but also the image of the landscape. The growing disconnection between living spaces and horticultural production has further diminished the space for groves, weakening the traditional link between home, work, and nature in Westland's cultural landscape

In terms of future vision, landscape reconstruction should not only focus on the improvement of ecology and space, but also consider whether intervention measures can promote new forms of cultural narrative and identity. Integrating an economic model that encourages community participation and cultural resonance is essential for people to accept the new landscape image. One possible way is to reconnect daily life with gardening -- to restore the connection between life, work and farming -- to cultivate a new relationship between people and the place.

Current SES



Based on the previous analysis, the theoretical framework of indivisible and complex social ecosystems and cross-scale research methods has been proven to help understand the multifaceted challenges facing the western region.

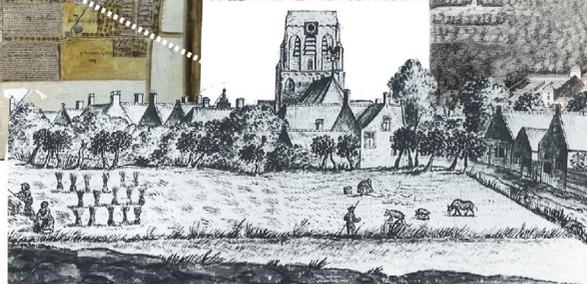
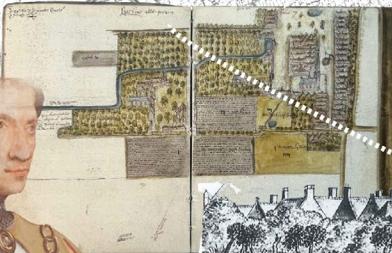
These include **habitat fragmentation and increased water pressure**, which are caused by the interaction of ecological, social, and economic factors. In terms of ecology, the fragmentation of blue-green infrastructure destroys landscape connectivity; social, institutional, and behavioral constraints hinder collective environmental action; and economically, the spatial pressure imposed by the greenhouse industry limits the alternative use of land. The coupling of these three aspects shows that effective interventions must operate within the scope of small-scale landscape design to the regional ecological connection strategy.

From a social perspective, a key challenge lies in **social isolation and a general sense of loneliness**. Regarding space, the limited accessibility between villages limits the provision of inclusive public space and exacerbates the inequality of different social groups in obtaining a green environment. Economically, the prevailing production-oriented model separates horticultural activities from daily life, resulting in landscape homogeneity and cultural erosion. Future design strategies should enhance connectivity between villages through barrier-free and multi-functional public green spaces, promoting social interaction. At the same time, re-evaluating the cultural and social aspects of horticulture will help re-establish a meaningful relationship between man and land.

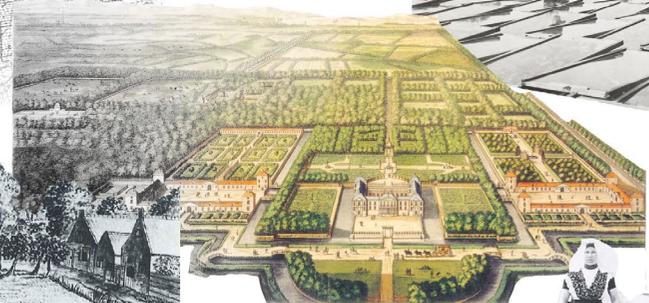
Economically, the horticultural sector is **vulnerable to increasingly severe constraints from market fluctuations**, rising energy and labor costs, and environmental and social challenges. Technically, Westland solves the energy problem through district heating and improves efficiency by transitioning from a small-scale greenhouse to a large-scale greenhouse. However, from the perspective of landscape architecture and spatial planning, further opportunities lie in the diversification of land use, the integration of ecological infrastructure into productive landscapes, and the design of adaptive and multi-functional spaces that consider ecological elasticity, social cohesion, and economic flexibility.

Inspiration—— SES system in old time

After having a particular understanding of the current social ecosystem in Westland, it is necessary to explore what the social ecosystem in Westland is like after the large-scale human intervention, what changes in the system have caused the landscape intervention, what development trends exist, and what enlightenment will be provided for future?



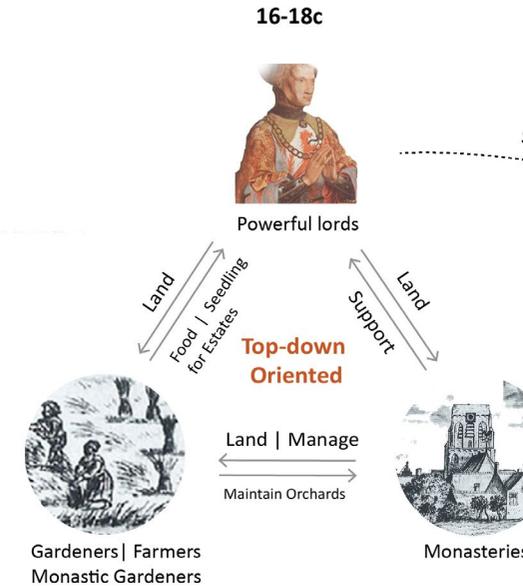
Monasteries and castles in the Westland also had orchards and fruit walls. Market gardeners could lease a piece of land to engage in 'warmoezerij'



In the 19 century, most country estates had disappeared and the freed-up land was used for horticulture.



From the sixteenth century onwards, powerful lords and wealthy merchants built country estates in the Westland. These houses had large gardens where fruit and vegetables were grown.



Sold or rented the land



16-18C

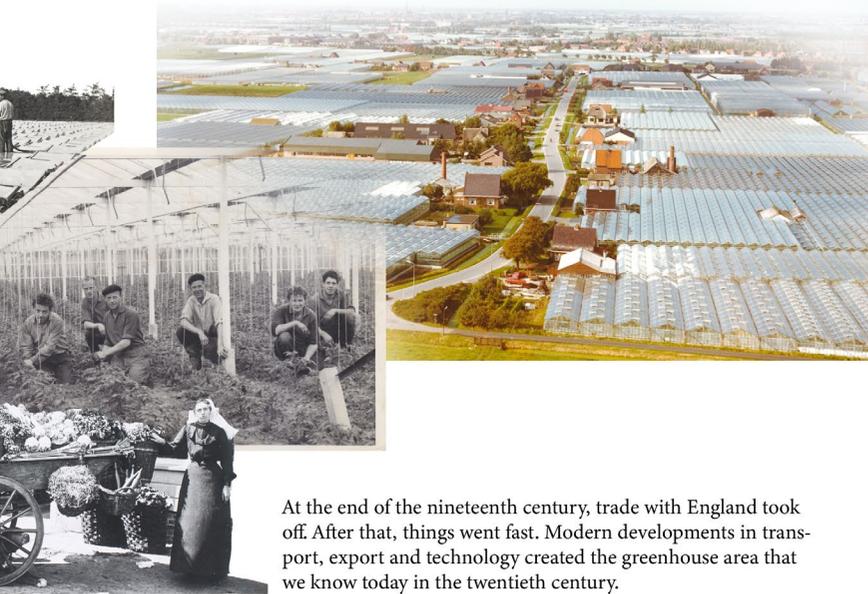
Looking at the history of Wasteland offers insight into its past socio-ecological systems. Between the 16th and 18th centuries, these systems were largely top-down, with powerful landowners distributing or renting land to gardeners, farmers, and monasteries. In return, they received food and seedlings for their estates and support from the monasteries.

At this stage, the ecological environment has received little human intervention. The original landscape image of Westland is an open landscape. Due to the planting of orchards and gardens, and manors, many trees have been planted. At the same time, due to water transportation, the connectivity of waterways is good, which improves the status of the ecosystem to a certain extent.

19-20C

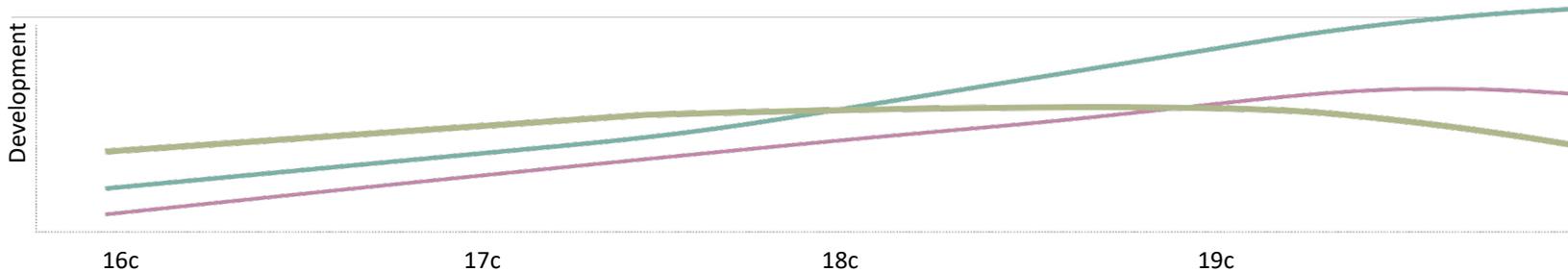
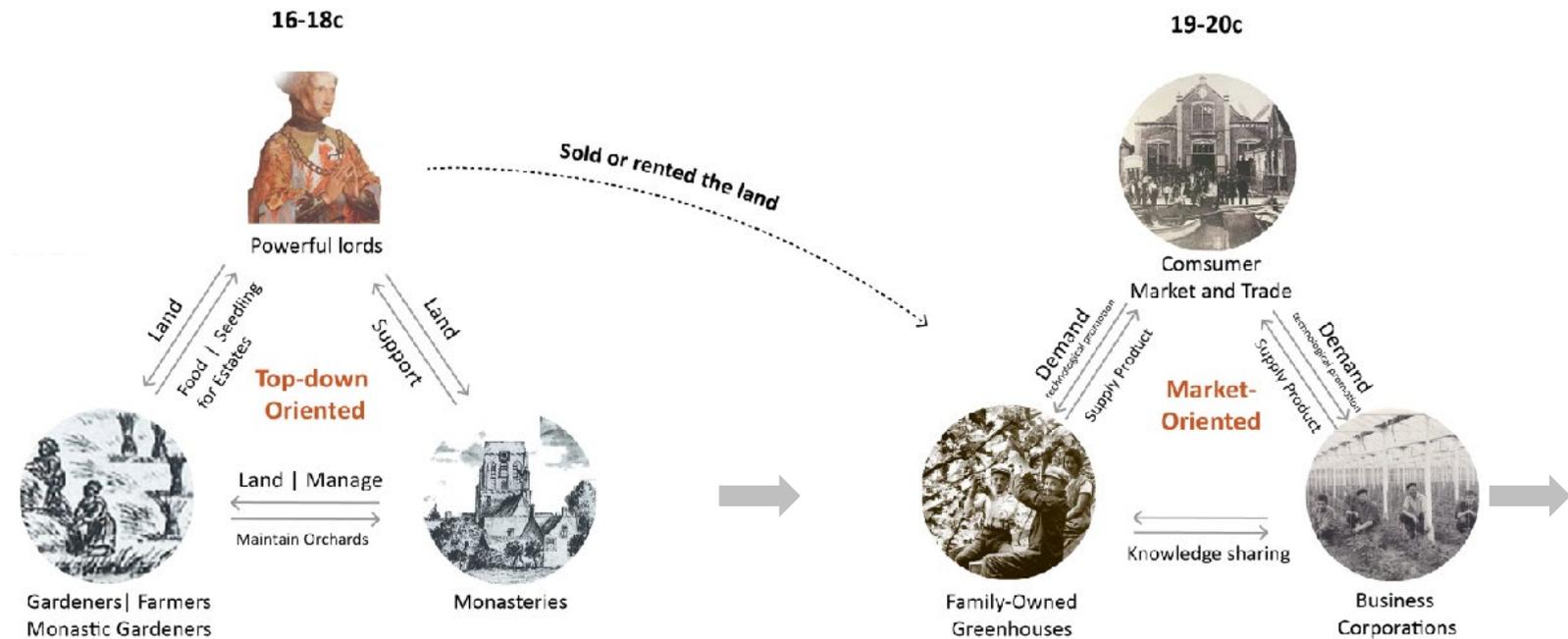
By the 19th century, the social structure shifted as landowners sold or rented land to family-owned greenhouse businesses, creating a market-driven economy. The greenhouse companies, benefiting from market demand, advanced technology, and knowledge exchanges, led to the greenhouse system we see today in the 20th century.

Due to the emergence of greenhouse, more and more large areas of land are covered with glass, and land transportation gradually replaces water transportation. The connection of water transportation is not as good as before, and the ecology is gradually intervened.



At the end of the nineteenth century, trade with England took off. After that, things went fast. Modern developments in transport, export and technology created the greenhouse area that we know today in the twentieth century.

Inspiration—— SES system in old time



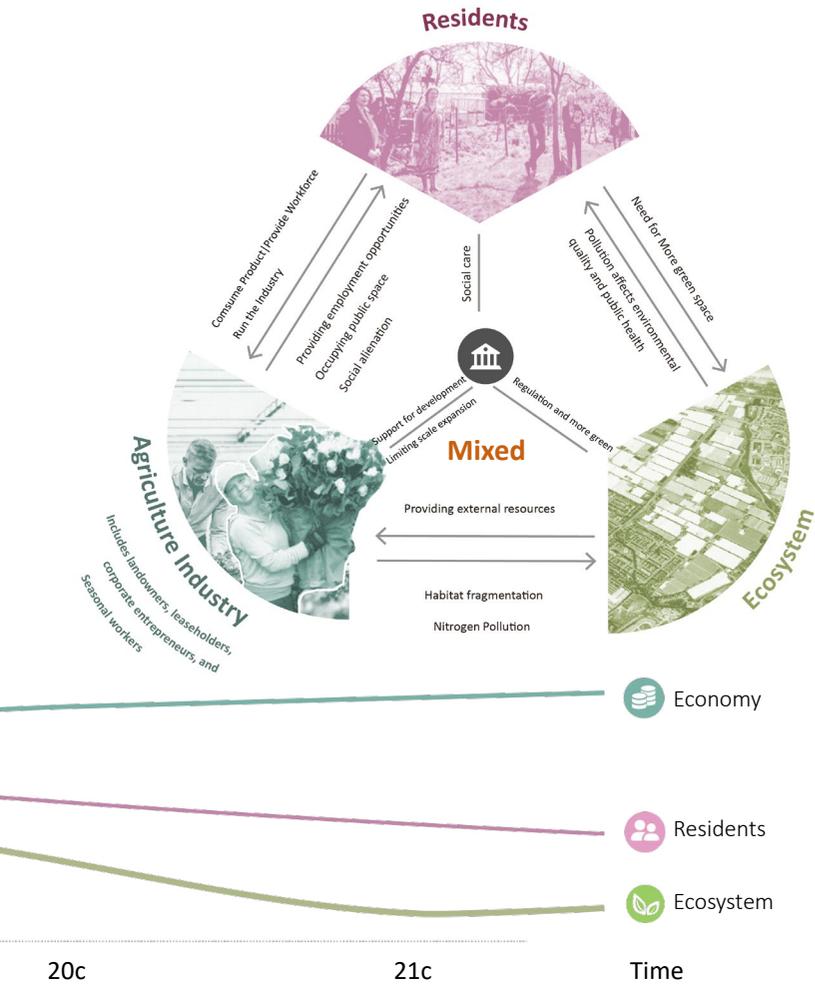
When comparing these three historical periods, we see a trend: Prior to the 20th century, agriculture helped foster social cohesion, but now, under the pressure of modern greenhouse industries, this has weakened. Environmentally, the shift from orchards and estates to intensive greenhouse production has led to ecological degradation.

The evolving role of woodland Commons and the future planning model

Historically, the development of woodland commons in Westland reflects the transformation of social and political structure and the change of land values. At first, these landscapes had a practical purpose -- farmland and pasture jointly managed by residents. Over time, especially in the period of enclosure and privatization, these lands are increasingly used as elite leisure manors, reflecting the rise of land grade control and aesthetic values. However, in the

later stage, the lower socio-economic status class regained land, and horticultural and greenhouse enterprises could be established. The future can transition to a more democratic landscape.

In the contemporary context, forest land is not only a natural landscape, but also a social ecological model that considers ecological restoration, cultural heritage, and inclusive use. In the future, the governance of such public forests may benefit from the comprehensive planning model, which combines top-down



strategic policies, bottom-up community participation, and market-oriented mechanisms. This mixed model can promote more adaptive, inclusive, and sustainable landscape transformation.

Applying these insights to Westland, a long-term strategy may include releasing some greenhouse-based landscapes to other areas in the Netherlands that are more suitable for large-scale industrial horticulture. This spatial redistribution will free up valuable land for diversified land uses in Westland, to realize the integration of

Partial transfer of agriculture industry



Greenhouse horticulture concentration (PBL, 2009)

For future design, I propose a transformation that shifts part of the industry towards other region of Netherlands and increasing ecosystem and social value. This would involve a blend of top-down, bottom-up, and market-oriented planning.

new industries, such as forestry, social forest land, ecological forest land, etc., enhance the ecological resilience of the region, strengthen social cohesion, and generate long-term economic value beyond intensive single agricultural production.

In this way, the Woodland common provides a conceptual perspective through which Westland can develop from a highly industrialized production landscape into a more multifunctional, inclusive, and resilient social ecosystem.

2.2 Objectives and Scope of the Design

Issues of concern to the project

Environment — [Habitat fragmentation
Increased water pressure

Society — [Social isolation
Sense of loneliness

Economy — [Vulnerable to market fluctuations
Unsustainable environmental
and social impacts

Grove of Westland in the future could be:

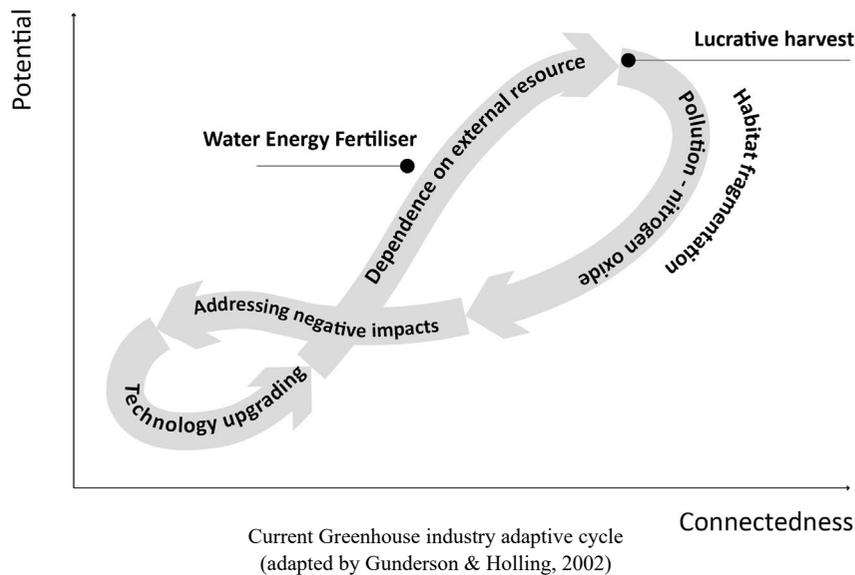
Remedial groves serve as ecological corridors,
mitigating pollution and preserving seasonal water
retention

[Spaces of social interaction to break down social segregation
Memorial grove recalling collective cultural memory
Productive groves restore the bond between growing and living

— Sustainable forest industries as part of a diversified economic strategy

2.3 Approach and Temporal Design Concept

Current Greenhouse industry Adaptive cycle



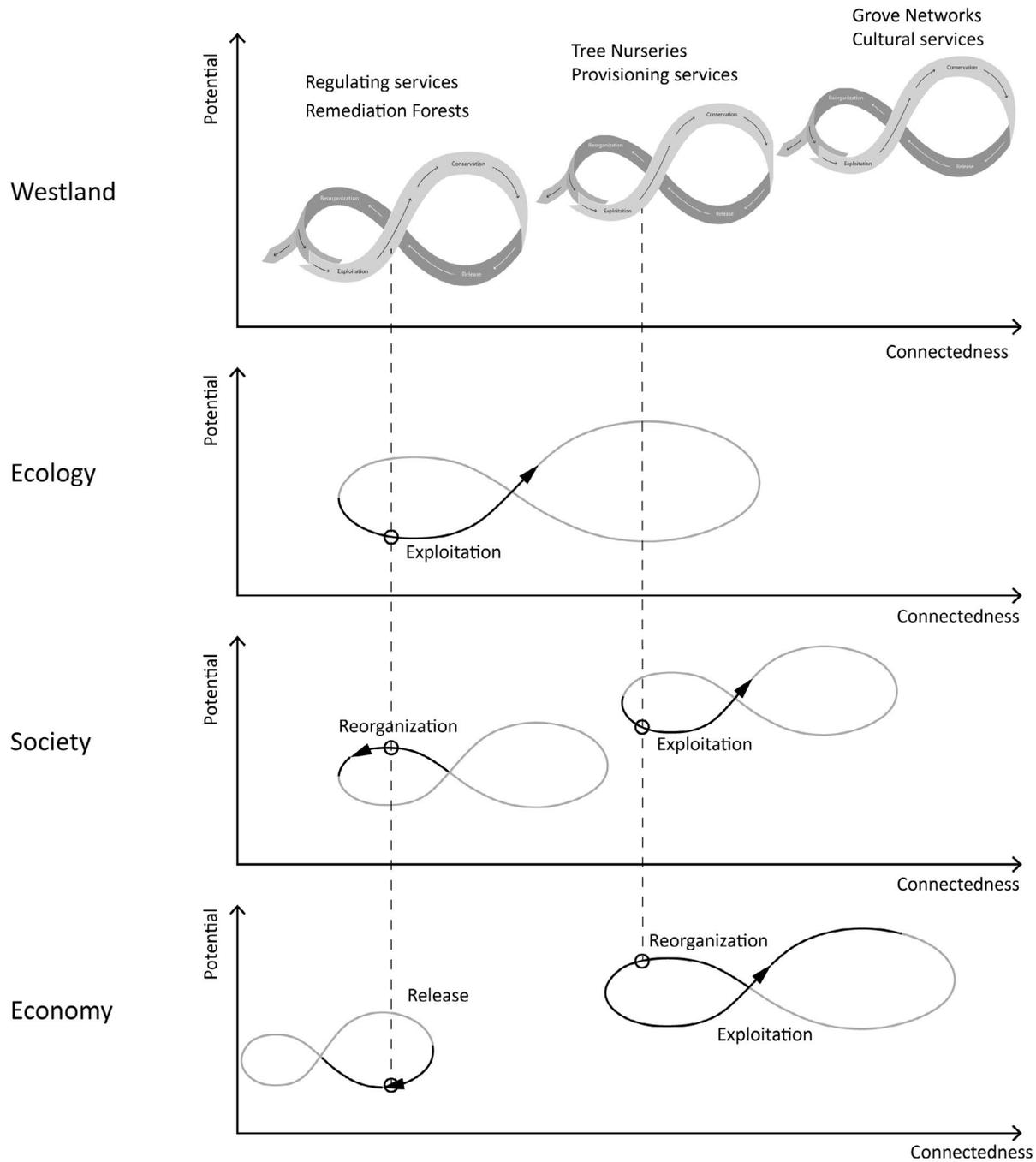
Planing Principle of Adaptive cycle

1. Consider the dynamic adaptive cycle across social, environmental, and economic dimensions.
2. Leverage diversity to absorb disturbances, regenerate, and adapt—this includes diversity of actors, institutions, and ecosystems within social-ecological systems (SES).
3. Actively promote transformative change beyond incremental adaptation.

