IN BETWEEN NATURE

Nature based placemaking for Rotterdam's territories in-between

Graduation thesis
Msc Urbanism - TU Delft

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PREFACE

This report is the result of 10 months research on Rotterdam's territories in-between. It discusses its challenges, but more importantly also its qualities and potentials.
I hope this thesis project inspires urban planners and designers to question current planning approaches towards in-between territories. It is essential to acknowledge and understand the social and ecological potentials of existing in-between territories as a first step to further spatial planning.

I would like to thank my mentors, Remon Rooij and Nico Tillie for guiding me throughout the whole process and helping me out with project related questions and putting confidence in me on this particular topic that was unfamiliar to me in the beginning. You also helped me at times when the project proved to be personally challenging, partly due to the corona-virus restrictions that where present.
Furthermore, I would like to thank all of my fellow students, friends, my parents and Sebastiaan for the fascinating discussions and well needed mental support. Without you I could not have accomplished this.

ABSTRACT

Territories in-between (TiB) have gained increased attention the past decades among researchers in the field of urban planning and design. These territories are identified as territories somewhere in-between the urban and rural. Typical land uses in the TiB are warehouses, sport complexes, allotment gardens and small-scale industrial activities. The TiB are often considered to be underused, lack spatial quality (sense of place) and are under mounting pressure of urban densification. However, the rich diversity of land uses and abundance of semi open spaces in the TiB provides unique habitats and social-ecological opportunities, different from exclusively urban and rural landscapes. Therefore we, as urban planners and designers, should reconsider conventional planning and design approaches towards these territories and acknowledge the social and ecological potentials of these territories.

The thesis project proposes an unconventional design perspective that makes space for the territory in-between and embraces its true unorganized and multi-functional nature. The design strategy that was developed through a research by design process is called: the recovering membrane and describes the vision for the territory around the urban fringes of the city that resembles the functioning of a membrane at landscape scale. This design strategy was developed in particular for the city of Rotterdam. The recovering membrane is defined as a spatial layer of interaction between two distinctive living environments –urban and rural- and various human and non-human actors in them. The membrane aims to bridge the urban-rural divide, enhance biodiversity and sense of place in the in-between territories at the urban fringes of the city. The proposed strategy is supported by landscape ecology theories on ecological edges and boundaries and a theory on sense of place experience emphasizing the importance of human-nature interactions.

By using these theories, the vision for the recovering membrane is elaborated at local scale for an in-between territory near Hoek van Holland. The research shows that nature-inclusive spatial design elements can mutually benefit the ecological quality of the in-between territory as well as the sense of place experience at local scale. This integrated design approach is described as nature-based placemaking. The spatial transformation of the in-between territory into a membrane landscape can be organized into three development stages at respectively: short, medium and long time period. (1) Engagement and activation of the local community through a nature-based placemaking process. (2) Connectivity and integration of the in-between territory within its surroundings through social-ecological corridors. (3) Re-distribution of clustered land-uses in order to strengthen the heterogeneous nature of the in-between territory. The latter is of specific importance as it seems that greater landscape heterogeneity does not only cause for greater ecosystem resilience and biodiversity, but also greater sense of place experience. To enable this new approach a new governing body is proposed: the Membrane Management Group.

Key Words: Territories in-between; Sense of place; Social-ecological development; Urban fringe; Rotterdam

THESIS PROJECT
P5 REPORT

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July, 2021

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All images without sources have been made by the author

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1. INTRODUCTION

This chapter first discuss my personal motivation for the project and will thereafter introduce the main concepts and problems that are the reason for this thesis project.
It will introduce the concept of the territories in-between and will elaborate on the specific challenges these landscapes face with respect to urbanisation, biodiversity and sense of place. In the last section these problems are synthesised into a problem statement and research questions.