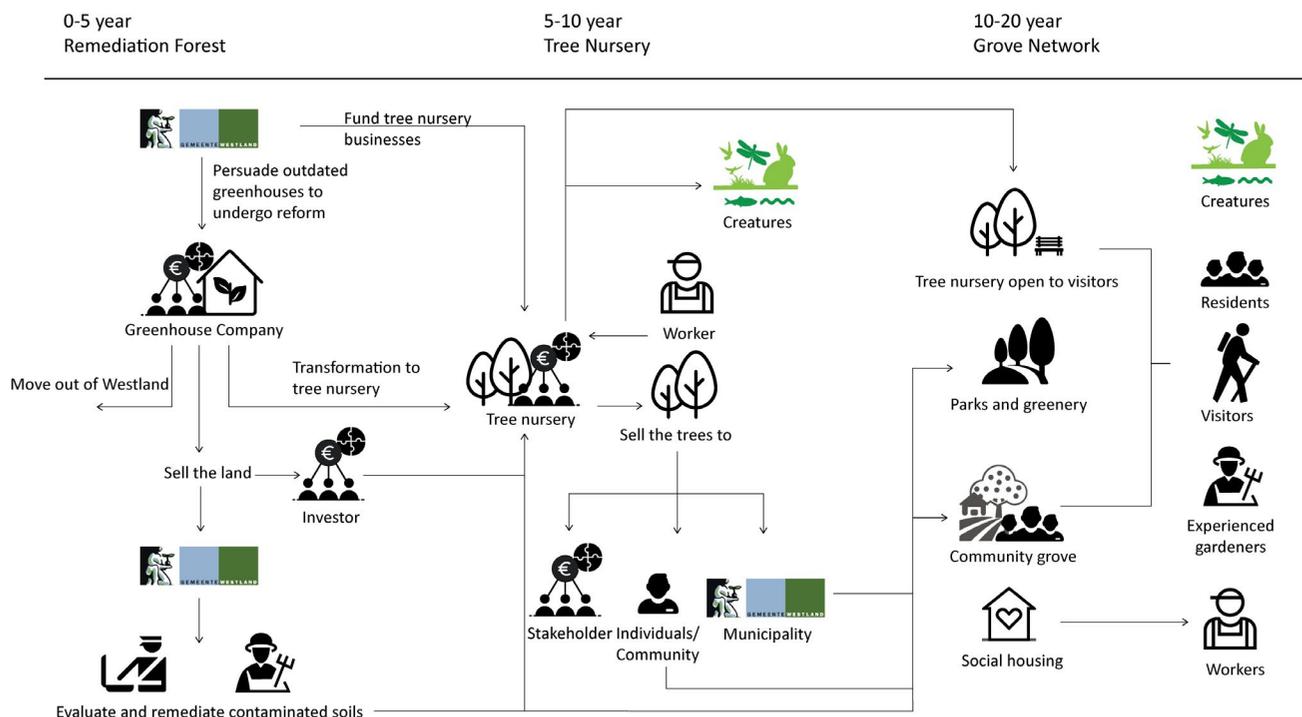
The greenhouse industry currently dominates the Westland region. Applying its present development trajectory to the adaptive cycle model aims to identify the key drivers in the four phases and the barriers blocking its transition into a new cycle.

This adaptive cycle illustrates the evolution dynamics in the process of industrial upgrading. As far as Westland's greenhouse industry is concerned, the **Exploration** stage usually relies on technological progress, such as a closed soilless cultivation system and improved plant varieties. When the system reaches the **Conservation** stage, it will increasingly rely on the continuous supply of external resources, including clean water, energy (historically natural gas) and nutrients. The system enters the **Release** stage when the productivity peaks under the given conditions. Emerging ecological issues (such as pollution or environmental degradation) may drive this shift, which may no longer meet national standards, thus prompting regulatory intervention. Rising costs, especially the recent surge in energy prices, will also contribute to this shift, forcing the region to seek alternatives to natural gas. The gradual resolution of these contradictions marks the arrival of the **Reorganization** stage; However, under the current industrial model, most environmental and social challenges can not be fundamentally solved, but can only be temporarily alleviated. Therefore, the system is still trapped in a continuous cycle, making it difficult to evolve into a higher-level adaptive cycle.

Westland's Temporal Concept



Actors in Temporal Design Concept



Westland’s vision can be articulated through three overlapping socio-ecological system stages—*rather than a strictly linear progression, each phase may loop or detour in response to specific site needs*. These stages correspond to the three categories of ecosystem services—regulating, provisioning, and cultural—and each suggests a distinct intervention focus:

Remediation Forest (Regulating Services)

In this phase, interventions prioritize remediating contaminated soils and enhancing drainage networks. As ecological functions recover, the Ecology enters the exploration phase of a new adaptive cycle. The decommissioning of greenhouses alters land-use patterns and social composition, prompting a reorganization of the social system. In contrast, the temporary loss of greenhouse income places the local economy in the Release phase.

Tree Nursery (Provisioning Services)

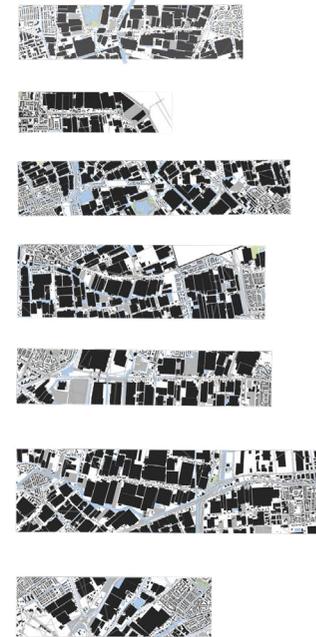
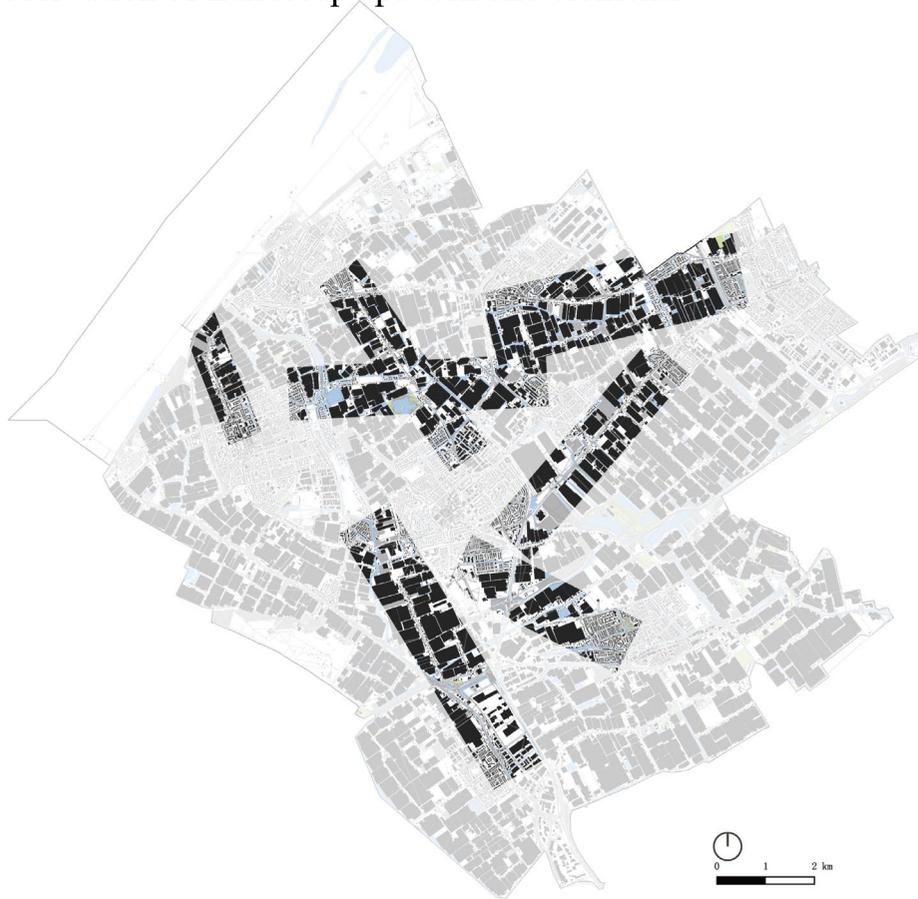
The second stage introduces novel economic models that drive economic reorganization. Establishing tree nurseries generates new actors and institutions—horticultural specialists, agritourism operators, plant-education and recreation programs, and municipal tree-procurement schemes—launching the social system into a renewed exploration phase and setting the stage for subsequent exploitation of these diversified provisioning opportunities.

Grove Network (Cultural Services)

Finally, the focus shifts to cultural ecosystem services by transforming private tree nurseries into publicly accessible groves. This transition fosters broader social participation and diversified economic activities. Functional diversity becomes a cornerstone of long-term resilience by embedding multiple uses and users within the landscape.

2.4 Spatial Design Concept

Observation of Landscape pattern and elements



The focus of this project is on the spatial space between the villages and the connection of the villages. Therefore, for the spatial design, I firstly analysed the spatial components of the inbetween area in Westland. The more significant elements are the city, the greenhouse, the wasteland and the water.

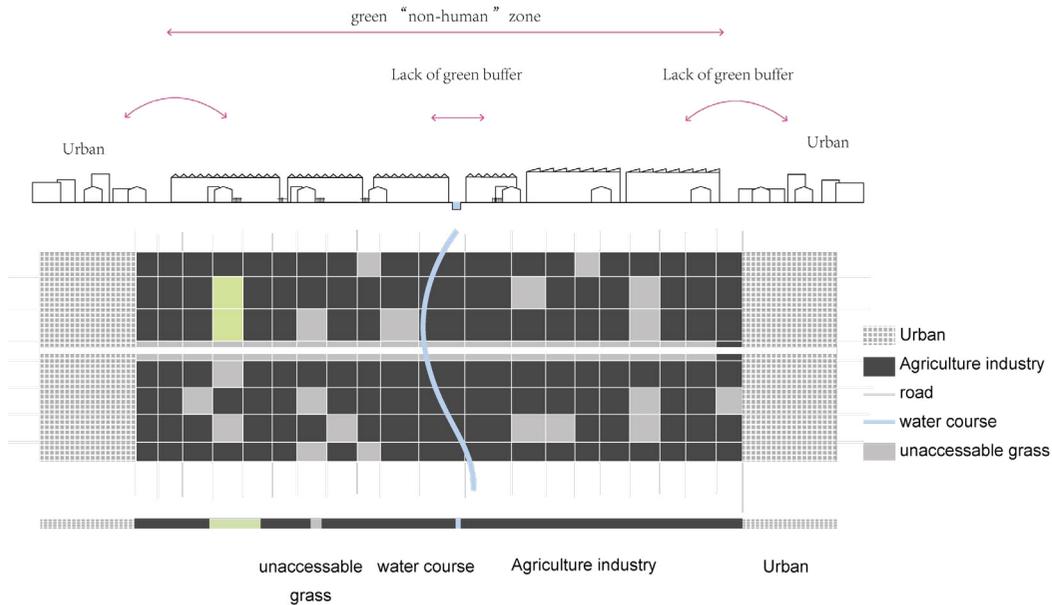
The selection of these specific areas for analysis is based on Westland's historical urbanization dynamics (see pages 48-49). In the initial stage of urban development, greenhouses are mainly built along the city's edge, closely connected with historical waterways and early transportation routes. As cities expand, greenhouses within the evolving urban boundaries are systematically relocated to peripheral areas, where they have experienced significant

expansion. Over time, these large-scale greenhouse buildings have extended to the gap space between different village settlements.

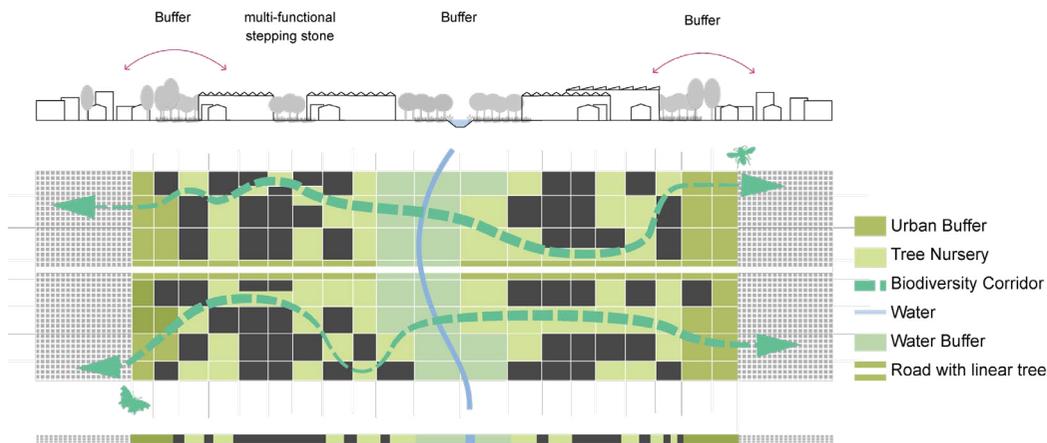
This spatial transformation provided the basis for investigating the corridor between villages. These transition zones not only represent the key spatial interface formed by the evolution of greenhouse industry, but also play a key role as a flow channel in daily life. Therefore, they have a strong impact on the perception of residents and the collective image of the western landscape. In addition, these spaces, especially those adjacent to watercourses, have great potential in ecological restoration and sustainable green and blue infrastructure development.

Current Landscape Patterns and Future Concept

Current



Concept

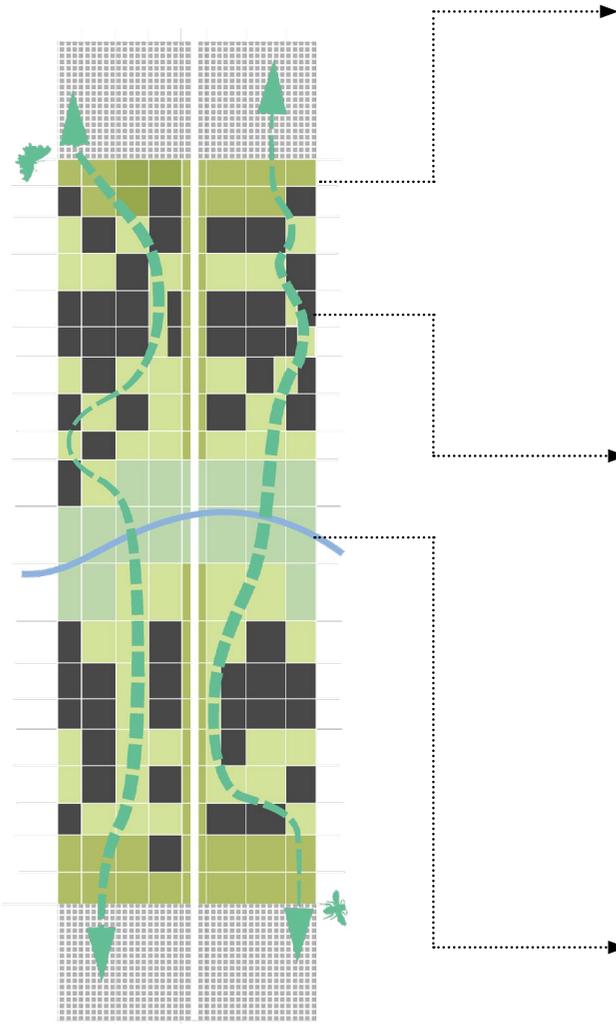


Currently, the landscape pattern exhibits abrupt transitions—from urban areas to the horticultural industrial zone (often labeled as a “green ‘non-human’” zone) and then back to urban. Within this matrix lie fragmented gray zones (as highlighted in the figure), such as inaccessible lawns, factory or warehouse parking lots. Although rivers and canals traverse the region, their banks are densely occupied by greenhouses. Overall, the pattern lacks intermediate buffers between the city and industrial areas, green “stepping stones” linking industrial zones, and ecological riparian corridors along waterways.

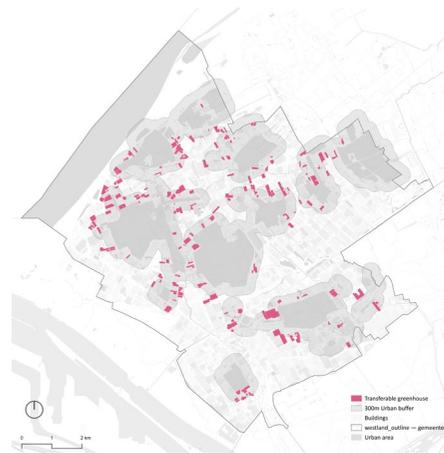
The envisioned future landscape for Westland is organized around its waterways, with continuous water buffers lining the canals. Interspersed tree nurseries act as ecological “stepping stones” through the greenhouse district, which then gives way to an urban buffer zone before transitioning into the city proper. This layered sequence dismantles the existing spatial isolation and allows green spaces to reconnect, forming a contiguous biodiversity corridor.

Spatial Concept for Westland

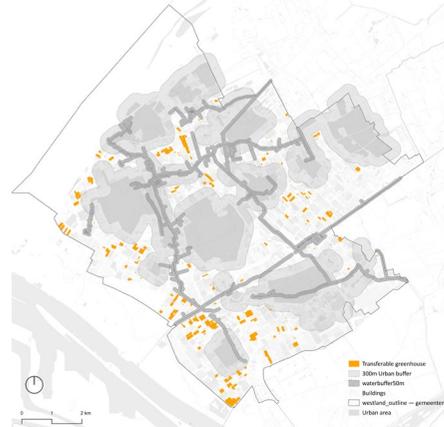
Transferable greenhouses have been identified as key to realizing the proposed landscape pattern. These facilities were constructed before 1980 and have not been retrofitted with clean-energy systems. They are generally smaller in scale, equipped with outdated infrastructure, and thus easily superseded by larger, more technologically advanced greenhouse.



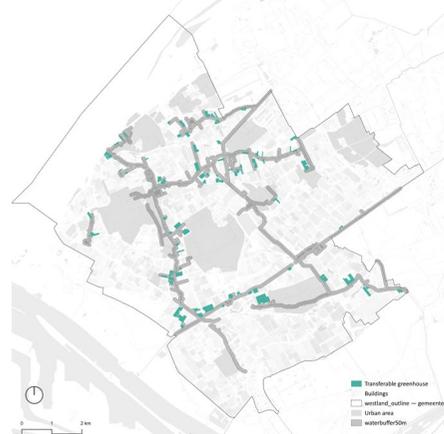
Landscape Pattern Vision



Urban Buffer Zone
Identified transferable greenhouses function as urban buffer zones within a **300 m** radius of each village. These small, outdated structures can serve as targeted “acupuncture” links between industrial areas and village green spaces; when reinforced with linear tree plantings along their perimeters, they create a coherent transitional belt.



Tree Nursery
The intermediate zone between the urban buffer and the water buffer is designated for future tree nurseries. Here, transferable greenhouses can be converted into propagation sites once soils have been ameliorated, knitting together a continuous green corridor.



Water Buffer Zone
The **50 m-wide** strips along both banks of the waterways are designated as the water buffer. Within this zone, transferable greenhouses can be transformed into wetland parks for floodwater retention or planted with linear tree belts to establish a continuous ecological corridor.

Overlay of the Three Spatial Layers



By overlaying the three spatial layers described above, I derive a conceptual spatial framework for the Westland region. This abstract vision map does not yet account for specific local conditions; instead, it highlights where opportunities for land-use change may exist. Here, “water buffers” run along both banks of the main waterways, forming a continuous ecological corridor that links into the adjacent nature reserves. Meanwhile, pockets of green space at the edges of villages and around tree nurseries are organically interspersed throughout the greenhouse belt. In the next phase, we will compare this vision against actual site conditions to identify the precise locations most suitable for targeted interventions.

- Transferable greenhouse of urban buffer
- Transferable greenhouse of modular forest
- Transferable greenhouse of water buffer
- 300m Urban buffer
- waterbuffer50m
- Buildings
- Westland
- Nature reserve
- Urban area
- wasted grassland

Part C

3.1 Westland Vision

Westland wooded common plan across 20 years.

3.2 Regional Design

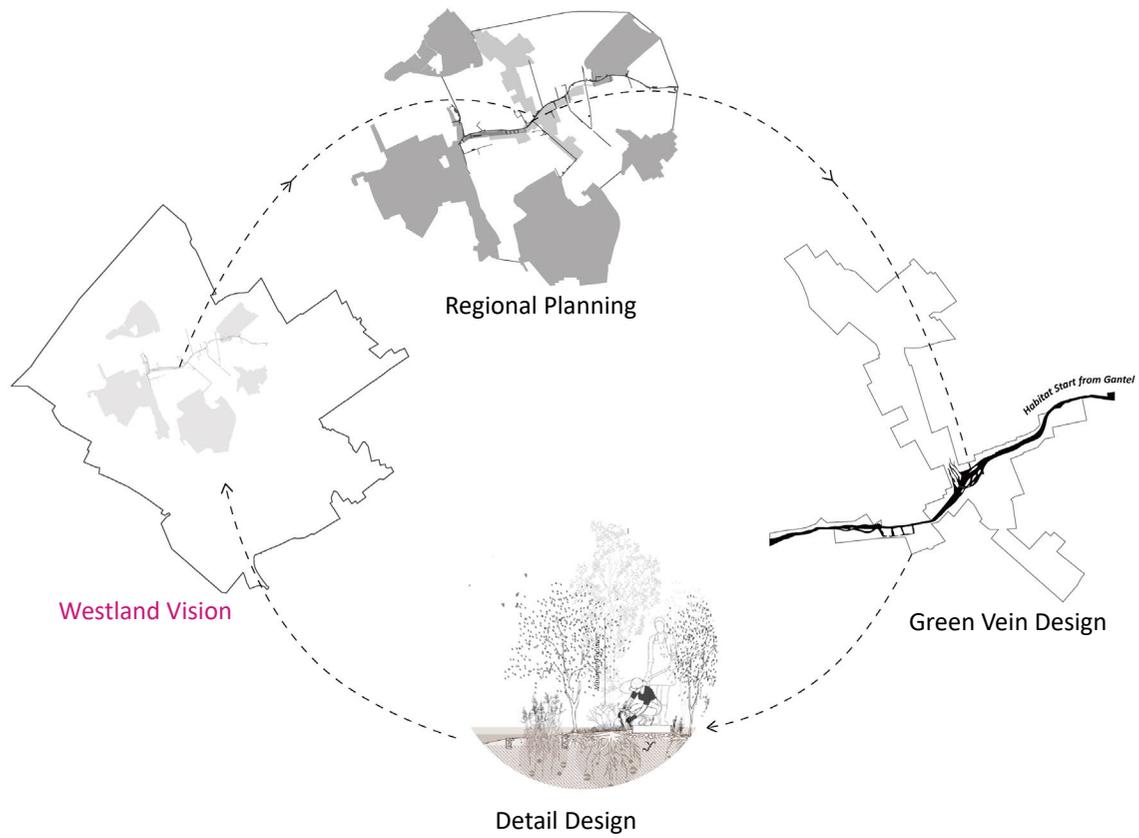
Site analysis
Strategy framework
Regional plan

3.3 Medium Scale Design

Grove typology
Green Vein's plan through time
Spatial Vision With Increased Funding and Policy Support
Central and flexible strategies
Ecological strategy and tree species

3.4 Detailed Design

Sensorial experiences through time
Social groups and potential spatial outcomes



3.1 Westland Vision

Westland Vision for 20 years

By overlaying the temporal and spatial concepts described above, a preliminary vision for the future of Westland begins to take shape.

0-5 years

5-10 years

10-20 years



NOx pollution

Remediation Forest



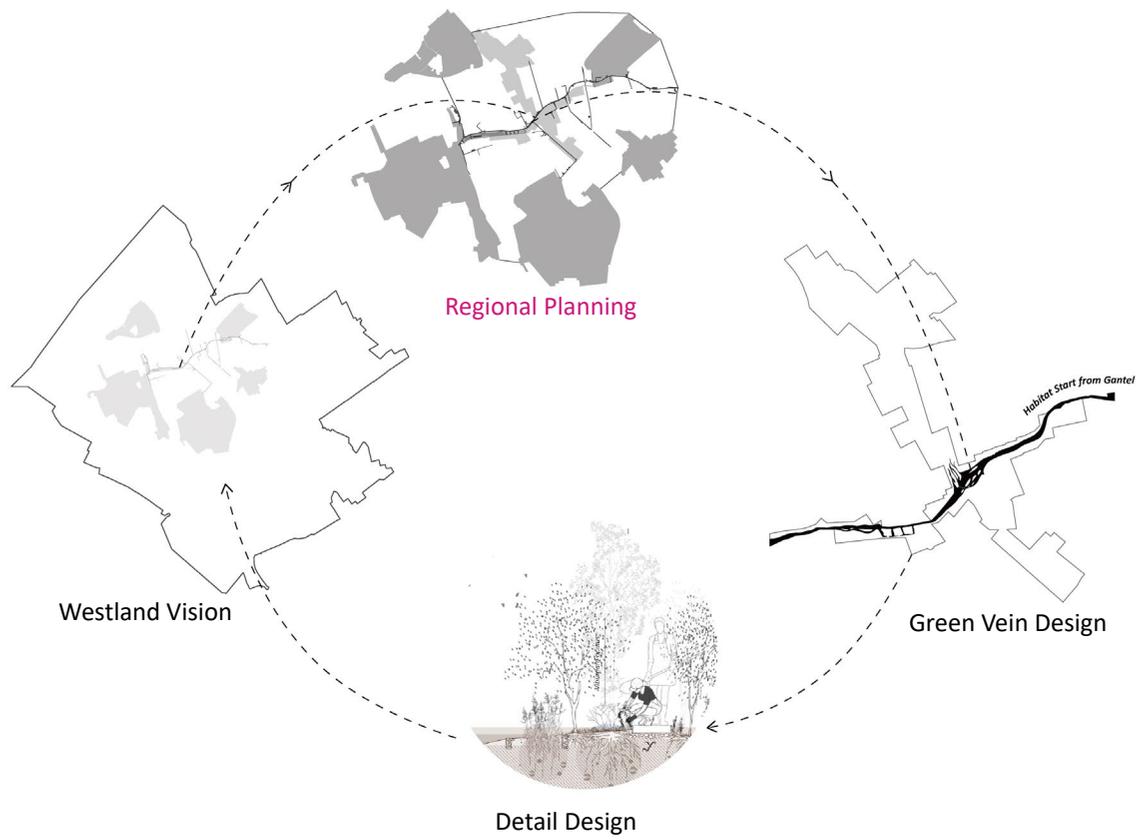
In the first phase, greenhouse plots and vacant lands within the polder are selected based on their level of nitrogen pollution. Then, the functions of each site are defined according to the three spatial categories identified in the spatial concept. Around villages and in the designated tree nursery areas, vegetation capable of absorbing pollutants is used for soil remediation, preparing the ground for the next phase. Along the riverbanks, greenhouse retreat begins, and water buffer zones are established through the planting of trees.

Urban buffer
Tree nursery
Water buffer

In the second phase, the wooded commons within the water buffer continue evolving, developing ecological value through diverse forms such as flooded forests and corridors. The remediation forests from the first phase are redefined spatially—some become community-oriented shared woodlands, while others are transformed into private productive forests or tree nurseries. During this stage, the tree nurseries help offset the economic losses from the first phase. Meanwhile, the government can organize regular seedling procurement to support planting in water buffers and community forests, enhancing both ecological and social benefits.

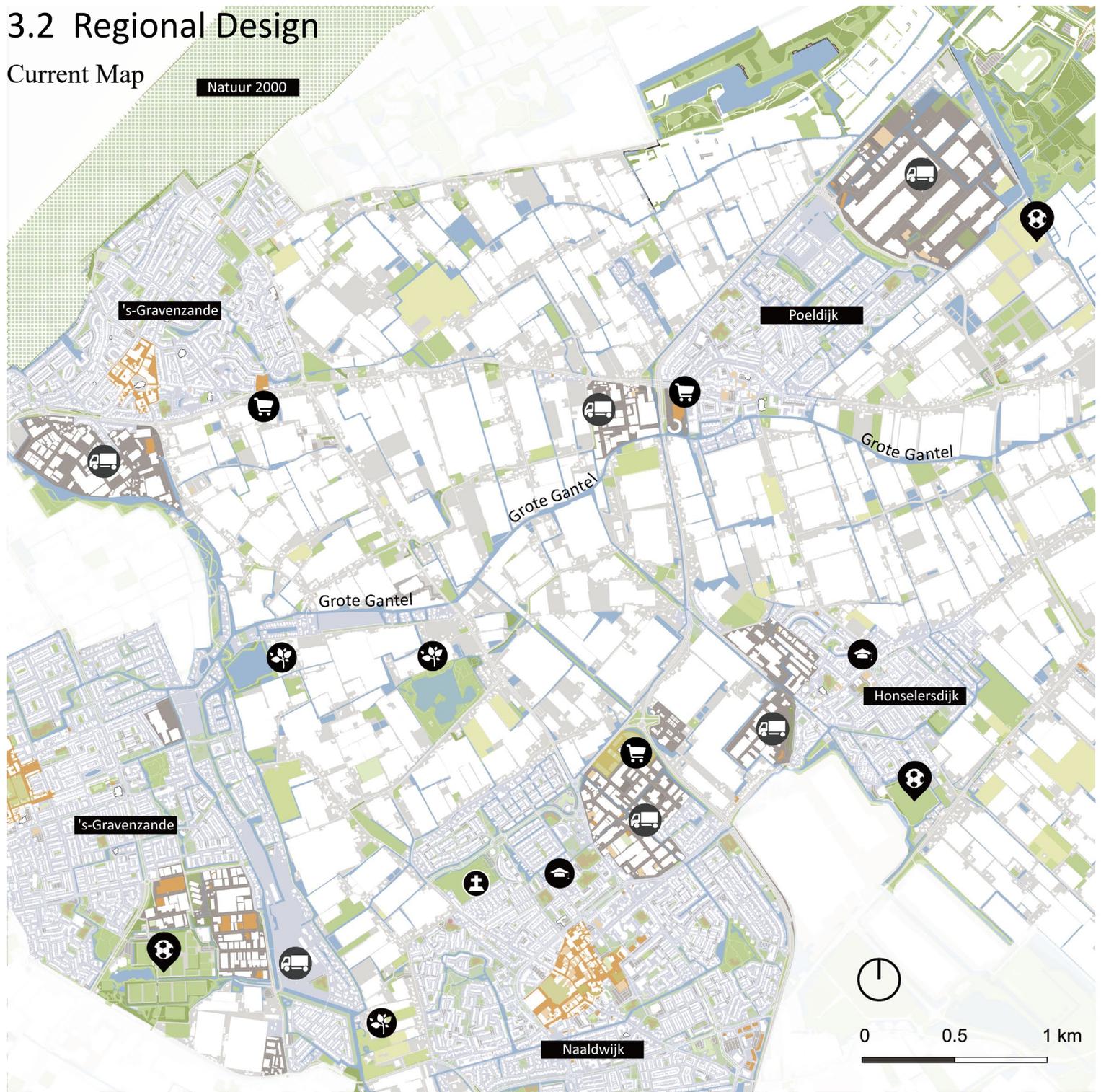
Transferable greenhouse of urban buffer
Transferable greenhouse of modular forest
Transferable greenhouse of water buffer
300m Urban buffer
waterbuffer50m
Nature reserve

In the third phase, the various spatial components gradually connect to form continuous ecological corridors, giving rise to regional parks that link surrounding villages. The water buffers increasingly incorporate woodlands with social functions, while some tree nurseries are transformed into accessible public spaces for visitation and leisure. Community forests become more integrated with neighborhood life, hosting a wider range of activities that foster social interaction and collective engagement.



3.2 Regional Design

Current Map





-  Wasted land
-  Nature 2000
-  Forest
-  Meadow
-  Park
-  Sports field
-  Water
-  Residential area
-  Greenhouses
-  Business park
-  Education
-  Commercial
-  Cemetery

The analysis area centers on the Gantel River corridor, framed by the villages of Monster, 's-Gravenzande, Naaldwijk, Honselersdijk, and Poeldijk. Here, a detailed analysis of site-specific challenges will inform the development of spatial-temporal strategies, including clear criteria for selecting intervention sites.

At present, this corridor is composed of five villages, which are mainly connected by the highway network, and there are dense greenhouse complexes on both sides of the main channel. Business parks, sports grounds and some urban parks occupy the edge of the village. There is great potential to strengthen the green connection between these existing open spaces, so as to enhance the landscape image and ecological continuity of the region.

In the future "tree nursery" stage, these commercial parks can be repositioned as seedling logistics and storage centers, adding new economic functions to the landscape. At the same time, other urban functions such as community centers, sports facilities and entertainment nodes will be integrated into the expanded green network to ensure that the region's growing infrastructure supports environmental goals and social vitality.

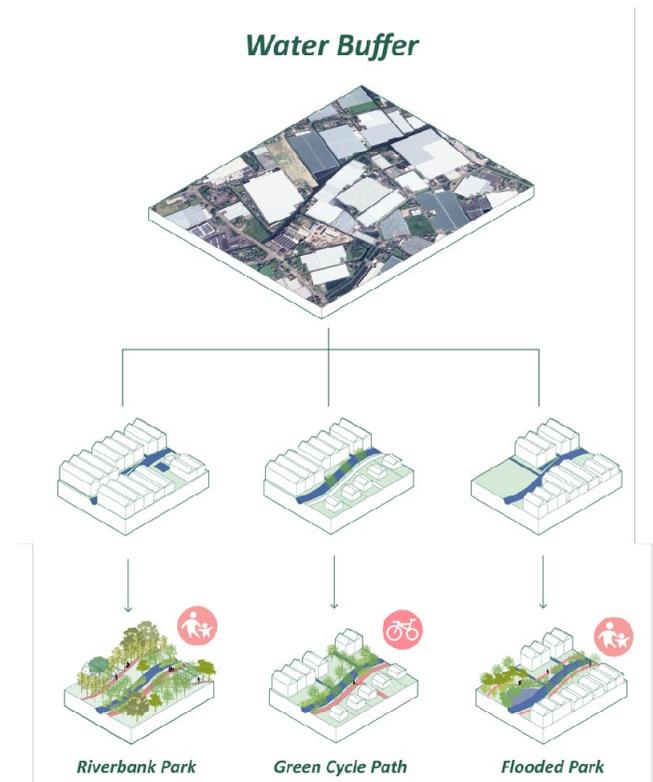
Site Analysis — Water Buffer

In the site analysis section, four representative spatial types—the Gantel River (water buffer), greenhouses, urban edges (urban buffer), and business parks—are examined for their primary challenges and conceive the final (the third stage in the temporal concept) spatial strategy.

Current Gantel River



Along the Gantel River, greenhouses, industrial sites, and even housing are built immediately on the riverbanks. This pattern is understandable—horticultural operations require water, and the Gantel and adjacent polders are linked by ditches, making river access convenient. However, this proximity compromises the Gantel’s potential as an ecological blue–green corridor and exposes both banks to flood risk during extreme weather. From a cultural landscape perspective, residents cannot easily approach or appreciate the river—despite its central importance to the region’s heritage.



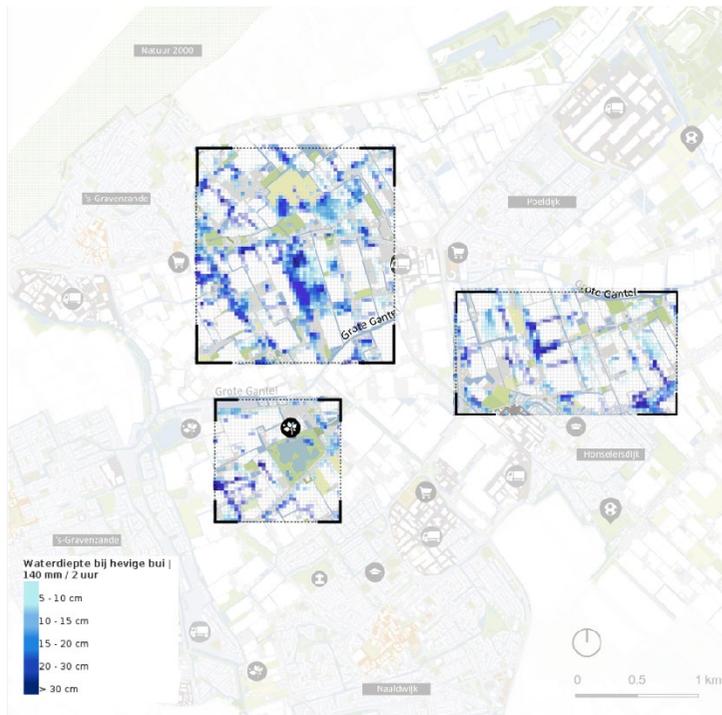
Transform cleared greenhouse plots into riverside parks for walking and cultural storytelling.

Create a bike-and-walk trail along both riverbanks to link villages and enhance views.

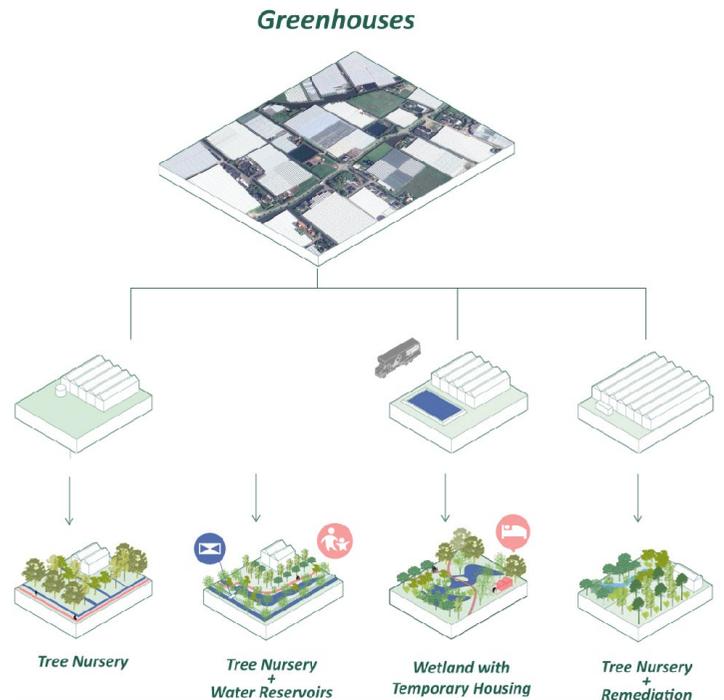
Use low-lying river edges to hold stormwater, boost flood resilience, and foster wetlands.

Site Analysis — Greenhouses

Current Greenhouses Industry



The greenhouse zone faces two key spatial challenges. First, the extensive, contiguous glasshouse footprint leaves almost no room for wildlife movement or habitat connectivity. Second, the squeezed water network undermines the area’s stormwater retention capacity—during heavy downpours, water depths exceed 30 cm in many sections, creating flood risks. The proposed design introduces natural retention basins linked by ecological corridors to restore hydrological function and reestablish habitat continuity.



After soil remediation, establish a private tree nursery bounded by ditches.

Create water reservoirs in low-lying areas with sluice-controlled ditches and plant riparian species around them to form habitat zones.

Convert former greenhouse retention basins into natural wetlands, and use salvaged greenhouse materials to construct

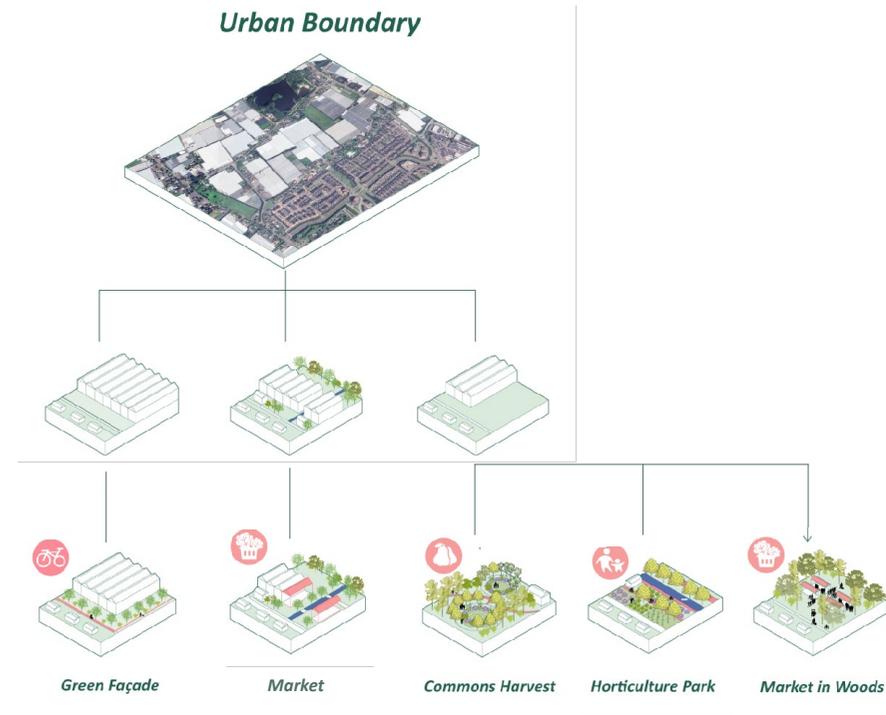
On previously contaminated land, implement a remediation forest; once pollutants are removed, transition the site into a tree nursery.

Site Analysis — Urban Boundary

Current Urban Boundary



Within the current urban boundary, three key issues emerge. First, the interface between the urban fabric and the surrounding greenhouses is abrupt, lacking any soft transitional buffer. Second, several municipal parks are effectively cut off from the urban core by adjacent glasshouse complexes, resulting in poor accessibility. Third, while the city center suffers from a shortage of green space, peripheral vacant lots offer prime opportunities to establish community woodlands.



Plant linear rows of trees at the urban–greenhouse interface to soften the transition and improve the landscape image.

Transform the greenhouse strip between the urban core and park into a market zone, enhancing park accessibility while providing retail spaces for greenhouse businesses.

Community Harvest – A tree-lined garden where locals grow produce together and join workshops.
Horticulture Heritage Park – A park laid out like historic orchards and greenhouses, blending culture with recreation.
Woodland Market – A shaded weekend market for residents and growers to sell fresh produce.

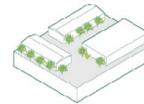
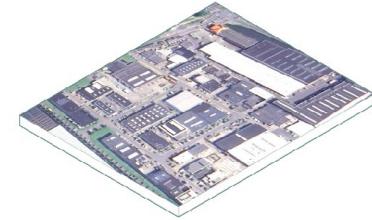
Site Analysis — Business Park

Current Business Park



In the business park, vast expanses of hardscaping and virtually no vegetation have created large habitat voids. The proposed design introduces planted areas to enhance ecological connectivity and foster healthier work environments.