Image made by author

1.1 MOTIVATION

After finishing my bachelors degree in Landscape Architecture in Wageningen I noticed that my fascination was mostly in the relationship between people and the (natural) landscape. In particular how the landscape around us serves our basic human needs, how we make sense of these landscapes and how we attach meaning to particular places. Because of that I chose to broaden my view and specialize in Urbanism at TU Delft because of its integrated understanding between people, their living environment and the interaction between them.

Traditionally, landscape architecture has been mostly set in rural and semi-rural environments with an emphasis on wildlife and environmental processes whereas the discipline of urbanism talks most about the living environment of people, the city and its anthropogenic processes.

During the first year of my masters I noticed that this dichotomy between the disciplines is not as clear as it may seem. I learned that reasoning from a landscape architecture perspective can provide promising solutions to modern day's urban challenges, such as biodiversity loss, heat stress, health problems, environmental safety issues and many more.

From this perspective I seek to deepen my understanding of the interface between landscape architecture and urbanism in my master thesis.

Personally, I have been particularly fascinated by landscapes that seemed to be somewhat unplanned or unorganized. Places that challenge me to explore hoping to encounter unexpected beauty. I realised this fascination has strengthened during the covid-19 situation. In order to get outside and get enough exercise while working from home I made daily walks, often accompanied by my dad. We tried changing our routes everyday in order to discover new secret places. New routes appeared along the railway, through the pastures and along the orchards. As a result of these walks and the interactions I had with some wild animals (birdwatching became a new hobby since) my sense of place has significantly deepened.

These experiences triggered my interest in semi-urban spaces that quite often seem to be undervalued and neglected in urban planning and design practices. Therefore, with this thesis project I hope to get a deeper understanding of the challenges and potentials of in-between territories for people and wildlife and the synergies between them.

Figure 1: Exploring Mien Ruys garden on TU Delft campus. Picture taken by my collegue and friend Floris Beijer.

1.2 CONTEXT AND PROBLEM FIELD

Urban growth and densification of Rotterdam region

It is expected that the amount of households in the Netherlands will further increase for several decades. This trend is the result of decreasing average household size and ongoing immigration (PBL, 2011). In order to meet the housing demand about 1 million houses have to be built until 2040, especially in the larger cities in the Randstad region, which include Amsterdam, Den Haag, Utrecht and Rotterdam (Verdaas, 2017). Rotterdam aims to built 50,000 new houses until 2040. The main strategy to allocate these new houses is to transform and densify within existing urban tissue. Brown fields, infrastructure corridors, old industrial districts and semi-open spaces along the fringe of the city are key locations for urban redevelopment and new housing projects (Strategische Verkenning Verstedelijking, 2019). These are the typical locations that Alex Wandl has identified as Territories In-between (TiB) (Wandl, 2020). This concept will be further elaborated in the next paragraph. As a result of the densification process in these territories the functions and services that these territories provide are under pressure. In practice this may concern land-uses that are not, anymore, desirable in the centre of the city, such as port activities, sewage treatment plants or large scale sport and leisure facilities. Figure 3 shows a selection of newspaper headlines that address the pressured position of sport clubs, allotment gardens, camp sites and small-scale business parks in Rotterdam.

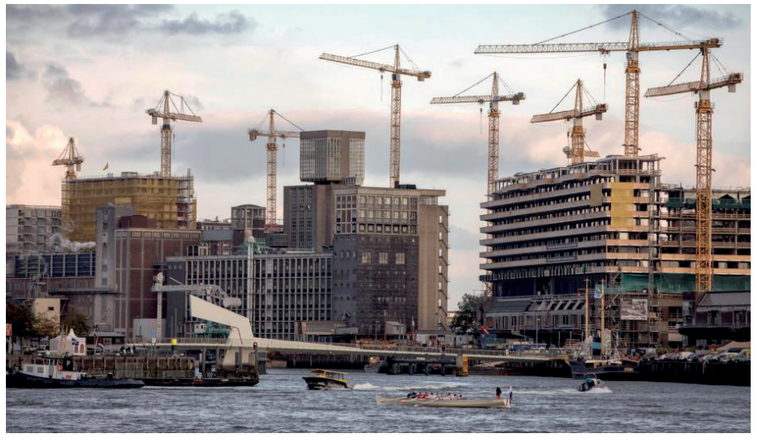


Figure 2: Urban development in Rotterdam's old harbour district. Retrieved from: www.stichtinghoogbouw.nl

Rotterdam gaat de komende twintig jaar volop huizen bouwen in nog open en groene gebieden binnen de ring. Aan de oostzijde, langs de A16 tot aan Feyenoord City, staan alleen al 22.000 woningen gepland. Dit gaat vooral ten koste van sportvelden, volkstuinen en bedrijventerreinen.

18-07-19, 07:59

Een van de ransuilen op het terrein van de volkstuinvereniging. Volgens de tuinders is de sloop van het tuinenterrein een aanslag op dit soort bijzondere dieren in de stad. (Foto:)

Help, waar blijven de sportvelden na bouwgolf? CDA maakt zich zorgen

Het CDA maakt zich zorgen over de enorme bouwgolf die Rotterdam wacht. De partij is enthousiast over de plannen om tussen nu en 2040 50.000 woningen te bouwen. Maar die nieuwbouw komt binnen de ring, in open en groene gebieden. Juist op de plek waar nu sportterreinen liggen.

Adrianne de Koning 18-07-19, 23:20

Petitie tegen de sloop van volkstuinen in Delfshaven

di 5 jan 2021, 13:08

Rotterdam - Tuinders van volkstuinvereniging St het gemeentebestuur om een groot deel van het tuinenterrein zou moeten worden opgeofferd om petitie gestart om sloop te voorkomen.

Dat wordt nu de truc in Rotterdam: bouwen zonder dat het ten koste gaat van de fijne stekkies in de stad

COMMENTAAR Het is dringen om ruimte in Rotterdam, waardoor Steeds Hooger moet vrezen voor z'n voortbestaan. Het verhaal van de voetbalclub is een voorbode van wat de stad te wachten staat.

Vraag naar volkstuin explodeert sinds coronacrisis: 'Overschie klinkt ineens als Zuid-Frankrijk'

Er is in heel Rotterdam vrijwel geen volkstuin meer te krijgen. Sinds het uitbreken van de coronacrisis is de vraag naar zo'n stukje groen in de stad geëxplodeerd. Bij veel verenigingen kom je zelfs niet eens meer op de wachtlijst: „Neem geen contact met ons op, dit heeft geen zin."

Volkstuinders protesteren tegen afpakken van hun 'park', maar ook voetbal en stadscamping zitten klem

VOLKSTUINTJES MOETEN WIJKEN VOOR WIJKEN

BNR Webredactie / zaterdag 3 augustus 2019, 10:00

Update: zaterdag 3 augustus 2019, 12:58

De populaire volkstuintjes dreigen te verdwijnen door nieuwbouwplannen van diverse gemeenten. In Rotterdam moeten de komende decennia zo'n tienduizend woningen worden gebouwd. Veertien volkstuinen zitten hierdoor in de gevarenzone. Ook in gemeenten als Den Haag, Leiden en Purmerend zijn of waren er plannen voor nieuwbouw op de plek van volkstuinen, zegt de Landelijke Organisatie voor Samen Tuinieren.

Figure 3: News headlines about threathend landuses as a result of ongoing densification in urban areas. Sources: AD.nl, BNR.nl, DeHavenloods.nl,