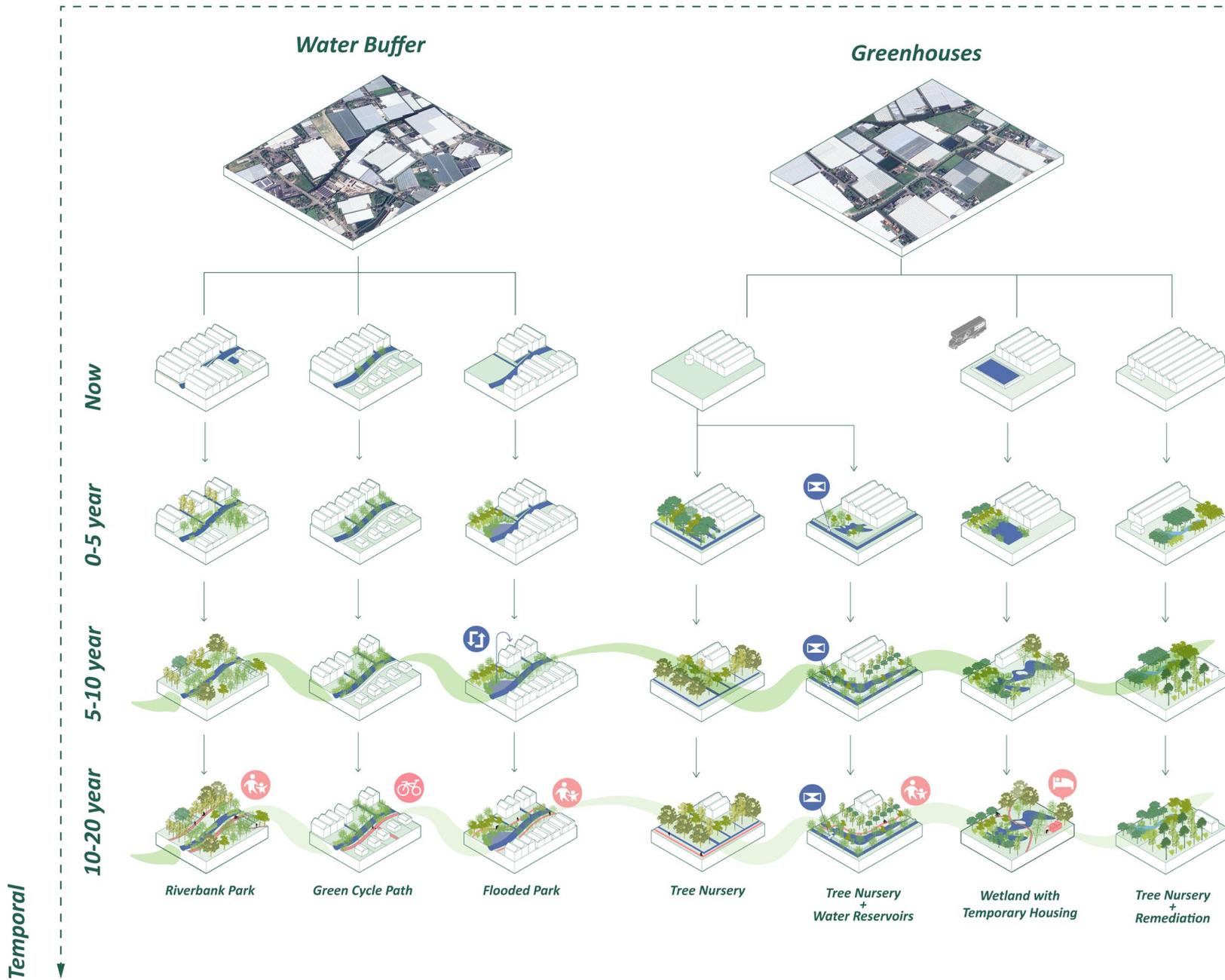
Business Park



Healthy Workplace

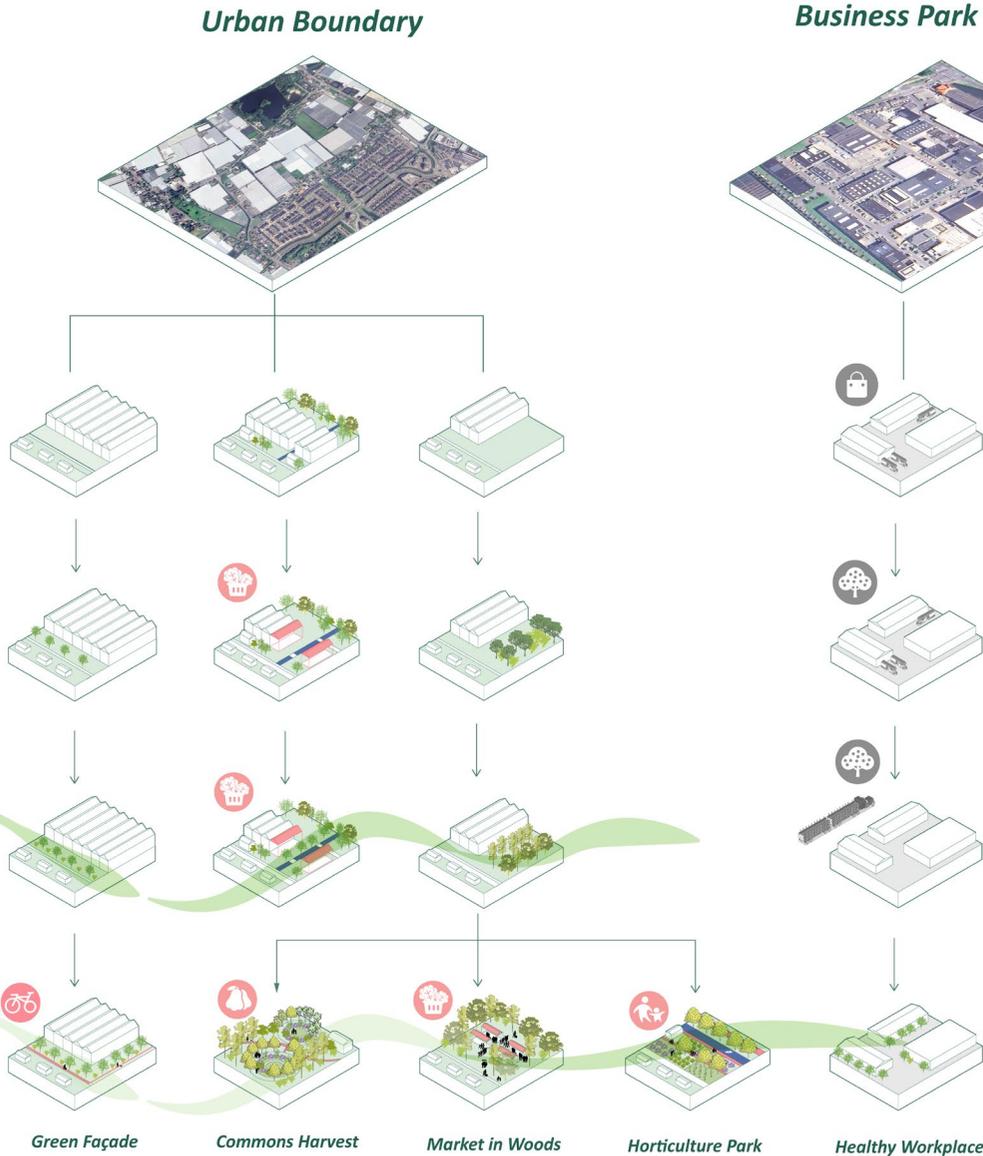
Introduces planted areas to enhance ecological connectivity and foster healthier work environments.

Temporal and Spatial Design Strategy Framework



Spatial

This Strategy Framework illustrates how different spatial types evolve over time in alignment with the temporal vision, developing into targeted interventions across three stages.

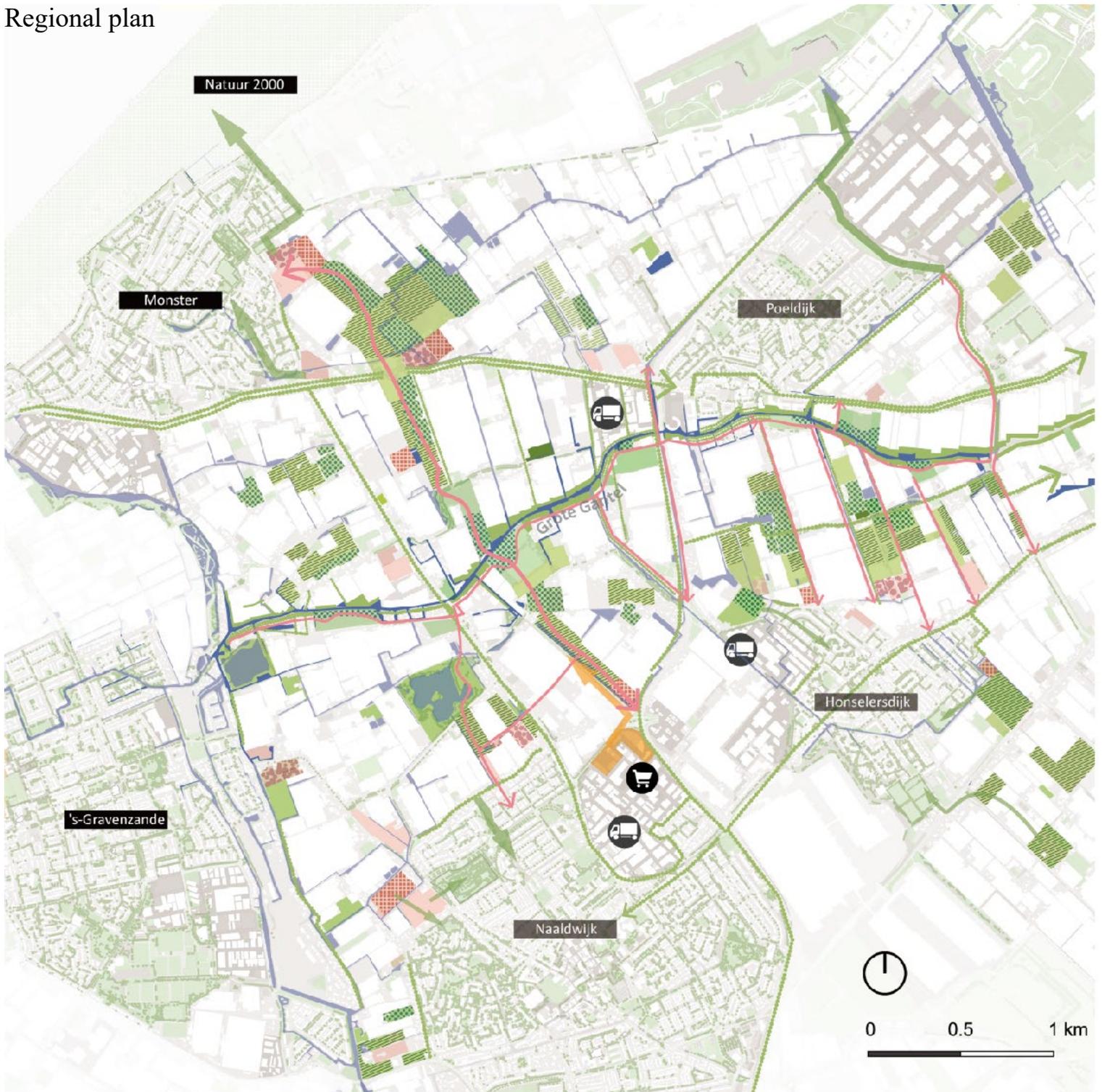


In the first phase, selected greenhouses are dismantled to make space for ecological restoration. Trees are planted to remediate polluted soils, and new waterways are introduced to support hydrological and ecological recovery. Business parks serve as temporary logistics hubs for seedlings, supporting the early stages of transformation.

In the second phase, tree nurseries expand, forming continuous habitat corridors that enhance biodiversity and ecological connectivity. These green infrastructures also begin to support local economic activity through horticulture and related services.

By the third phase, the landscape becomes more socially dynamic. Public woodlands host community events, cultural activities, and markets, integrating ecological functions with everyday life. The transformation culminates in a resilient and multifunctional social-ecological system.

Regional plan



Water Buffer

 Riverbank park



 Green path

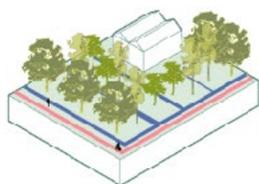


 Flooded park



Tree Nursery

 Tree nursery



 Tree nursery+
Water reservoirs

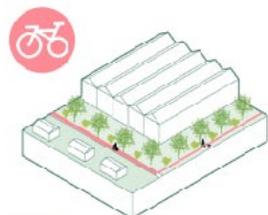


 Tree nursery with
Temporary housing



Urban Boundary

 Green façade



 Commons Harvest



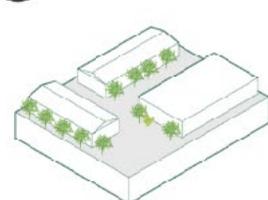
 Market in wood



 Horticulture Park



 Healthy Business park



 Commercial Area

 Cycle path

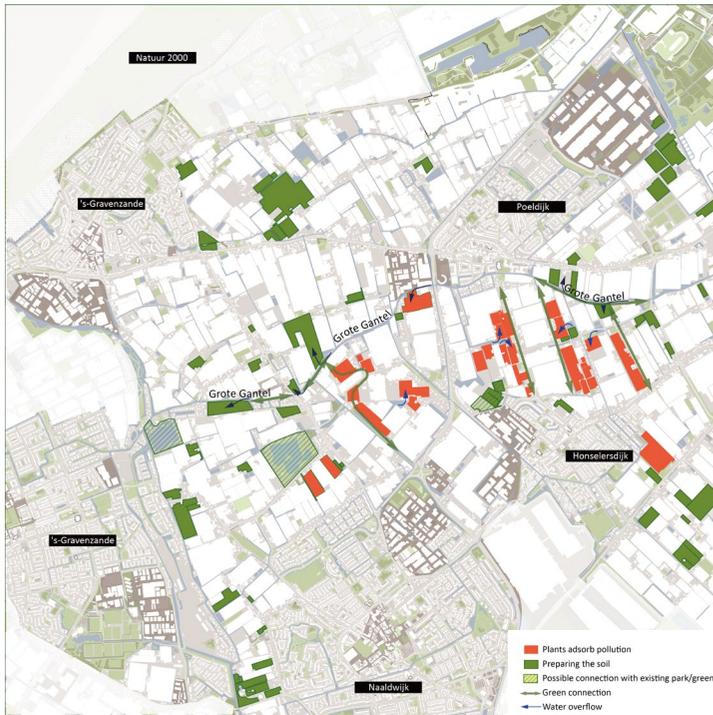
The drawing on the left illustrates the regional plan envisioned for the final phase, where a combination of strategies forms a new web of connections. The first major linkage follows the Gantel River, establishing a primary blue-green corridor that not only enhances ecological functions but also accommodates public access and mobility.

Secondly, a continuous woodland belt is introduced between Monster and Naaldwijk. This strip crosses the Gantel River to create a cross-shaped structure that significantly improves connectivity among four villages. It is anchored by community forests at both ends and interwoven with a variety of tree nurseries and ecological woodlands in between.

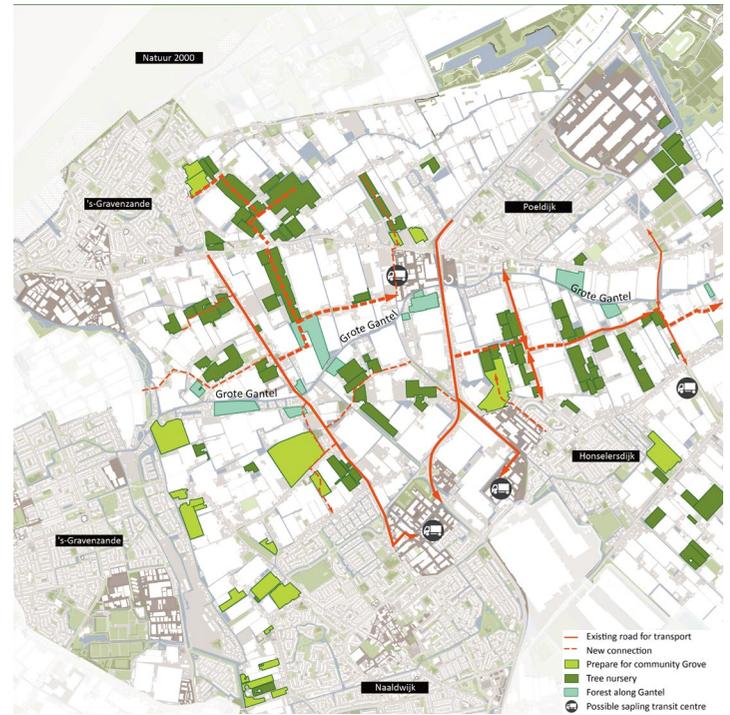
In addition, linkages between villages are reinforced through networks of tree nurseries—for example, between Poeldijk and Honselersdijk, where nurseries are organically distributed and supported by the business parks of both villages. These hubs contribute to the diversification of the local economy.

Lastly, linear tree plantings along regional roads strengthen visual and ecological continuity between settlements, softening the stark contrast between urban areas and greenhouses while linking to existing green spaces within the villages.

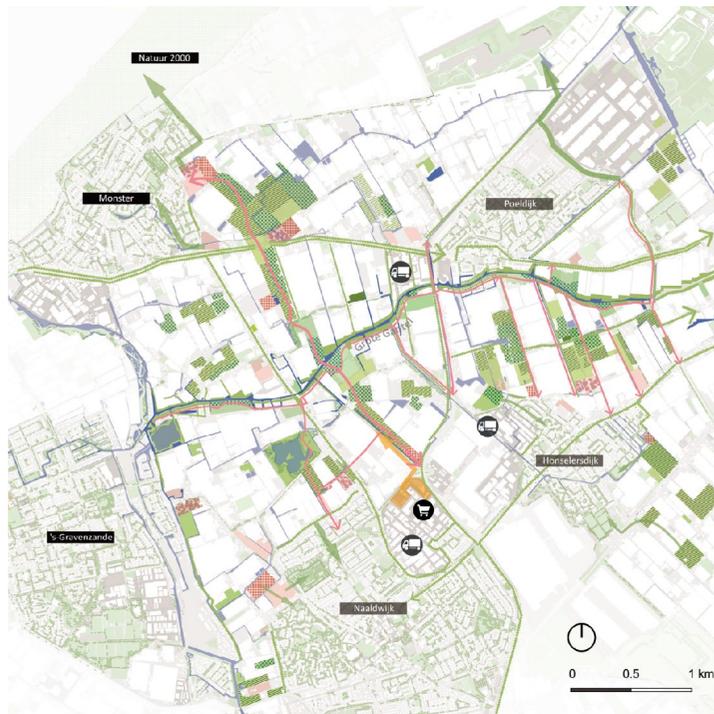
Regional Plan Through Time



0-5 year



5-10 year



10-20 year

During the first five years, interventions will begin with the most severely polluted slots—areas affected by soil and water contamination. These sites will be treated through the introduction of remediation forests and water retention zones, laying the groundwork for the future development of tree nurseries and other landscape functions. Meanwhile, underutilized or vacant lands will be activated to strengthen community connections or be designated as ecological conservation zones.

In the 5–10 year phase, remediated areas within the urban buffer will gradually be transformed into community forests. Sites located between the water buffer and the urban buffer will be used as private tree nurseries. As tree nursery operations require frequent seedling transport, nearby business parks will be repurposed as storage and logistics hubs. At the same time, new secondary roads will be developed between villages to facilitate transportation and enhance regional connectivity.

The final phase envisions a multifunctional landscape: previously private tree nurseries diversify into public-facing spaces—some open for visitation, blending economic activity with social value. A blue-green corridor along the Gantel River supports both ecology and mobility, while woodland links anchored by community forests and tree-lined roads enhance connectivity and soften the urban–greenhouse transition.

SES in Regional Planning



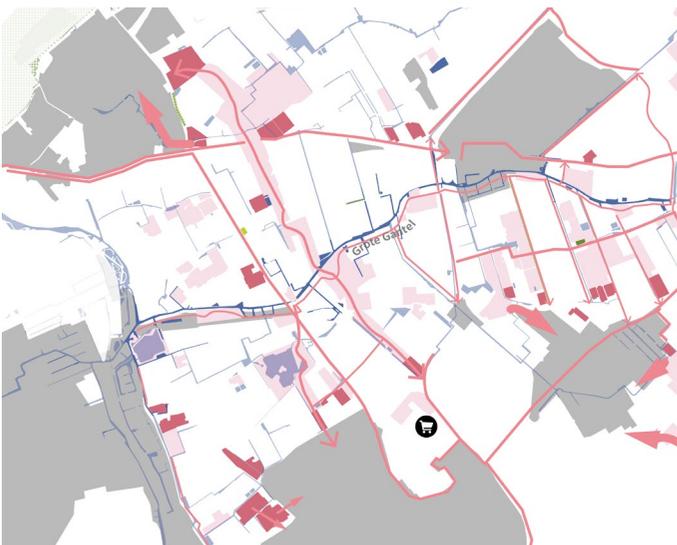
ecological value

The new green network enhances habitat connectivity within greenhouse areas, linking blue-green systems and conservation zones while also strengthening ecological corridors between villages.



Addressing extreme weather events(Climate adaptation strategies)

Tree nursery water habitats and Gantel's flooded forests improve regional waterway continuity and bolster flood resilience in extreme weather.



Social connectivity

Ecological, productive, and community forests introduce participatory landscapes that strengthen social interaction, while improved connectivity between sites enhances social cohesion across the region.