Territories in-between

This relatively new term is used as an umbrella term to describe areas which are somewhere in between the urban and rural. Therefore, their functioning and spatial patterns show similarities with the urban environment as well with the rural environment. Key characteristics of TiB are: the presence of infrastructures, strong function mix and the intermingling of built and unbuilt spaces. Figure 4 shows the large amount of surface area that can be characterised by these features (Wandl, 2020). Regardless of the great abundance of the TiB and the need for integrated design approaches, most spatial planning documents and urban design proposals continue to focus on the dichotomy between urban and rural. This discrepancy became even more apparent in PBL recent publication: *Grote Opgaven In Beperkte Ruimte* (PBL, 2021). In which they also emphasize the need for more spatial integration between economy, society and nature in order to cope with modern day's great societal and environmental challenges (PBL,2021). Nevertheless, they fail to consider the importance of in-between territories for sustainable and integrated spatial development. As a result of this neglect of the TiB in spatial planning documents their potential for sustainable development remains underestimated. This is unfortunate, because the TiB seem to exhibit a great potential for providing ecosystem services. This especially concerns the abundance of underused open spaces in the TiB (Wandl, Rooij & Rocco, 2012). Examples of typical open spaces in the TiB are shown in the pictures on the right side of this page (figure 5). Consequently, the densification and redevelopment process in these territories provides a window of opportunity for the investigation on how to develop these territories in a systemic way that integrates the social and ecological values that these territories exhibit. The main ecological value that is considered in this project is biodiversity and the main social value that is considered is sense of place. These concepts, their relevance for TiB and their interrelations are explained in the following paragraphs.

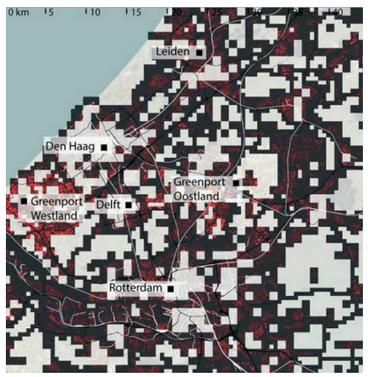


Figure 4: TiB in South-Holland
From: Territories -in- between: A cross case comparison of Disperesed Urban Development in Europe (p. 307) by A. Wandl (2020)

Figure 5: Images of typical open spaces in the TiB in Rotterdam. Photo's where taken in the vicinity of N471 and Rotterdam The Hague airport. Made by author.

Biodiversity under pressure

Biodiversity is a comprehensive term from biology that mainly talks about diversity and richness of genes, species and ecosystems within a certain area (Compendium van de Leefomgeving, 2017). It has been proven that urban landscapes offer a great potential for biodiversity. Especially in comparison to mono-functional agricultural landscapes. Urban brownfields, infrastructure buffer zones and other informal urban landscapes can be of great potential for biodiversity (Rupprecht, Byrne, Garden & Hero, 2015) In short, typical landscapes that make up the TiB (Wandl et al. 2014). The importance of biodiversity for human well-being and liveability has been widely stressed and has gained increased attention past decades (Haines-Young & Potschin, 2010; Haq, 2011). Particularly for the city of Rotterdam, biodiversity and improvement of the natural environment has been a major topic as the city's ranking on ecological capital is the lowest out of all municipalities in the Netherlands (Zoeteman et al. 2016).
It is argued that the potential of TiB for the provisioning of ecosystem services is still underestimated and not yet used to its full potential (Wandl et al. 2014). Moreover, the urban densification of the open spaces in the TiB increases the pressure on biodiversity and the provisioning of ecosystem-services in these areas, which includes the provisioning of essential cultural ecosystem services such as sense of place. More information on the relationship between territories in-between and ecosystem services can be found in the theory paper in the appendix (V).

Lack of sense of place

Sense of place is a complex concept that describes the attachment of people to their living environment. The concept is rooted in both objective effects such as landscape design, form and sensory perceptions (smell, sound, climate etc.) and on the other hand subjective experiences such as memories, emotion, history and culture. (Bush et al, 2020; Masterson et al, 2017; Shamai, 1991) Places that lack a sense of place are usually described as placeless. Because of the spatial and social fragmentation and limited attention for the design and planning of territories in-between they often lack the presence of significant landscape features which strengthen the sense of place (Wandl, 2020). Figure 6 describes the prevalent lack of integration of ecological values (biodiversity) and social values (sense of place) in TiB.
Improving sense of place is crucial as it can improve community cohesion and stewardship to a place. As a result, it can be an important notion to consider when engaging people with sustainability issues. Moreover, ecological design interventions are essential for the strengthening of sense of place through the provisioning of cultural ecosystem-services and the sustainment of liveability in these territories (Masterson et al, 2017; Haussman, Slotow, Burns & Minin, 2016).

1.2 PROBLEM STATEMENT

Bringing together the issues that have been discussed in the previous paragraphs results in the following problem statement:

*The neglect of **Rotterdam's Territories In-Between** in spatial planning and decision making results in **limited ecological quality** and **lack of sense of place** in these territories.*
*The ongoing densification process in the TiB further increases the **pressure on urban green spaces** and requires urban designers to think of **new integral design strategies** to ensure the **liveability** of both human and non-human species in the TiB.*

Figure 6: Conceptual diagram of problem statement, showing lack of integration of biodiversity and sense of place in the TiB. Made by author.

1.3 RESEARCH QUESTIONS AND AIMS

MAIN RESEARCH QUESTION:

HOW CAN A NATURE BASED PLANNING AND DESIGN APPROACH
STRENGTHEN BIODIVERSITY AND SENSE OF PLACE
IN ROTTERDAM'S TERRITORIES IN-BETWEEN ?

Strategy
Aim
Context

RESEARCH ORIENTED SUB-QUESTIONS

1. How are Rotterdam's TiB addressed in local and regional **spatial planning processes**?

2. What are the **spatial characteristics** of Rotterdam's TiB?

3. What are the **ecological opportunities and challenges** of Rotterdam's TiB?

4. What are the challenges and opportunities with respect to **sense of place** of Rotterdam's TiB?

DESIGN ORIENTED SUB-QUESTIONS

5. What kind of **ecological design interventions** can strengthen sense of place in Rotterdam's TiB?

6. What kind of **spatial planning strategy** can ensure biodiversity and the provisioning of ecosystem services in the TiB at local and regional scale?

7. How can ecological design interventions that strengthen biodiversity and sense of place in the TiB be spatially **integrated in a design transformation** for a particular case in Rotterdam.

PROJECT AIMS

1. Explore how ecological design interventions can contribute to a sense of place in Rotterdam's TiB.

2. Advise local and regional authorities on how to plan and redevelop TiB from an ecological and social perspective.

3. Propose an integral and interscalar spatial planning and design strategy for biodiversity and sense of place in Rotterdam's TiB.

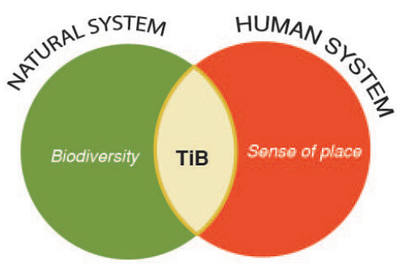


Figure 7: Conceptual diagram of project aim. Showing integration of biodiversity and sense of place in the TiB. Made by author.