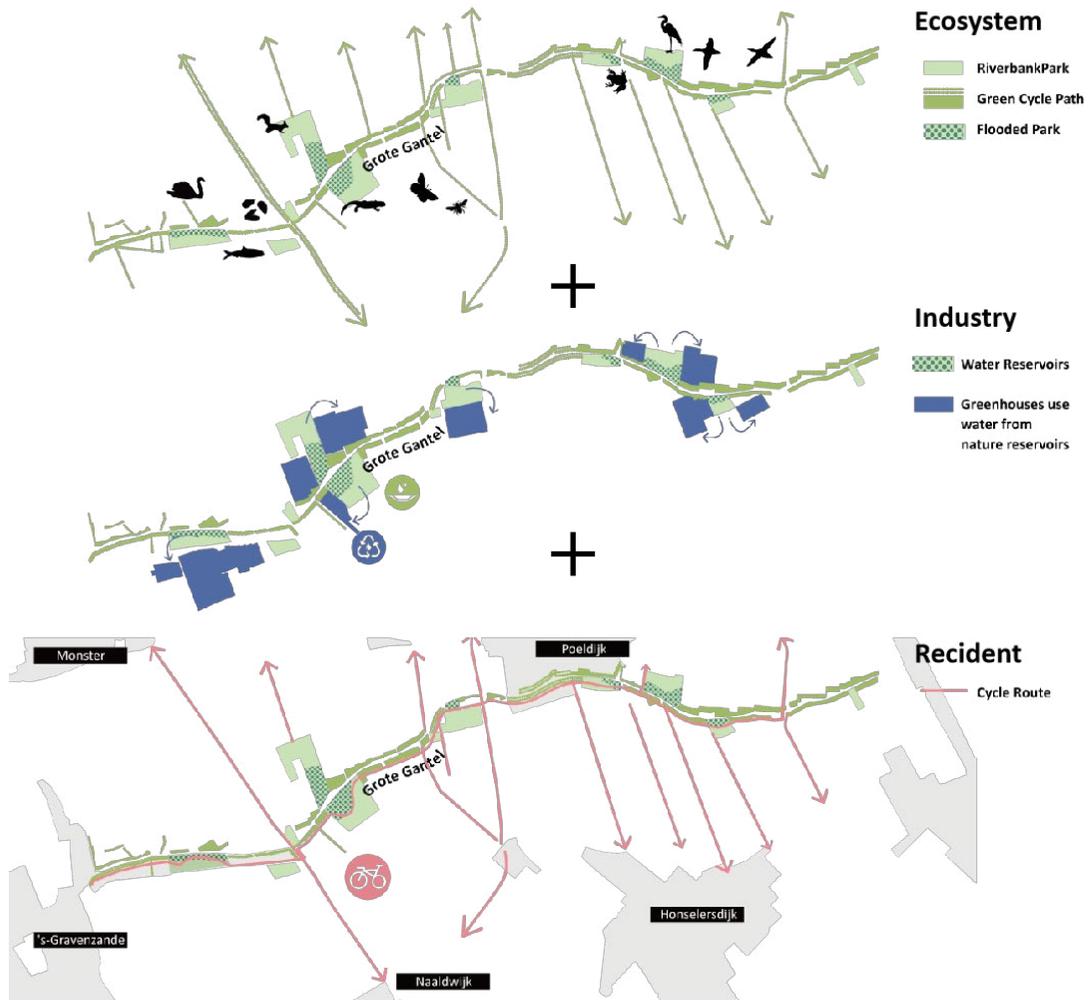


Resilient local economy

Tree nurseries offer stable returns and steady demand, support eco-tourism and landscaping, and complement greenhouse farming to boost regional economic resilience.

SES in Regional Planning

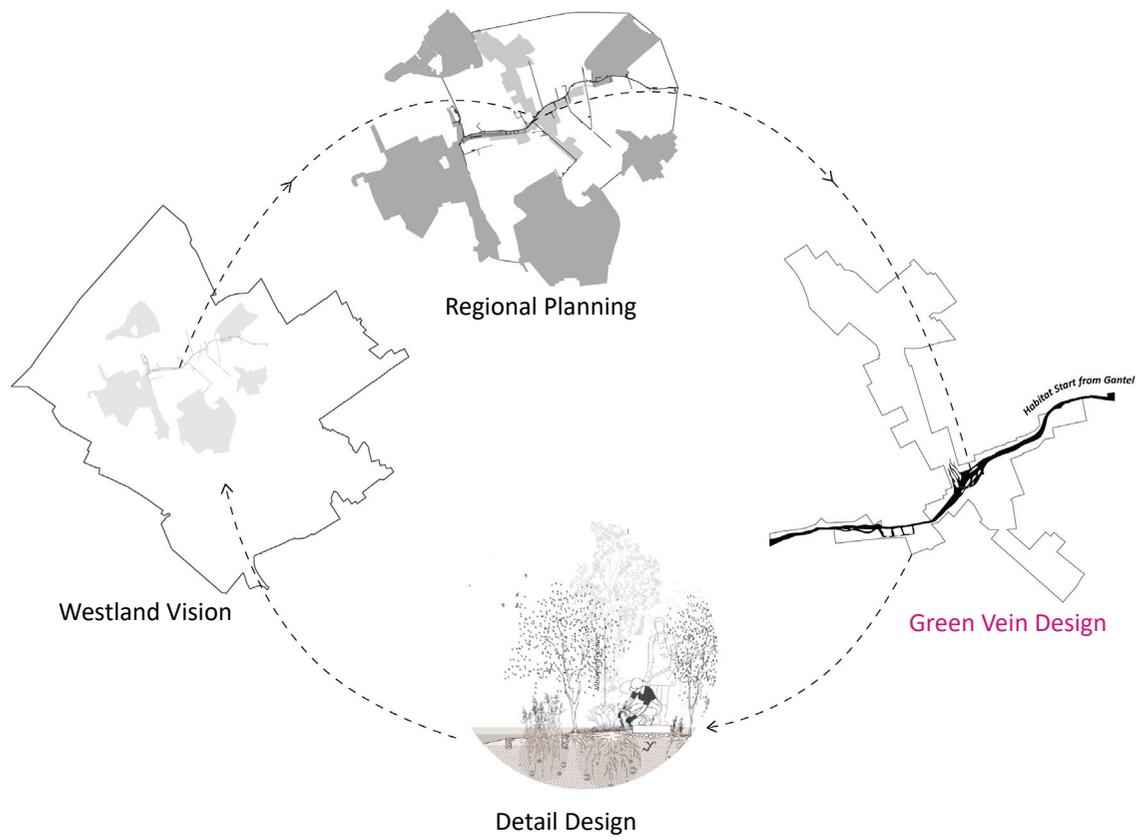
Connection on Gantel River



The ecosystem along the Gantel River is connected through a network of flooded parks, riverbank parks, and linear tree corridors, extending outward along roads and ditches perpendicular to the river. Various hydrophilic plants and wetlands provide habitats and migration pathways for birds, mammals, aquatic animals, amphibians, and insects.

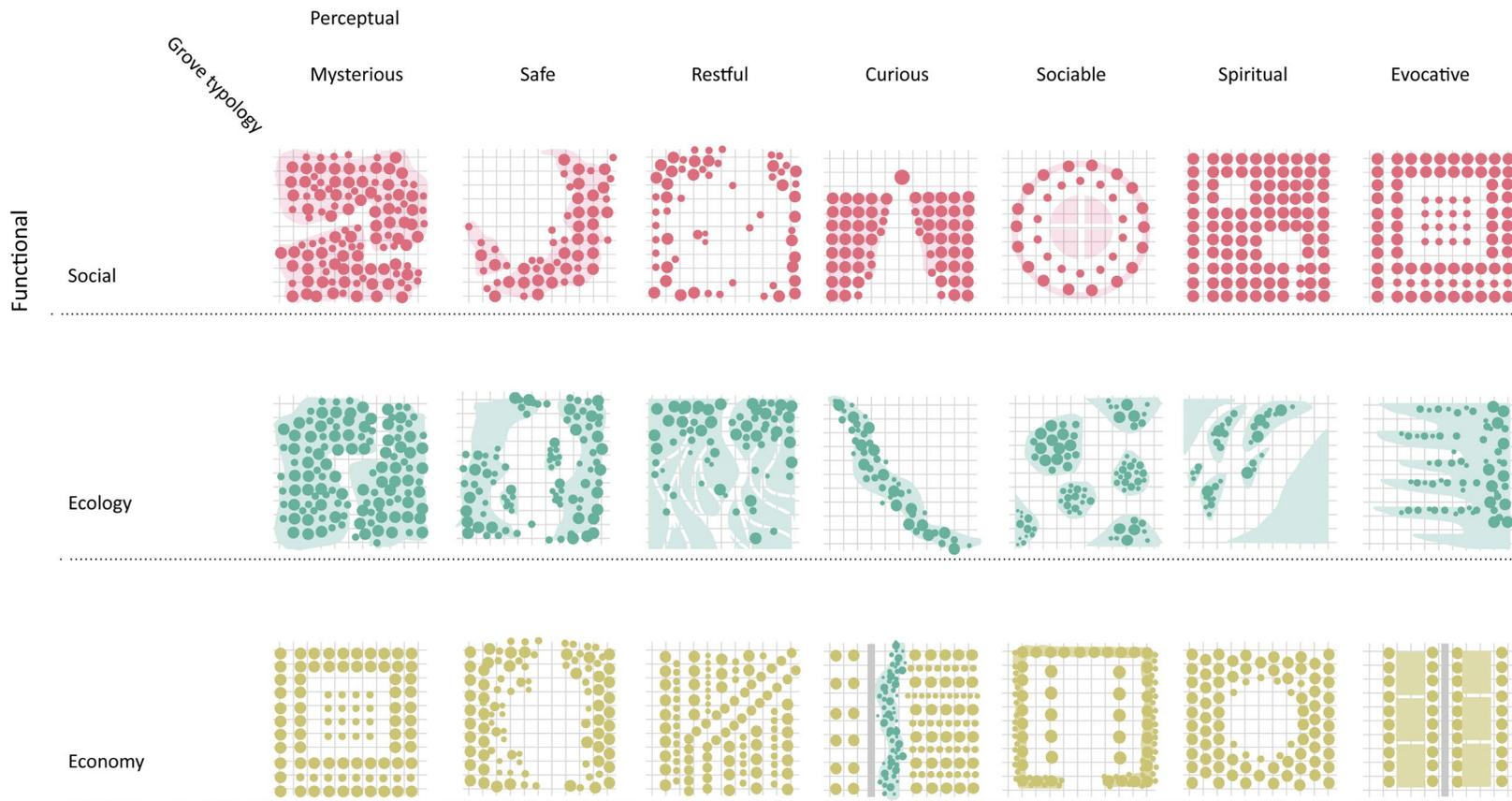
The design of the Gantel River also considers economic aspects. Natural water reservoirs near the riverbanks can partially replace artificial storage basins by purifying wastewater from greenhouses and enabling its reuse.

The walking and cycling paths along the Gantel River are connected to the urban roads that run perpendicular to the river, transforming the once-inaccessible riverbanks into inviting and accessible public spaces. This encourages people to explore the Gantel and engage with the story of Westland.



3.3 Medium Scale Design

Grove typology



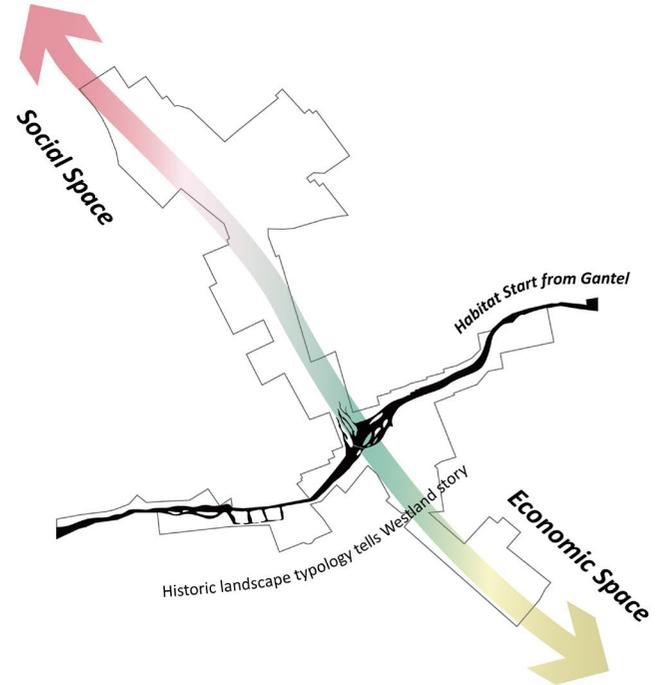
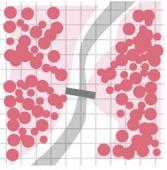
The landscape design of the Green Vein follows the concept of the “Grove” as a spatial and perceptual framework, integrating ecological, social, and economic functions through different types of woodland spaces.

Social groves are shaped by community activities and inspired by historical landscape elements—such as 16th-century estates, orchards, and wetland ditches—offering spaces that evoke diverse sensory experiences rooted in heritage and interaction.

Ecological groves incorporate focused restoration strategies such as phytoremediation forests, biodiversity corridors, stormwater filters, and interception hedgerows, each delivering distinct spatial and perceptual qualities while enhancing environmental resilience.

Economic groves include tree nurseries, markets, repurposed greenhouse restaurants, and community hubs. These spaces are not only productive but also designed to generate immersive and memorable experiences for visitors and residents alike.

Risky

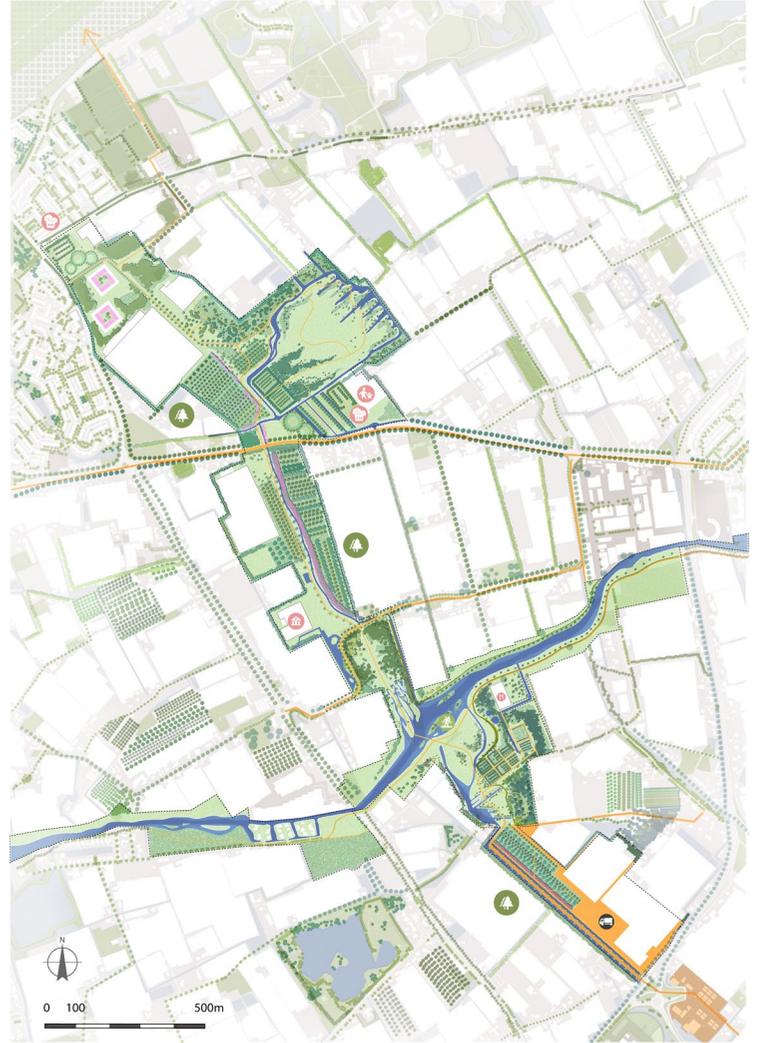


The story of Westland's habitats begins with the Gantel River—and so does the narrative of the Green Vein. Flowing from this central artery, the landscape unfolds in two directions: toward Naaldwijk, it leans into economic functions, shaped by clusters of commercial tree nurseries and production spaces; toward Monster, it embraces a more social character, weaving together community groves and shared spaces. Along this journey, each grove becomes a chapter, quietly recounting the evolving landscape history of Westland—its greenhouses, orchards, ditches, and the lives shaped among them.

Green Vein Plan Through Time



0-5 year



5-10 year

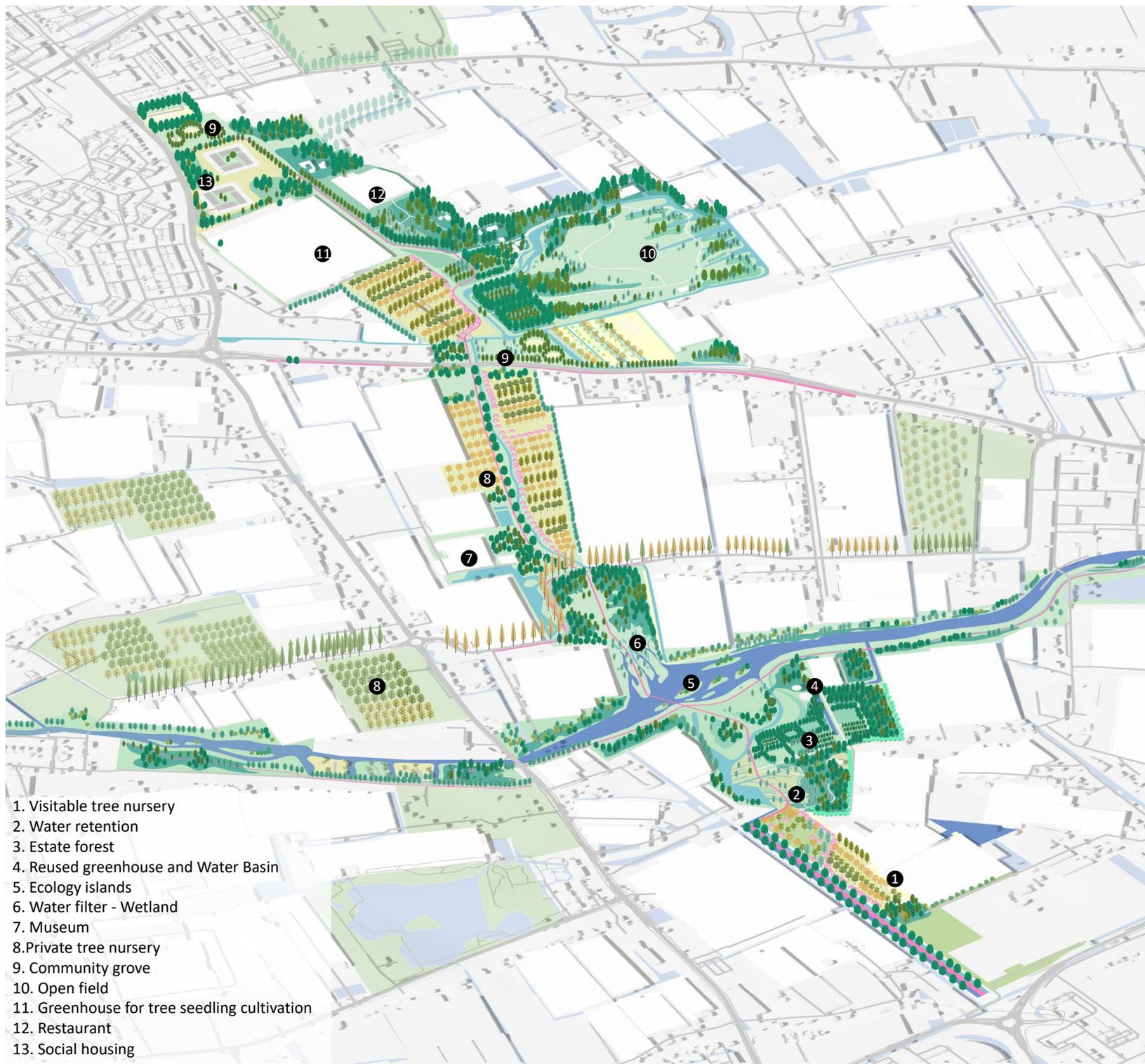


10-20 year

In the first phase of the Green Vein, selected greenhouse areas are reclaimed, with 80% of soil remediation done through willow-based phytoremediation. A more diverse water system is introduced to improve stormwater retention and prepare for future wetlands, while interception hedgerows buffer external pollutants and connect to surrounding greenhouse zones.

In the second phase, former phytoremediation forests are gradually transformed: 50% become private tree nurseries, 40% are converted into ecological groves, and 10% form the early stage of social groves, including markets, woodland gardens, and temporary housing. Main visitor routes also take shape during this stage.

In the third phase, the Green Vein evolves into a regional park with diverse grove typologies, where ecological, social, and economic functions are seamlessly integrated. Private tree nurseries give way to more accessible ones, while narrative groves rooted in landscape history are completed and better connected with the water system.