2. METHODOLOGY

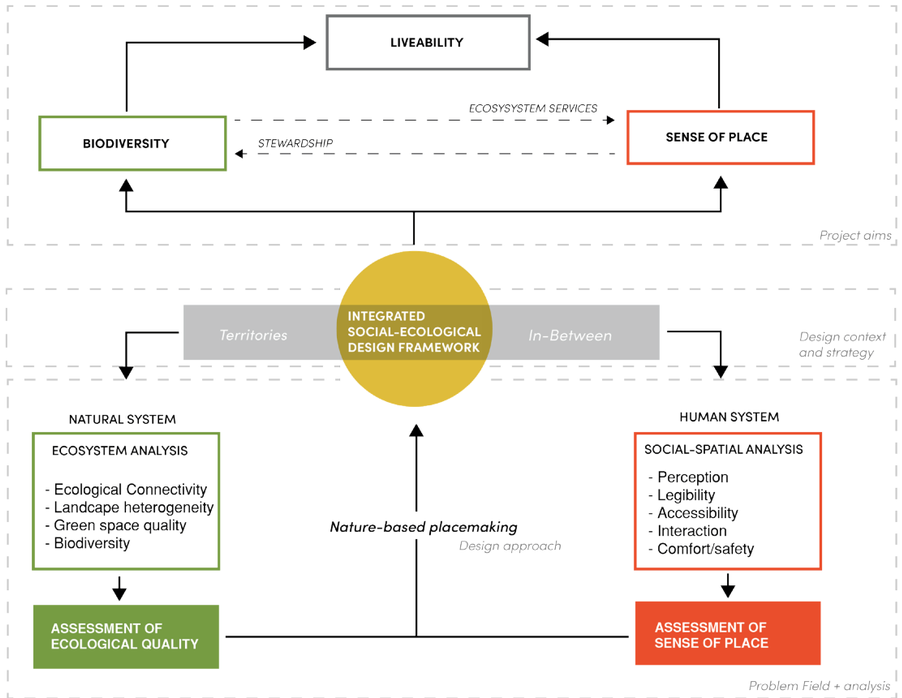
The aim of this chapter is to give an understanding of the general approach of this project and provide an overview of the applied research and design methods.

Image made by author

2.1 CONCEPTUAL FRAMEWORK

The conceptual framework addresses the relationship between the problem field, the design approach and the proposed strategy and the project aims.
The context of the project are the territories in-between (shown in the grey box) (figure 8). Within this context two problem domains have been identified, the natural system and the human system. The problem of lack of ecological quality in the TiB is derived from the natural system and the lack of sense of place in the TiB is derived from the domain of the human system. In the boxes the different subjects of analysis are depicted. The project proposes a nature-based placemaking approach to integrate the needs of both the human as well as the natural environment in the design process. The reasoning behind this approach is that synergies between people and nature can be established in the TiB. This design approach will be embedded in the design framework that will be the final product of this thesis project. The project aims that are achieved through the design of this framework are biodiversity and sense of place. Resulting in improved liveability for human an non-human species within the context of Rotterdam's TiB.

Figure 8: Conceptual framework of thesis project. Made by author.



2.2 RESEARCH METHODS

The following sections will elaborate on the specific research methods that are applied in order to answer the sub-research questions.
It will discuss how each of the methods is used and what kind of outputs they will produce.

1. LITERATURE REVIEW

Primary literature
The primary literature review will cover the domains of landscape ecology, biodiversity, and sense of place theory and placemaking. Combining these bodies of literature will give a comprehensive understanding of the theories and the relationships between them.

Secondary literature
The review of secondary literature will include public governmental documents, such as spatial strategies and visions which which may or may not include the TiB. This will give insight in the way the TiB are considered in spatial planning and policy-making. Some of the findings will only be reported in the theory paper (appendix V).

2. SPATIAL ANALYSIS

The spatial analysis will be applied at 2 different scales.
First at the regional scale of the city of Rotterdam and secondly at the district scale. The spatial analysis at district scale will be applied through a selection of three case study locations within the region of Rotterdam.

Regional spatial analysis
The aim of the regional analysis is to understand where the TiB manifest themselves at the regional level. To understand how to map the TiB, where they are located and how they are integrated in their surroundings with respect to the urban and rural environment.

Tools:
1. GIS data
2. Spatial visions and strategies from municipality and other sources.
3. Historical maps
4. Google earth imagery

Comparative case site analysis at district scale

After the regional analysis three sites for spatial analysis at district scale are selected for a comparative study. The aim of this comparative study is to get an understanding of the social-ecological characteristics of the TiB at a more local level, which cannot be addressed at the regional scale. These are the ecosystem analysis and cognitive analysis, discussed in the following paragraphs. Therefore, the case study analysis is not a research method in itself, but a way of approaching the

spatial analysis. By comparing the different findings from the analysis of the three locations it is expected that some generalisations on the social-ecological challenges and potentials of the TiB can be made, specifically for the case of Rotterdam. These findings will later be translated into a regional planning strategy and design principles for the TiB. Thereafter, a critical case will be selected to be developed in further detail and showcase the implementation of these design principles at local level. The following paragraph explains how these three sites are selected.

Site selection

The locations that will be used for the case studies are selected based upon 3 conditions:

1. Representative urban fabric, to make sure the area is exemplary for TiB and results are transferable.

2. Distinctive landscape typology
In order to understand how different landscape characteristics can influence the ecological system and the feeling of sense of place each case study is located in a distinctive landscape typology. Which are: the landscapes of the old sea clay polders in the south of Rotterdam, the Dune landscape at Hoek van Holland and the peat landscape in the east.

3. High level of urgency
To make sure the case locations have a certain need to strengthen the urban ecological structure and sense of place. For instance because there is nearby urban re-development.

3. ECOSYSTEM ANALYSIS

The ecosystem analysis is conducted at all three case sites. The aim of the ecosystem analysis is to gain insight in the ecological characteristics of the TiB and identify opportunities for improvement which can be translated into a regional strategy to strengthen biodiversity in the TiB. Two methods will be used to conduct the ecosystem analysis:

1. GIS data analysis
Analysis of ecological data such as habitats, species distribution and ecological corridors. Used to create an understanding of the landscape ecological mosaic (patches and corridors). Waarneming.nl is used to gather more site specific data on local species distribution and abundance. This helps to understand what kind of specific species are currently encountered in the case locations.

2. Photography study
for ecosystem analysis at local scale, this will be fieldwork. This study will help verify the findings from the GIS data analysis. Unfortunately it is winter and the ecological quality and species diversity might not be very visible.

3. Google earth imagery
Google earth imagery will be used to support the GIS data where it might be lacking or verification is needed. It is also used for reference study and as design inspiration. The outcomes of the ecosystem analysis will inform the design proposal at a regional and intermediate scale, in terms of ecological networks and in terms of species selection.

4. COGNITIVE ANALYSIS

The aim of the cognitive analysis is to analyse the spatial characteristics of the TiB from a cognitive and subjective point of view. Which can give additional insights in the perceived spatial quality of the TiB.

1. Site visit and Cognitive mapping
Creating mental map based on site visit and understanding the sense of the place from the perspective of the urban designer. The Lynch method is used as a tool to map and sketch significant spatial features that help us to make sense of the place (Lynch, 1960). This method investigates the relationship between physical form and sense of place.

2. Site visit and street interviews
In order to create a more complete understanding of the experienced sense of place by other visitors and users of the area some people will be asked about their perception of the area and their reasons of being there. This will be investigated through an unstructured and informal conversation.