1. Visitable tree nursery
2. Water retention
3. Estate forest
4. Reused greenhouse and Water Basin
5. Ecology islands
6. Water filter - Wetland
7. Museum
8. Private tree nursery
9. Community grove
10. Open field
11. Greenhouse for tree seedling cultivation
12. Restaurant
13. Social housing

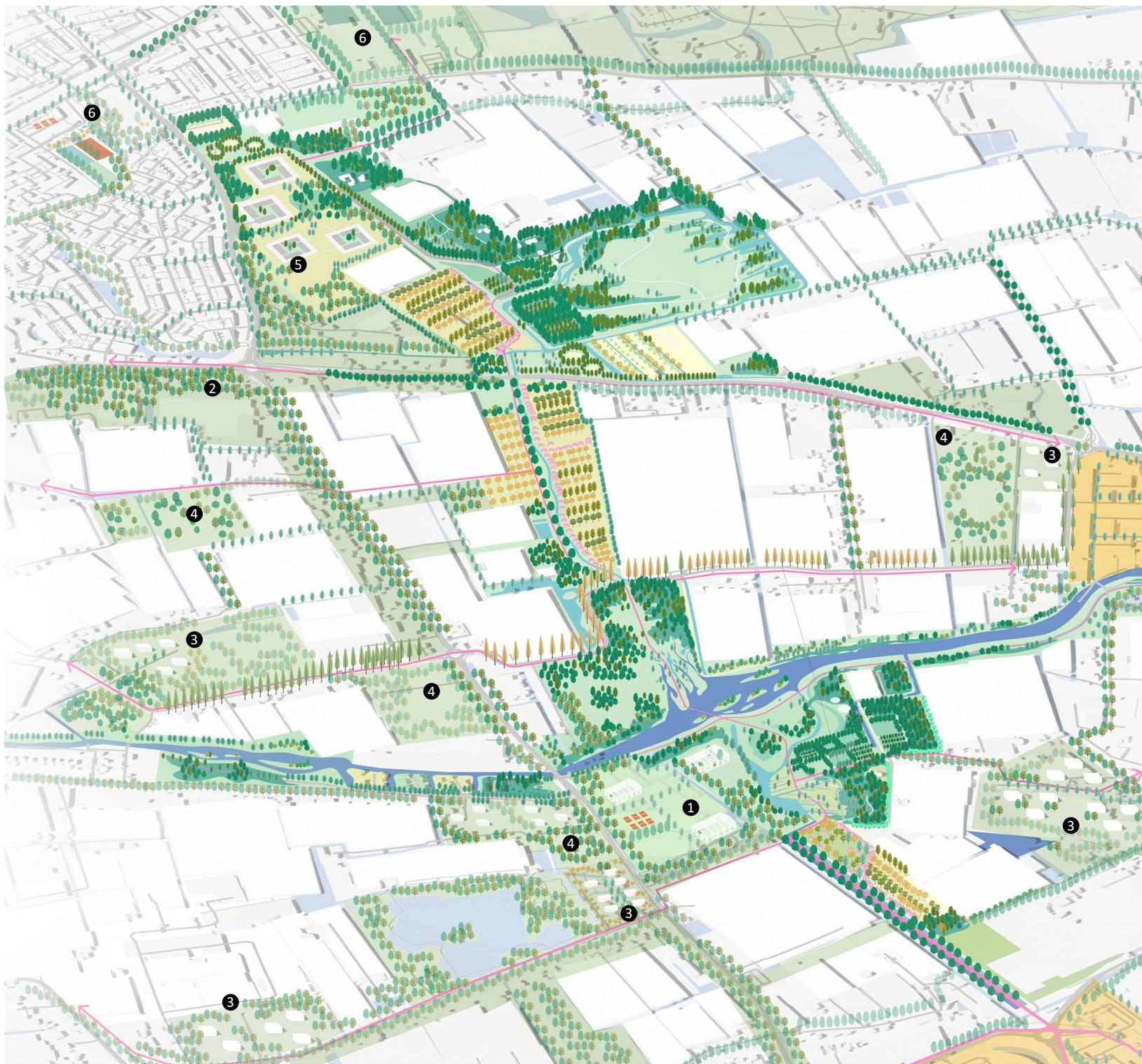
SES in Green Vein



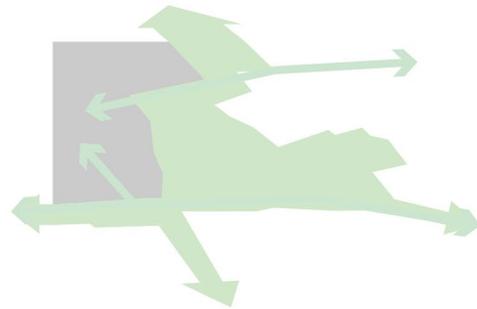
The Green Vein serves as an ecological connector, linking nature reserves, rivers, and urban areas. Linear tree plantings extend outward along cross-regional roads, forming a radiating green network. A diverse mix of vegetation and wetlands supports habitats and migration routes for birds, mammals, aquatic species, amphibians, and insects.

Within the Green Vein, two major clusters of tree nurseries not only cultivate and sell seedlings but also supply trees for public landscapes such as the Gantel riverbanks. Existing greenhouses are repurposed as storage and processing facilities, with business parks serving as logistics hubs for regional distribution.

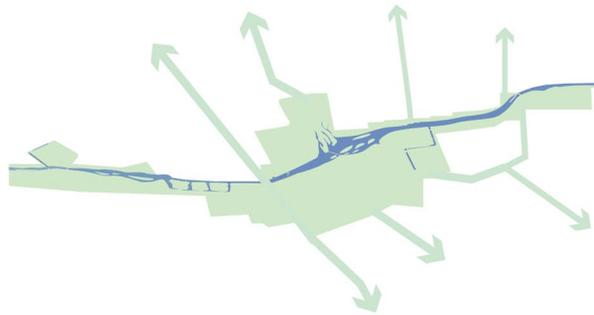
The Green Vein offers residents a richly layered landscape corridor that stretches from Naaldwijk to the coastal nature reserve, blending ecological, cultural, and social experiences.



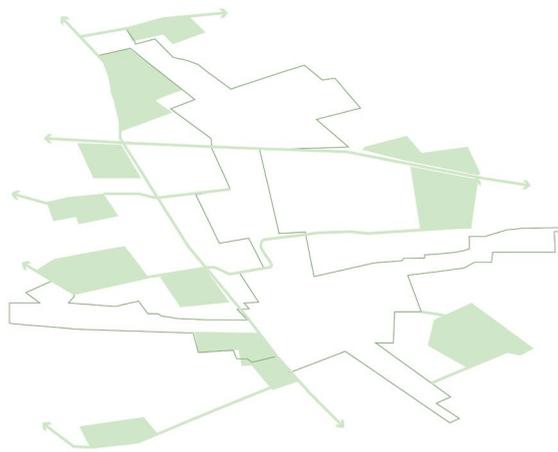
Spatial Vision With Increased Funding and Policy Support



More Connected Urban Buffer



Wider Water Buffer



More Tree Nurseries and Communities in Woodland

1. Reused greenhouse and sports field
2. Green façade as urban buffer
3. Community in woodland
4. Wooded common on former tree nursery
5. Enlarged social housing
6. Sports field

If the project receives more funding and policy support, the process of relocating greenhouses could accelerate, freeing up more land for alternative uses.

As urban livability becomes more emphasized, the buffer zones at the urban edge could be strengthened and better integrated with community groves, social housing, and public parks. This would gradually transform the landscape identity of the Westland region—shifting from a sea of greenhouses to a forest-like living environment. As a result, the urban heat island effect, as well as light and noise pollution, would be reduced.

More space along both sides of the Gantel river basin has been freed up to enhance ecological connectivity and increase rainwater retention capacity.

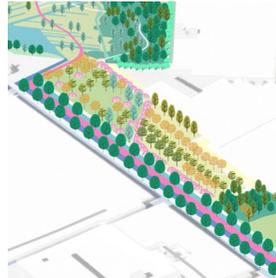
More space in the former greenhouse areas will be transformed into patches of tree nurseries, which may later be developed into housing or parks. These areas will be connected to existing regional parks, strengthening both community ties and ecological networks.

Central and Flexible Strategies

Ecological Approach



Tree Nursery



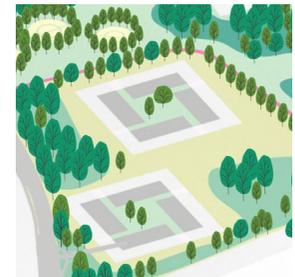
Social Common



Community Grove



Reuse of Greenhouses



Shared Space
in Social Housing

Central

Led by the Municipal
and Water Boards

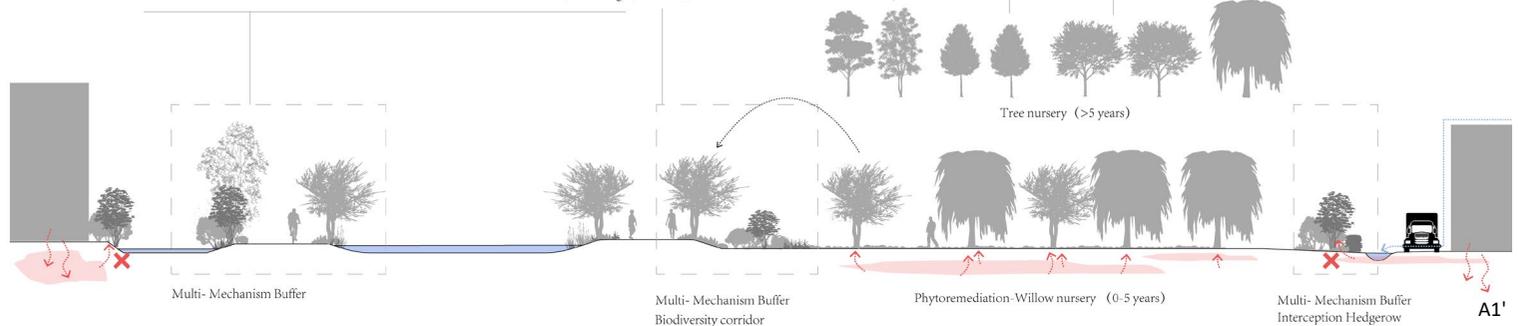
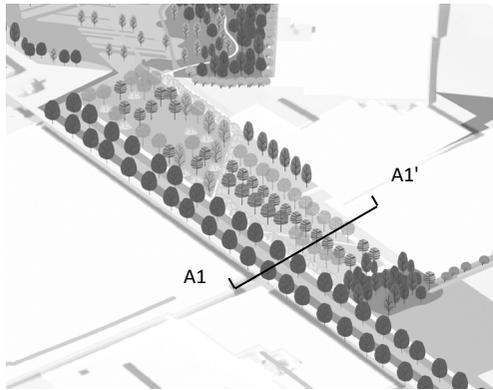
Semi-Flexible

Tree nursery operators
decide when and how to
open the public tree nursery

Flexible

Space users can decide or
propose the spatial form

Ecological Strategies



Salix, Populus, and Alnus, known for their high ecological value, are used to create buffers that provide an ecological transition along major roadways.

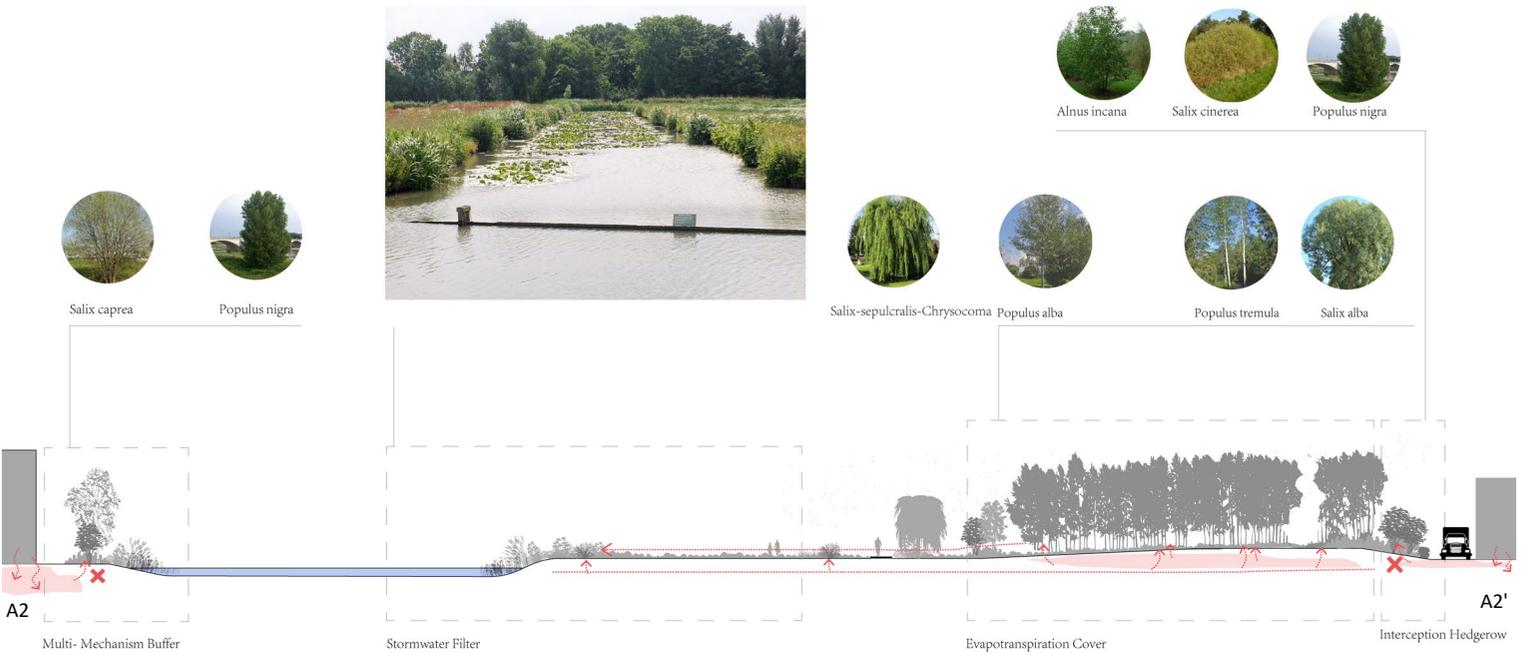
Salix alba (knotwilg) is planted along the canals to revive the traditional cultural landscape that is gradually disappearing in Westland.

Shrubs and flowering plants that bloom or bear fruit at different times of the year are planted in strips between the linear willow rows and the tree nurseries. For visitors, they serve as a soft visual barrier to the private nurseries; for wildlife, they form an ecological corridor.

In the first 0-5 years, willows are planted to absorb soil pollutants. After transitioning to tree nurseries, the tree species will be selected based on market demand.

To prevent external pollution from nearby greenhouses, interception and degradation hedgerows are planted along boundaries.

Ecological Strategies

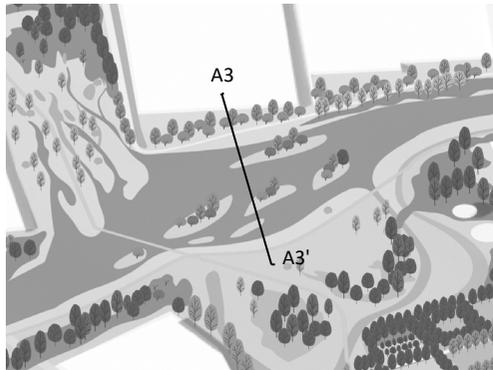


Salix and Populus, known for their high ecological value, are used to create buffers that serve as ecological transitions beside greenhouses, helping to filter pollution and soften landscape contrasts.

Salix and Populus, fast-growing trees with high evapotranspiration rates, are densely planted to absorb site pollutants and support soil remediation.

To prevent external pollution from nearby greenhouses, interception hedgerows are planted along boundaries, including Alnus, Salix and Populus.

Ecological Strategies



Salix caprea



Betula pendula



Salix-sepulcralis-Chrysocoma



Water lily



Salix cinerea



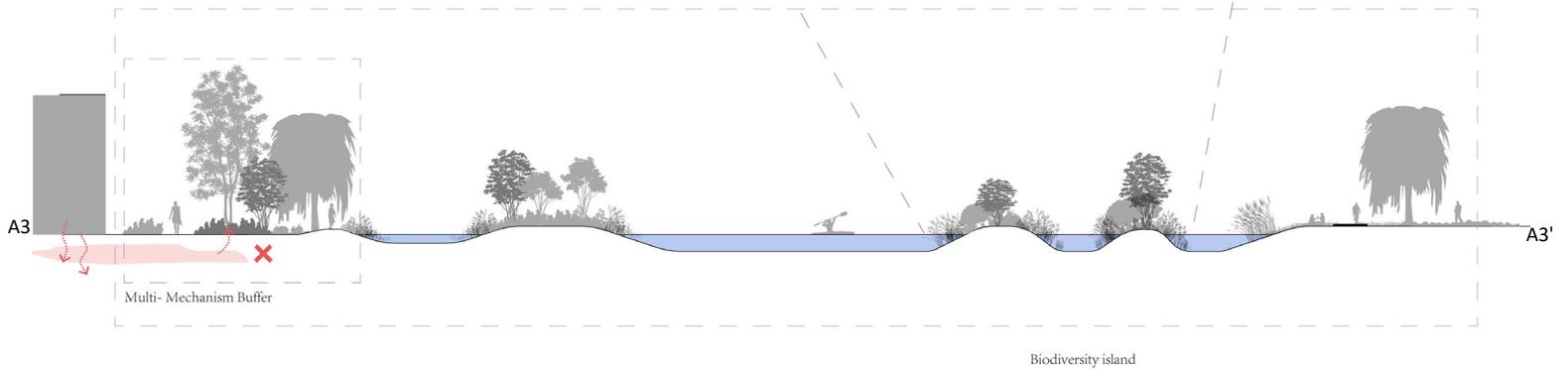
Alnus incana



Typha latifolia



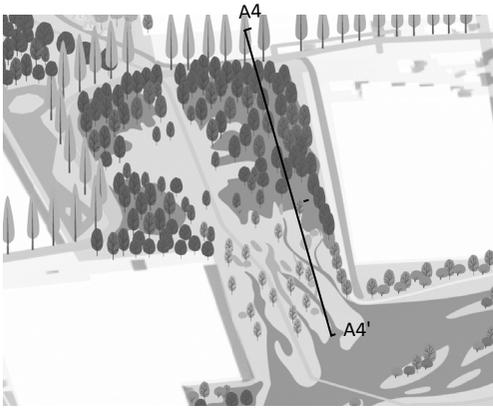
Salix-sepulcralis-Chrysocoma



Salix and Betula and shrub are used to create buffers that serve as ecological transitions beside greenhouses, helping to filter pollution and soften landscape contrasts.

On the islands within the Gantel, species such as Salix cinerea and Alnus incana, which are favored by wildlife, are planted alongside ecologically beneficial water lilies and reeds, creating biodiverse ecological islets.

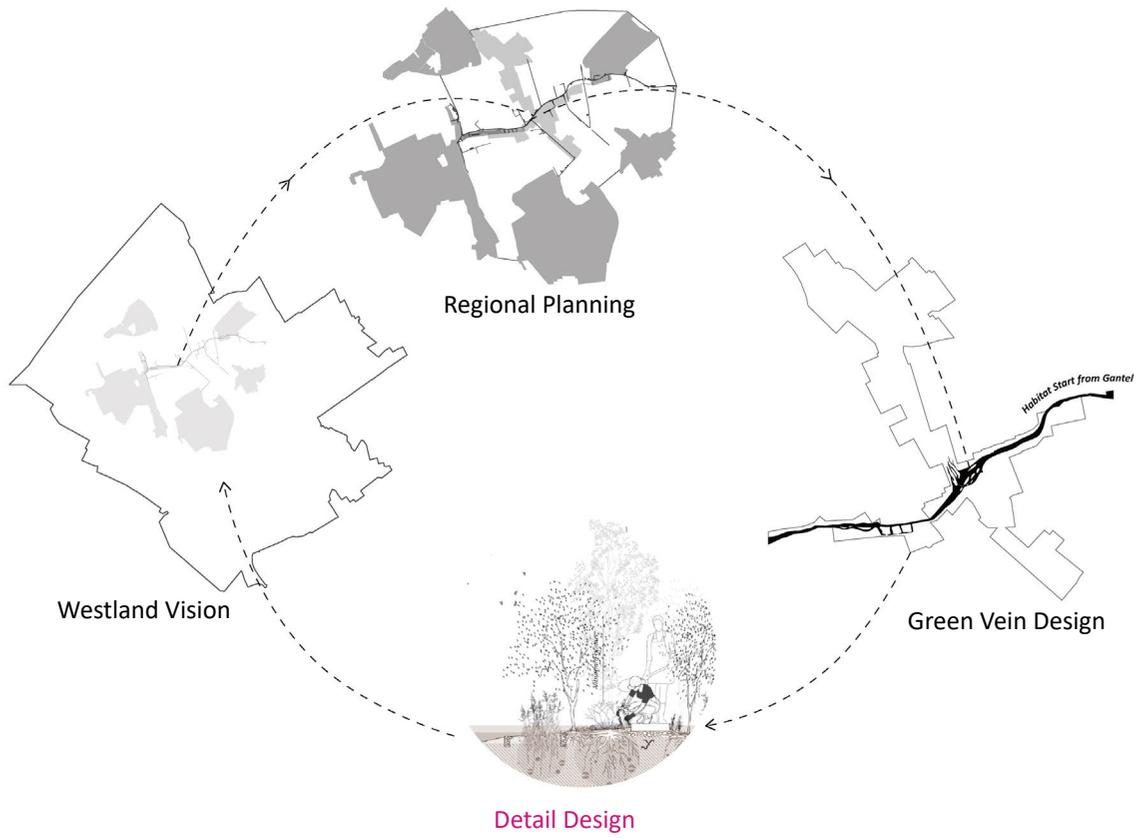
Ecological Strategies



Salix and Populus, fast-growing trees with high evapotranspiration rates, are densely planted to absorb site pollutants and purify surface runoff from nearby roads

Salix, Populus, and various shrubs are planted in a dispersed pattern, with subtle ground shaping to create seasonal wetlands during high-water periods, providing habitat for wildlife. As Salix is more tolerant of moist soils than Populus, it is placed in the lower-lying

Reeds are planted along the riverbanks, as they thrive in shallow waters less than one meter deep and provide vital habitats for various species such as birds and fish. A phased maintenance approach is applied—removing dried reeds in alternating zones—to preserve the habitat for as long as possible throughout the year.



3.4 Detailed Design

Tree Nursery in 20 years

I selected the tree nursery area as a detailed focus to explore what kinds of interventions and actors are required for an adaptive cycle at the micro scale.

In the first phase, the site undergoes land remediation, primarily through the planting of willows. These trees help absorb pollutants such as nitrogen and residual nutrients from previous greenhouse operations. Due to their resilient root systems, willows can survive transplantation and are later relocated along the canal to form a linear knotwilg willow landscape.

In the second phase, the remediated land is repurposed into a tree nursery aimed at economic return. At this stage, the nursery is not open to the public, and dense ecological corridors or interception and degradation hedgerows are planted along the woodland edges to act as natural walls.

By the third phase, parts of the tree nursery are opened to visitors. A public path is introduced, allowing access to open nursery fields, accompanied by greenhouses hosting workshops and demonstrations of seedling cultivation. This creates a coherent visitor experience. Meanwhile, the layout of the shrub "walls" is adjusted according to the new configuration of private nurseries, while still leaving space for maintenance and vehicle access.



10-20 year: Visible tree nursery



Sensorial experiences through time

Phytoremediation Willow

0-5 year

Private Tree Nursery

5-10 year

Transplantation

Pruned willow branches that have absorbed pollutants





Biodiversity corridor as a fence

+Public Tree Nursery

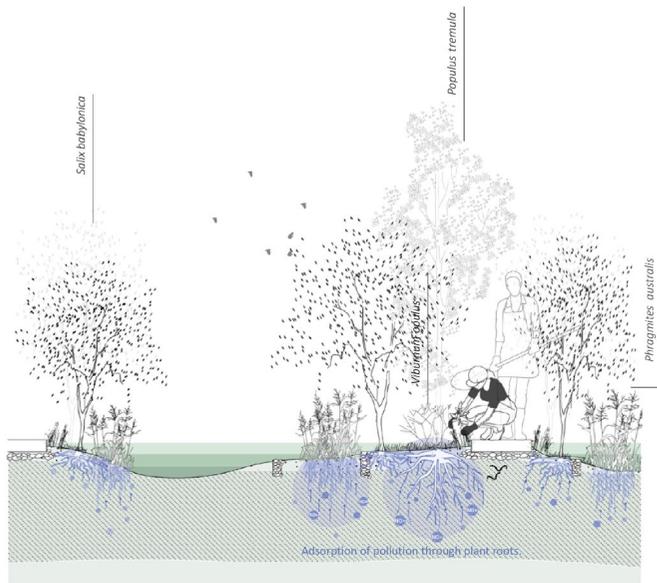
10-20 year



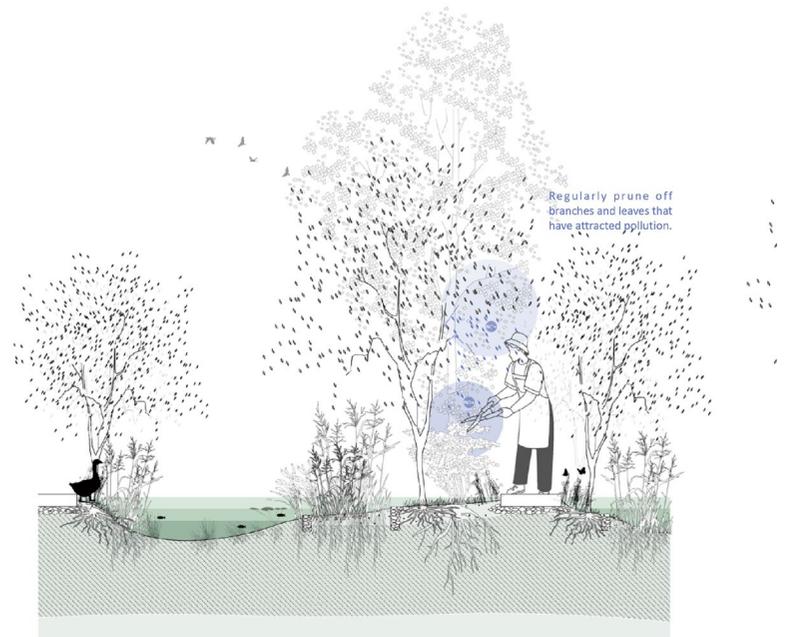
Detail 2 : Stormwater Filter

Sensorial experiences through time

0-5 years



5-10 years



10-20 years

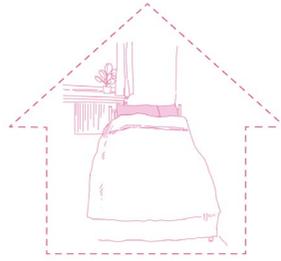


The second detail focuses on the stormwater filter area.

In the first 0–5 years, a network of water channels is constructed to introduce water from the Gantel River into the site. Along these channels, horticulturists plant willows, poplars, shrubs, and reeds to absorb pollutants from the soil and adjacent water bodies. In the second phase, maintenance staff regularly prune branches and leaves to remove the accumulated pollutants from the system. By the third phase, elements made from recycled greenhouse materials, such as concrete stepping stones, are added to enhance interaction with the water landscape. Fallen trunks, sedimentation, and increasingly lush vegetation create a diverse mosaic of habitats for wildlife.

Social groups and potential spatial outcomes

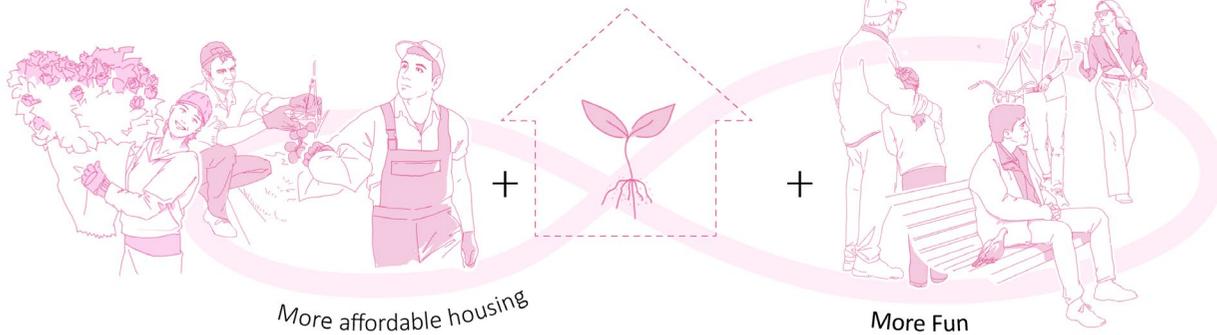
Seasonal Workers



Housing Pressure + Lack of Community

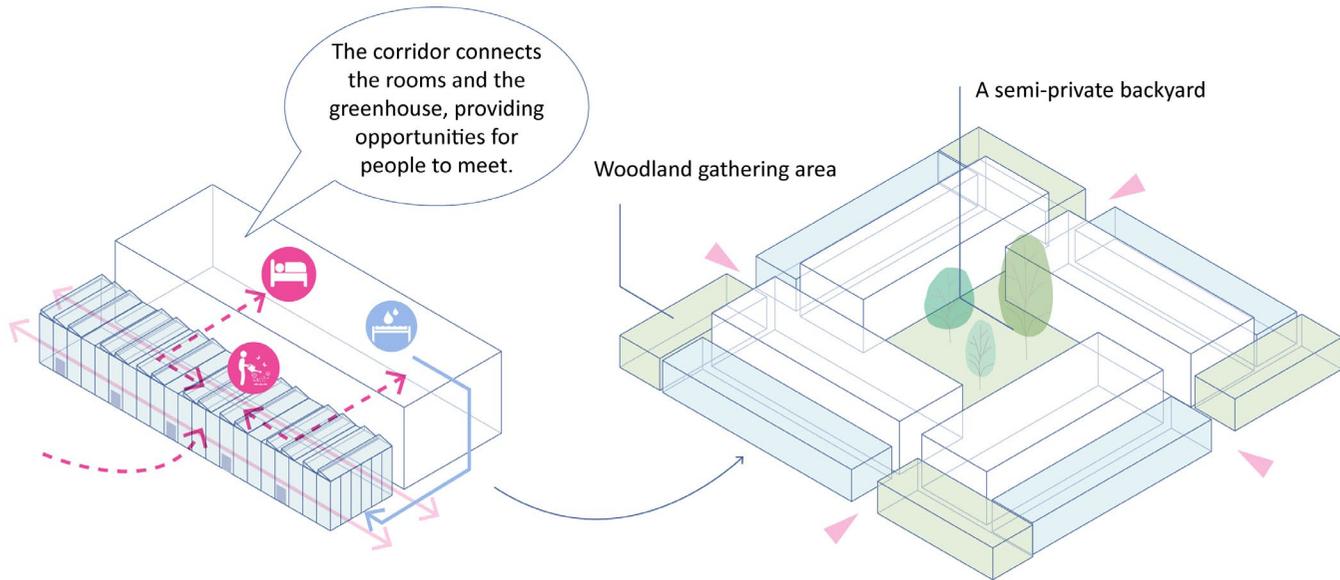


More Connection



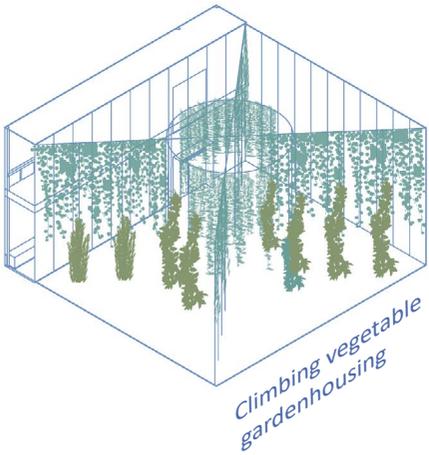
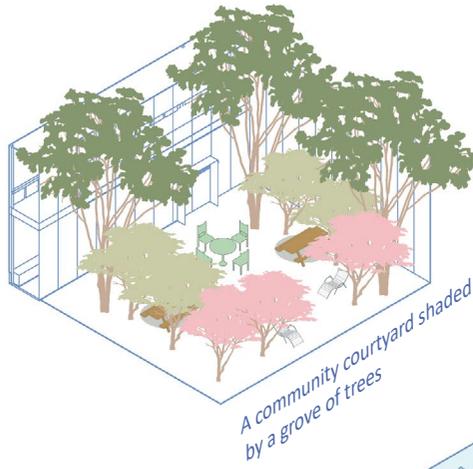
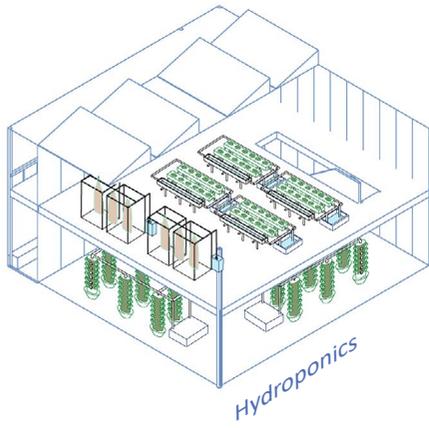
Cultivating Belonging

Integrating Greenhouses into Social Housing to Foster Community Ties



Repurposing greenhouses for social housing within the government-supported Green Vein project could help ease housing shortages and reduce long commutes. Some homes could also be offered to the general public, such as those seeking a greener lifestyle or elderly people in need of restorative environments. In these communities, seasonal Polish workers could share cultivation knowledge with plant enthusiasts through regular workshops, in exchange for their work—fostering social connection and a sense of belonging.





The connection between social and developable housing and woodland





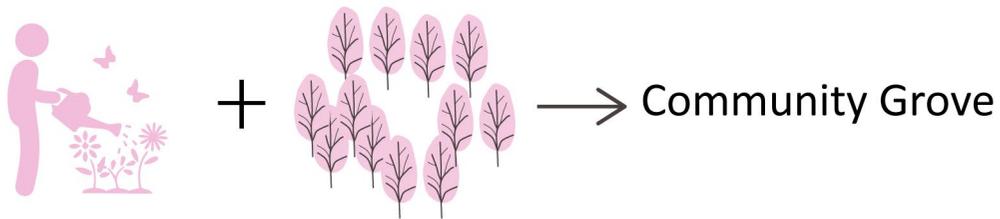
Social housing is primarily located on the urban fringes, close to greenhouses. This helps address the housing shortage and long commuting distances faced by seasonal laborers. Living alongside greenhouse enthusiasts and jointly managing shared courtyards fosters the formation of community ties and promotes mutual understanding. In other parts of Westland, tree nurseries can also provide both employment and housing. Over time, these nurseries can be gradually transformed into forest-based communities. Existing worker housing can be adapted or retained as part of this transition. Anchored in the former tree nursery infrastructure, these communities will benefit from strong connections to public transport and nearby parks, gradually shaping a community identity that is more closely connected to nature.

Social groups and potential spatial outcomes

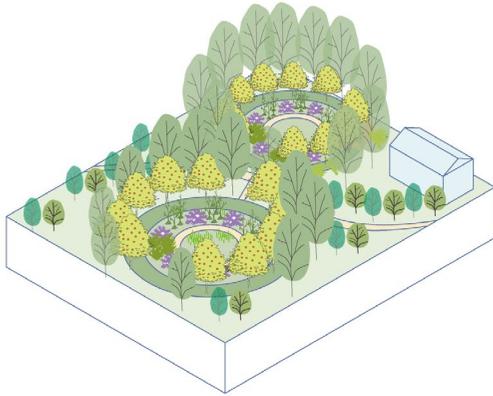
Senior citizens



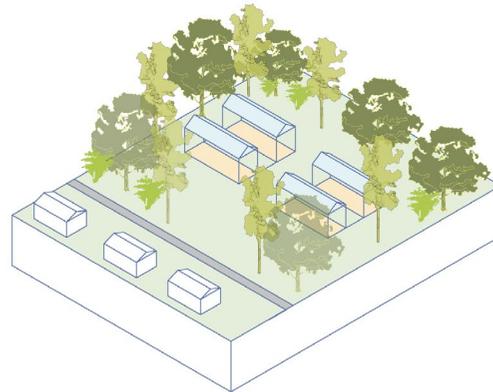
Loneliness + Loss of horticultural memory



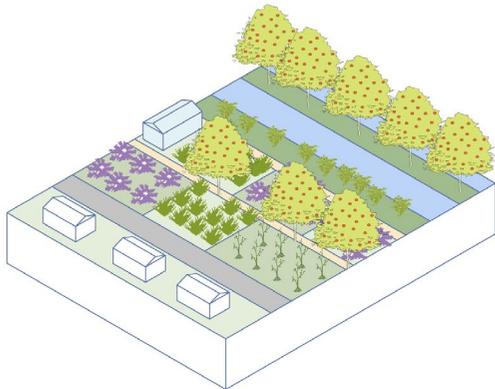
Possible Community Grove Typology



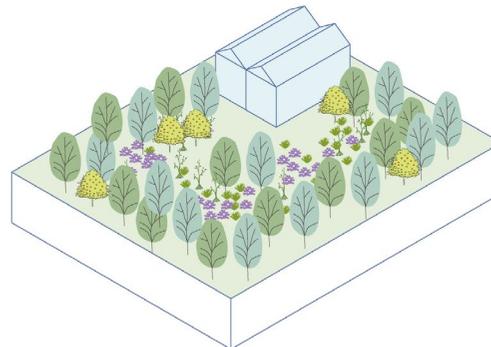
A concentric structure of windbreaks, fruit trees, and vegetable gardens



Market in woodland



Mimicking traditional layouts of gardens, fruit trees, and water canals



A more flexible form of agriforest





Community groves are often small in size, but through thoughtful spatial planning and connections, residents can easily access nearby wooded commons. Shared use of groves between neighborhoods can help strengthen social ties across communities.

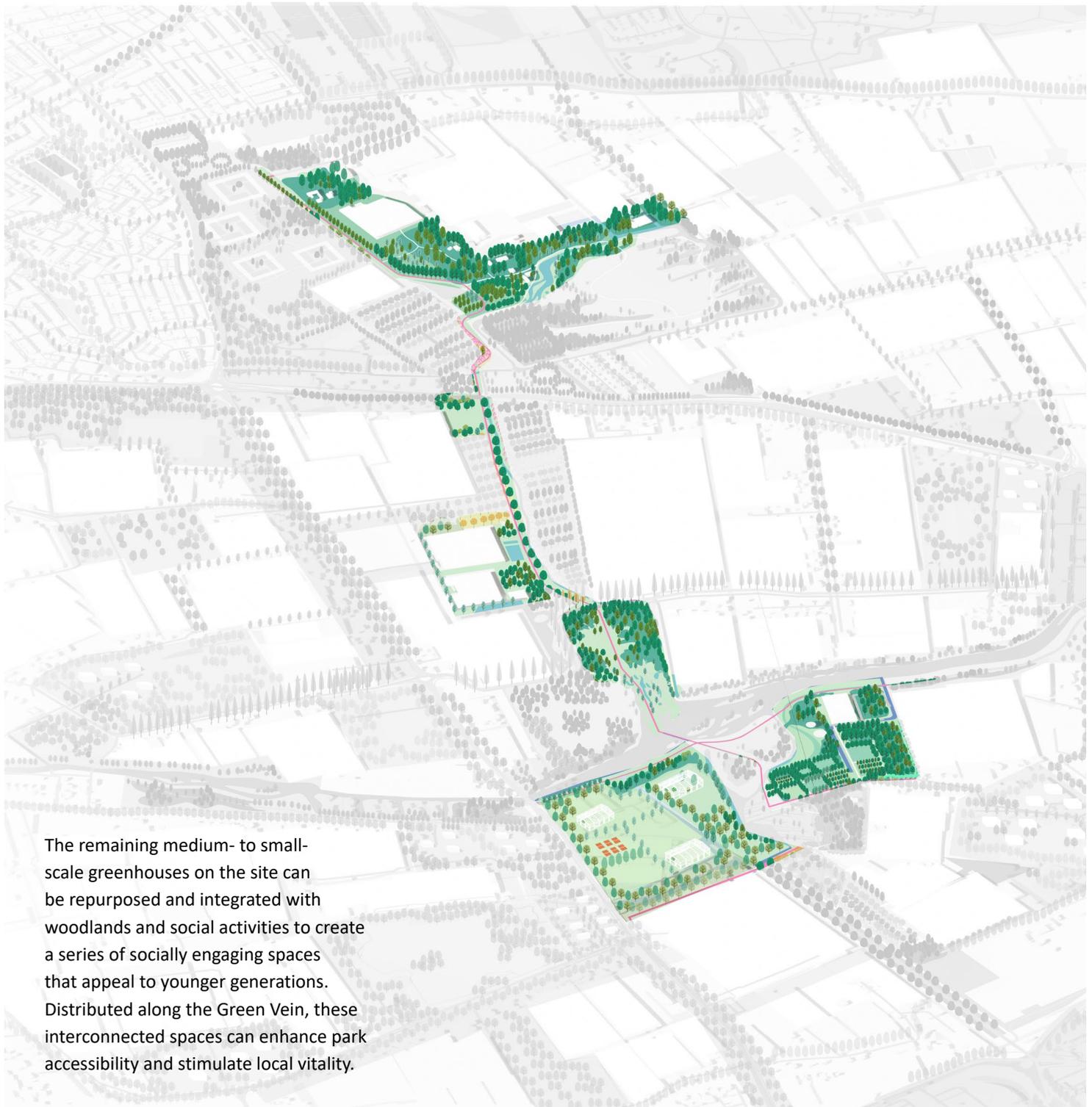
Social groups and potential spatial outcomes

Younger generations

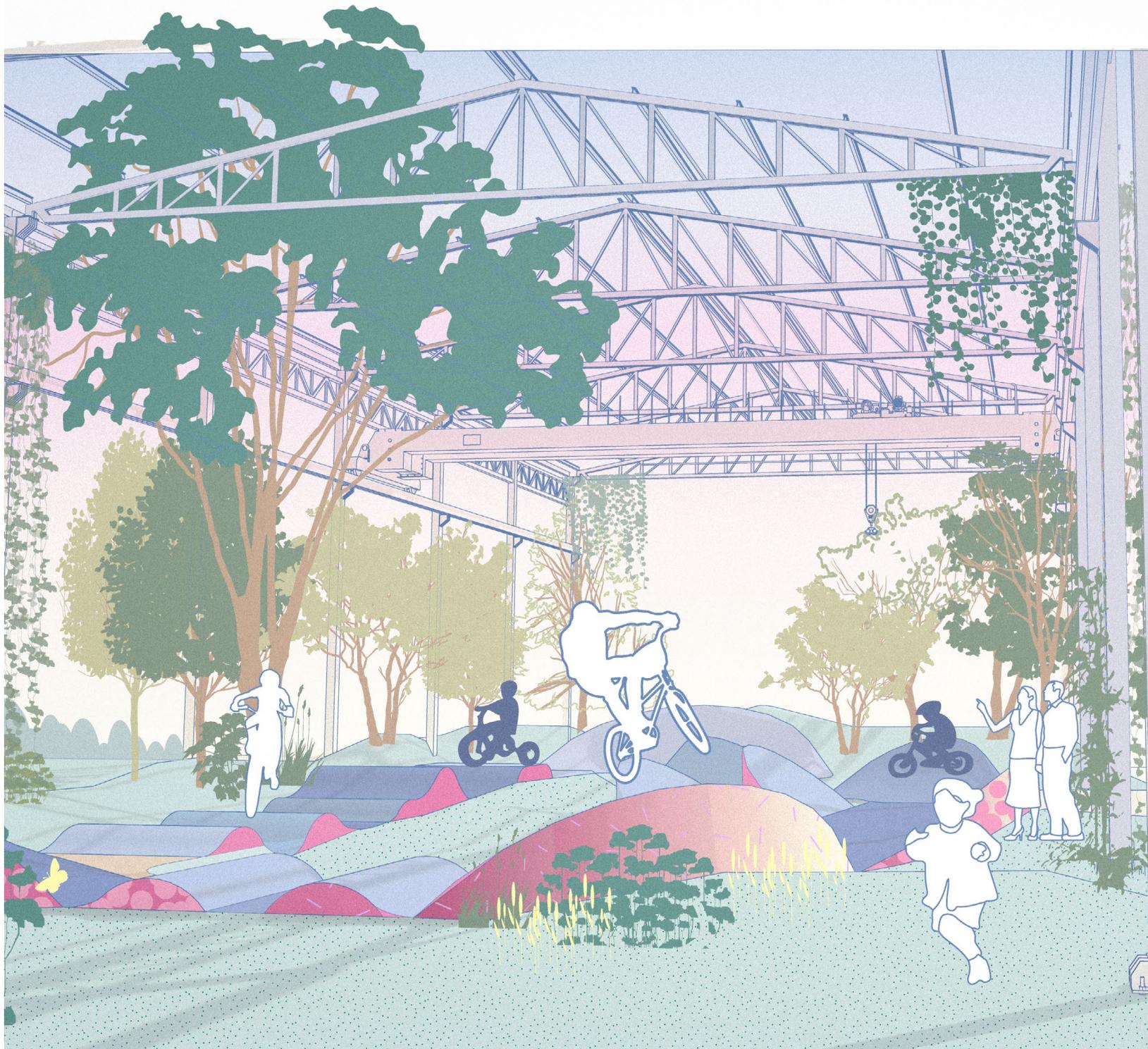


The space lacks appeal to young people



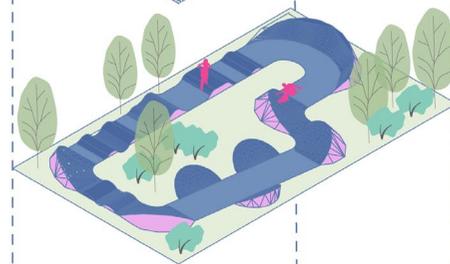
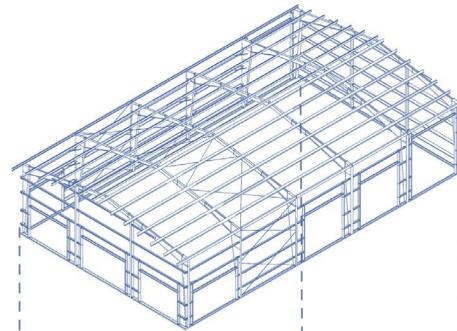


The remaining medium- to small-scale greenhouses on the site can be repurposed and integrated with woodlands and social activities to create a series of socially engaging spaces that appeal to younger generations. Distributed along the Green Vein, these interconnected spaces can enhance park accessibility and stimulate local vitality.

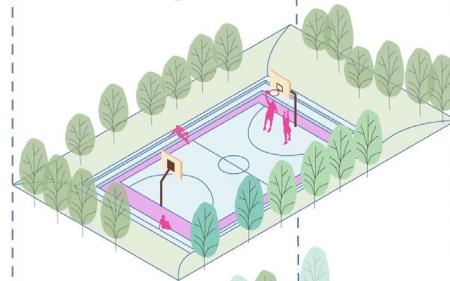




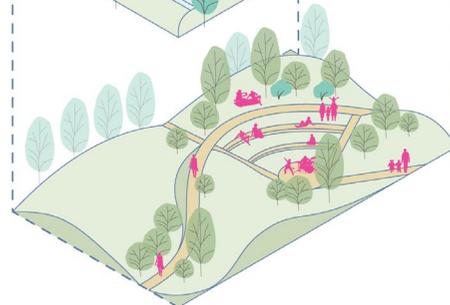
Possible Typologies for Greenhouse Reuse



Pump track



Sports field



Park and stage

PartD

4.1 Conclusion

The aim of this project is to envision a resilient and livable social-ecological system for the future of Westland — a region with a rich landscape heritage but diminished green quality due to the dominance of a compact, industrialized greenhouse sector. The central hypothesis is that socio-ecological theory — particularly the concept of wooded commons — can provide meaningful inspiration for landscape transformation. It is hoped that this work will inspire landscape architects and urban planners to develop SES-informed design approaches that engage deeply with complex sites, navigating across spatial and temporal scales in a step-by-step, systemic way.

The main research question for this project was: *How to improve landscape quality and foster a resilient social-ecological system in an economic-driven region like Westland through redesigning wooded common?*

The outcome of this thesis project is a 20-year regional woodland plan and design for Westland. It spans four spatial scales: the broader Westland region, the Gantel River region, the Green Vein regional park, and detailed site-level interventions. This design process demonstrates how the principles of Social-Ecological Systems (SES) and the adaptive cycle can guide a design approach in which wooded commons serve the ecological, economic, and social needs of the site.

Based on the literature research, this thesis adopts socio-ecological resilience as a key theoretical lens for addressing site-specific challenges in dynamic landscapes. **The literature emphasizes the inseparable interdependence of ecological, social, and economic systems, which are conceptualized as components of a coupled Social-Ecological System (SES).** It also underscores the importance of **cross-scale dynamics**, acknowledging that landscape change unfolds through nested interactions across spatial and temporal dimensions.

The adaptive cycle model, derived from resilience theory, offers a valuable framework for **designing across time and scale**. Its phases—growth, conservation, release, and reorganization—provide insight into how systems evolve and adapt. This model supports a design approach that is both flexible and responsive, enabling the landscape to absorb disturbances while maintaining its core functions.

As a spatial strategy, the wooded common emerges from the literature as a promising typology for supporting socio-ecological resilience. It combines shared governance with multifunctional land use, allowing for the **delivery of ecosystem services alongside gradual transformation**. Together, these concepts bridge theory and design practice, positioning landscape design as a strategic tool to guide and shape socio-ecological transitions.

The first sub question was: *How to understand Westland's challenges in terms of its social-ecological systems?*

Understanding Westland's challenges through a social-ecological lens reveals the close coupling of ecological, social, and economic pressures. Ecologically, fragmented blue-green networks and water stress disrupt landscape connectivity. Socially, limited accessibility between villages fosters isolation and inequality in accessing green space. Economically, the dominance of intensive greenhouse production creates spatial lock-in, homogenizes the landscape, and severs horticulture from daily life—while also facing market, energy, and regulatory pressures. Addressing these interlinked challenges requires cross-scale, adaptive strategies—from plot-level designs that strengthen habitat and buffer zones to regional plans that reconnect villages, diversify land use, and embed ecological infrastructure into productive landscapes.

The second sub question was: *How to design a resilience vision for the future of Westland based on ecosystem services and using adaptive cycle theory as a approach?*

A resilience vision for Westland integrates regulating, provisioning, and cultural services within an adaptive-cycle framework. First, soil and wetland remediation frees landscapes in a release–reorganization transition, allowing ecological exploration. Next, tree nurseries capitalize on regenerated conditions to drive economic exploitation and diversification. Finally, publicly accessible groves deliver cultural services, fostering community engagement and heritage. These stages overlap and can loop back in response to emerging stresses, ensuring continuous adaptation. By combining soil remediation, diversified economic functions, and woodland networks, Westland's landscape can absorb disturbances, regenerate key functions, and sustain ecological integrity, social cohesion, and economic resilience through an iterative, cross-scale process.

The third sub question was: *What is the potential for wooded common on temporal and spatial demision to foster westland 's more resilient social-ecological system?*

In this project, the temporal and spatial interventions of the wooded commons are repeatedly explored across multiple design scales.

On spatial demision, wooded common through phased interventions—such as early-stage phytoremediation, mid-term productive nurseries, and later-stage community engagement and ecological accessibility— support continuous transformation. These cycles align with the adaptive cycle model, enabling landscapes to evolve through growth, reorganization, and renewal.

On spatial demision, wooded commons, through diverse grove typologies, spatially integrate ecological restoration, social interaction, and economic activity. In Westland, they reconnect fragmented landscapes, support biodiversity, and promote community engagement by transforming functional spaces—like tree nurseries or stormwater zones—into shared, adaptive, and meaningful places.

The last sub question was: *Which models of governance and maintenance are most effective for sustaining this system?*

In the final part of the Green Veins regional park project, I discuss governance and argue that it should be adapted to fit the characteristics of social-ecological systems (SES). Governance seeks to bring together diverse perspectives from ecological, social, and economic sectors to form a collective force. Additionally, the approach involves cross-regional coordination and collaborative governance strategies, combining top-down, bottom-up, and expert-supported bottom-up models to promote the system's sustainability. This diversity in governance models contributes to enhancing the resilience of the SES by fostering flexibility, inclusiveness, and adaptive capacity.

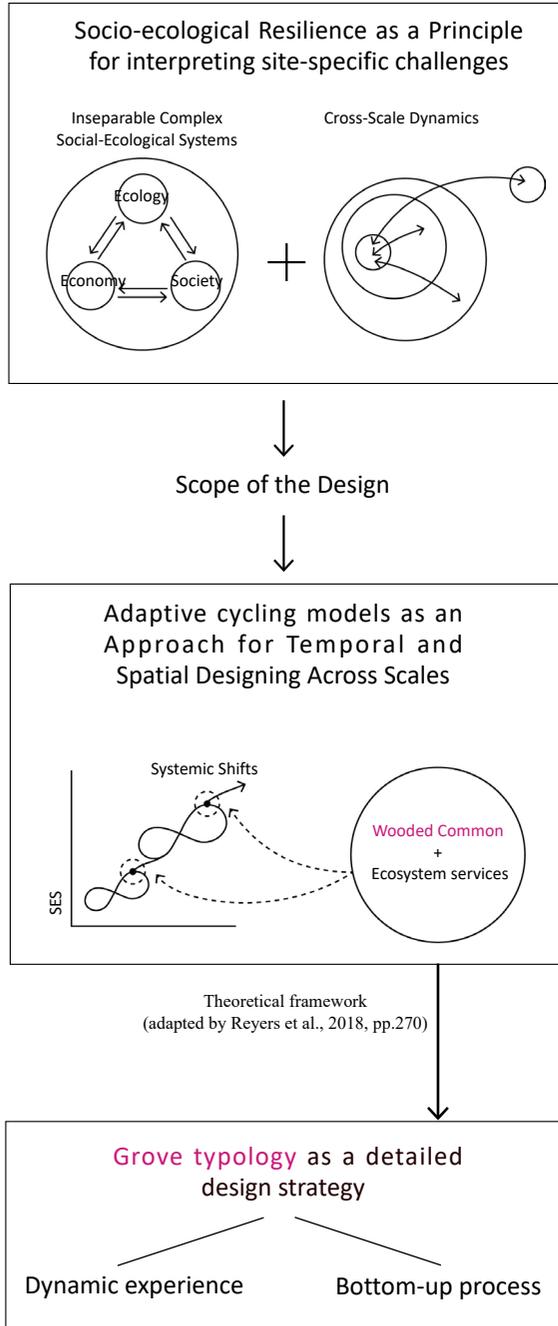
4.2 Reflection

Reflection on SES and Theoretical framework

Traditional SES often focuses on forests, farmland, or urban green spaces, while Westland's extreme greenhouse density provides a special "industrialization ecological" entry point. Your research demonstrates how to integrate ecological and social functions through "woody commons" in a highly intensive context, adding new types of land use and feedback pathways to the SES framework

I believe that the theoretical framework of indivisible and complex social ecosystems, combined with cross-scale research methods, effectively aids in understanding the multifaceted challenges facing the Westland region. From my perspective, approaching site issues through the interconnected lenses of social, ecological, and economic factors allows me to ask deeper questions beyond conventional thinking. Additionally, the adaptive cycle model helps me grasp the non-linear development patterns of systems through phases of exploitation, conservation, release, and reorganization, reflecting the coupled dynamics of society, ecology, and economy. This theory enables me to approach my design in a more systematic and holistic way.

However, I believe that when applying this theoretical framework to guide design, attention must be paid to the connection between the concept and the actual design. The framework is relatively broad and abstract, and I encountered difficulties translating it into concrete site interventions. This challenge sometimes made the design feel too vague and unfocused. To address this, the theoretical framework could be supplemented with more specific guiding terms related to wooded commons as spatial elements. The temporal concepts derived from the adaptive cycle can complement this by providing a clearer time-based perspective. Additionally, defining concrete design goals early in the research process is essential to smoothly transition into site-specific design. Ultimately, analysis should serve to inspire and inform the design rather than remain purely theoretical.



Reflection on Design

Can this design method be applied to other place?

I believe that the principles of cross scale thinking, integrating multiple temporal dimensions, and actively promoting transformative change beyond simply incremental adaptation are widely applicable to various landscape design backgrounds. The core of this approach is to comprehensively integrate social, economic, and ecological coupling within the Social Ecosystem (SES) framework, providing a holistic perspective for addressing complex and dynamic challenges in different environments.

Although this study specifically focuses on the concept of Westland Forest Commons, its underlying theoretical framework provides enormous potential for adaptation and expansion. Future scholars and practitioners can explore the integration of SES theory with broader landscape typology, tailoring interventions based on the unique biophysical and socio-cultural conditions of different locations. These efforts will allow for critical comparisons between SES informed designs and designs derived from more traditional methods, potentially revealing new ways to enhance the resilience, multifunctionality, and social engagement of landscape design.

Reflection on potential design result

How might the design influence social groups' lifestyles and behavior, and what impact could it have on overall ecological and climate resilience? What kind of potential spatial outcomes might emerge?

For the elderly among the native residents of Westland, the implementation of the design would offer opportunities to reunite with old friends and relatives in shared public woodland spaces that connect villages. Cycling between villages would become more common as connectivity improves. Community woodlands, orchards, and vegetable gardens could help elderly residents who once worked in horticulture reconnect with their memories. By engaging in farming, produce exchange, or small-scale selling, they would foster stronger community bonds. This may even lead to the spontaneous emergence of more diverse forms of community orchards and gardens.

With the introduction of more greenery and diverse programs, Westland would likely become more attractive to younger generations. More young people might choose to live near these new green spaces. This could spark further development of gathering areas along the green corridor — such as forest bars, greenhouse-converted guesthouses, clubs, sports fields, or arts festivals. Some young residents may also volunteer or work in the community gardens, especially those undergoing psychological recovery. This could expand the scale and diversity of such spaces and lead to the emergence of more nonprofit organizations. In turn, Westland could develop a socially beneficial woodland system and a network of green spaces, similar to the welfare food gardens in Rotterdam.

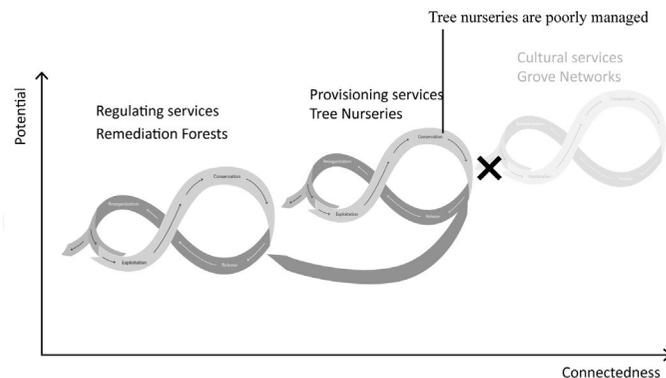
For seasonal laborers, such as Polish workers, major challenges have long included housing stress and a lack of social organization. Social housing created by repurposing greenhouses within the government-supported Green Vein project could help alleviate these issues, easing housing shortages and reducing long commutes. Some of these homes may also be rented or sold to the general public, including people seeking a greener lifestyle or elderly individuals looking for restorative environments. Within these communities, regular workshops could be held where Polish seasonal workers, in exchange for their work in greenhouses, share cultivation knowledge with plant enthusiasts — creating a sense of social connection and belonging in the process.

If more funding were invested, what would happen, and are there any additional spatial outcomes that could be expected?

With more investment, the design implementation could accelerate, and we would likely see a greater mix of spatial typologies emerging within the same timeframe. The ecological and social benefits of the forested areas would begin to take shape much earlier. This acceleration would be driven by the network of agencies involved in the transformation process.

For example, if the government provided increased subsidies to struggling greenhouse businesses, land could be released and repurposed more quickly. Policy support for soil remediation would also be easier to implement—though if phytoremediation remains the method, the time required for soil recovery itself would remain the same.

Additional funding could also fast-track the introduction of tree nurseries, which could begin operating on plots with lighter contamination. These nurseries could supply the municipality with young trees for building the "Green Vein" rural corridors. Moreover, with financial support, there would be less pressure for forested areas to generate immediate income. Willows planted for soil remediation, for instance, wouldn't necessarily need to be harvested and converted into private tree nurseries after five years. Instead, they could remain as public ecological wetlands or mixed forests, enhancing the region's accessibility, ecological value, and landscape diversity.



The SES transitions back into remediation forests due to poor management of the tree nursery

Reflection on the approach

Which approach is central, and which ones are optional or flexible?

In this design, the primary approaches focus on ecological and social dimensions. Ecologically, the strategies centered around remediation forests and water retention are foundational. On the social side, the Community Grove supports interaction among residents, while the Horticultural Grove, although stemming from ecological interventions, gradually contributes cultural services in the later stages.

In contrast, economically driven strategies such as tree nurseries, which aim to diversify the local economy, are relatively more flexible. As a form of provisioning service, they may either transition back into remediation forests or evolve more rapidly

Two possible scenarios illustrate this adaptability:

If tree nurseries are poorly managed, leading to issues such as soil compaction due to repeated plowing, monoculture planting that disrupts nutrient balance, or overuse of fertilizers and chemicals resulting in soil acidification or salinization, then their productivity may decline. In such cases, parts of the nursery areas can be temporarily fallowed, allowing for tree crop rotation, phytoremediation, or layered planting systems to restore soil health. These zones can also serve an educational or recreational purpose as part of a more open, public landscape.

Alternatively, if public woodland development accelerates—for instance, through government acquisition or developer interest in converting tree nurseries into parks, ecological forests, or woodland-based communities—the nurseries may enter a third adaptive cycle earlier, shifting their role toward generating social value into cultural landscapes and services.

Reflection on Adaptive cycle

What would it mean if a new cycle occurred in 20 years?

How could the strategy be applied to the same area under different conditions?

It is possible for a new adaptive cycle to emerge within the planned design period. This could lead the system into either a positive or negative direction.

If Westland receives sufficient policy support and funding, and the transition is handled properly, the region could reach a higher-level adaptive cycle within 20 years. With the right policies and funds, Westland can complete a complete adaptation cycle within 20 years. Scattered greenhouse areas will give way to multi-functional forests and new green communities - shared orchards, forestry enterprises and development projects for living together to attract young residents and entrepreneurs and strengthen social networks. The rapid diversification of land use will promote the ability of ecological services and climate restoration, while public forest land will become a place for daily gathering.

However, there is also a risk of entering a negative cycle. This could result from imbalances between economic, ecological, and social factors—or external pressures. For instance, a sudden economic downturn could cut budgets, leading to neglected lands with weak ecological value and underused “hollow” green spaces. Rapid commercial development may prioritize short-term gains—like monoculture orchards or premature commercialization of forests—at the cost of biodiversity and long-term soil health.

The strategy could be adapted to future conditions by recalibrating its focus based on new ecological, social, or economic needs. For example, if climate conditions shift or community priorities change, the balance between remediation, social engagement, and economic provisioning could be adjusted. Flexibility in spatial typologies—such as converting tree nurseries into mixed-use community forests or adapting water-retention landscapes into recreational wetlands—allows the framework to remain relevant and resilient across changing contexts.

Reflection on research

I think the limitation of my research part in this research project is that most of my research is based on second-hand materials such as papers, existing research in books and atlases, visit materials, news, web pages, museums, etc In the early stages of my research, I felt that as a non-native, it was very difficult to understand the social and ecological issues in Westland Especially SES requires exploring the fundamental causes and interrelationships of problems However, even though I went to the venue, I found that I could only understand it through observing, feeling, and experiencing these traditional landscape exposition patterns However, since I am studying social ecological theory, in the early stages of my research, I was very eager to communicate with people who understood the local area, but I did not do so I have learned that some anthropological scholars have personally experienced months of work to understand the seasonal laborers in Westland, and have written ethnographic surveys. Although I may not be able to do so due to time constraints, I still hope to have the opportunity to conduct more in-depth field research or organize workshops to communicate with different local social groups and understand their demands in the future. This will be more helpful.

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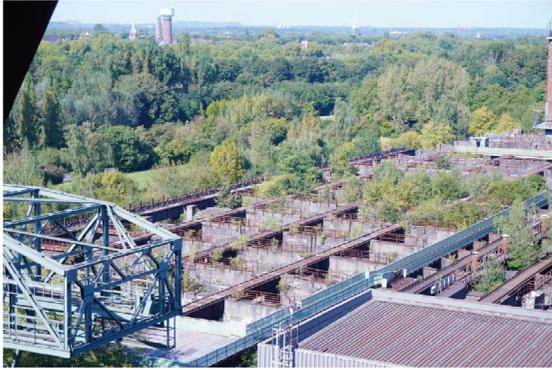
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Appendix

Reference Cases

Landschaftspark Duisburg-Nord | Duisburg DEU | Latz + Partner | 1994

Case studies aimed at theoretical frameworks provide frameworks for socio-cultural interventions in wooded common ways.



ALMERE FLORIADE 2022 | Almere NL | MVRDV | 2022

Case studies for COMPOSITION are designed to examine how landscape cases where agricultural traditions and social processes are involved arrange and organise landscape elements to achieve specific aesthetic, functional and ecological effects.



Rijnvliet Edible Neighborhood | Utrecht NL | Felixx | 2017

Case studies for process purposes are designed to examine how social processes intervene in wooded common projects, such as intervention, management and maintenance.



2.2 Precedent Projects

For Precedent Projects, I selected three case studies, each corresponding to different stages of the design process.

The tree-planting strategy in the Landscape Park Duisburg-Nord project provides valuable insights for the theoretical framework. The tree spaces in the project exhibit diverse attributes: ecological, social, and cultural. Moreover, the spatial arrangement of trees varies according to the hierarchy of spaces, transitioning from 'first place' to 'third place'.

The Almere Floriade 2022 project provides a valuable case study for exploring innovative approaches to integrating green infrastructure in urban settings, particularly in combining agriculture, horticulture, and woodland design. The project highlights the potential for multifunctional green spaces to balance ecological restoration, social interaction, and urban aesthetics.

However, the project has also been subject to controversy. Muller coined the term 'mega-event syndrome' to describe how such ambitious initiatives often fail to deliver on their promises. Based on interviews, he identified a recurring pattern of overpromising benefits, underestimating costs, and public authorities engaging in high-risk decision-making, often leading to 'elite predation'. According to Noël van Dooren (2023), the promised benefits, if realized at all, tend to flow disproportionately to the more affluent parts of the city. Even in cases where neighborhood upgrades occur, they often fail to benefit the original inhabitants, who may find themselves displaced or negatively impacted by environmental destruction.

The third case, Rijnvliet Edible Neighborhood, demonstrates how wooded commons can be integrated into the design process. This project, spanning 150,000 square meters and featuring over 200 species of (edible) plants, exemplifies ecological resilience and innovative urban planning. It breaks new ground by employing participatory design to co-create a residential neighborhood centered around accessible urban agriculture. Residents actively contribute ideas to shape the design and will maintain the food forest under the guidance of a forester, fostering a sense of ownership and community engagement.