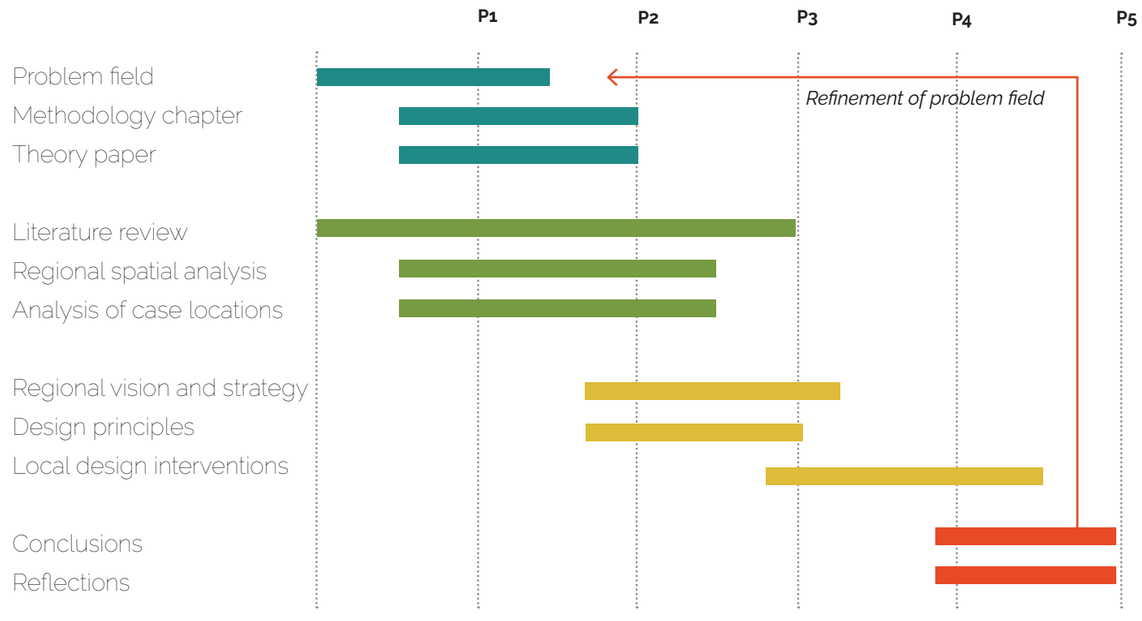
5. STAKEHOLDER ANALYSIS

Considering the ambiguous positioning of the TiB in the environment, land ownership and users of the spaces are often not as clear as they seem. The aim of the stakeholder analysis is to get an understanding of the different parties that need to be involved in the design process, especially at local scale. An onion diagram is used to investigate stakeholders role in the placemaking process. The closer the stakeholder is to the centre the greater its involvement and influence in the design creation and execution (Czischke, 2018).

6. RESEARCH BY DESIGN

Research by design will be the process through which all theoretical and empirical data on the topics of ecology and sense of place that has been gathered so far will be translated into an integral spatial vision and design proposal. Therefore, it is a creative process informed by theoretical and empirical knowledge. Moreover, design will also be used as a tool to test theoretical insights, evaluate them in a the design context of the TiB, refine them to the particular context and enrich the knowledge base on nature based design for the TiB.

Figure 9 : Conceptual time planning of thesis project. Made by author.



2.3 SUMMERY OF METHODS AND OUTCOMES

MAIN RQ

How can a nature based planning and design approach strengthen biodiversity and sense of place in Rotterdam's territories in-between ?

DESIGN OUTCOMES

1. Regional vision and planning strategy.
2. Meso scale transferable design principles for TiB
3. Integrated spatial design proposal for one of the cases.

	SUB RQ	METHODS	OUTCOMES
ANALYSIS	1. *What are the spatial characteristics of Rotterdam's TiB?*	**Spatial analysis** at regional and district scale through GIS mapping.	Map of locations of TiB in the region of Rotterdam and identification of their common spatial characteristics that distinct them from urban and rural environments.
	2. *How are Rotterdam's TiB addressed in local and regional spatial planning processes?*	**Primary and Secondary literature review**	General understanding of considertation of TiB in spatial planning documents particular in the region of Rotterdam.
	3. *What are the ecological opportunities and challenges of Rotterdam's TiB?*	**Ecosystem analysis** through **GIS mapping**, analysis of google earth imagery and **photography study** on site.	Inventory of open spaces (patches and corridors) in the three case study locations which are of potential for ecological improvement.
	4. *What are the challenges and opportunities with respect to sense of place in Rotterdam's TiB?*	**Cognitive analysis** through a site visit and cognitive mapping approach inspired by Lynch mapping method.	General understanding of sense of place perception in the TiB with the respect to the relationship between physical form, function and perception of the place.
	5. *What kind of ecological design interventions can strengthen sense of place in Rotterdam's TiB?*	**Primary literature review**	Inventory of ecological design principles and interventions that can strengthen the sense of place.
DESIGN	6. *What kind of spatial planning strategy can ensure biodiversity and the provisioning of ecosystem services in the TiB at local and regional scale?*	**Research by Design** at strategic and regional level.	Spatial vision and planning strategy for Rotterdam's TiB.
	7. *How can ecologcial design interventions that strengthen the biodiversity and sense of place in the TiB be spatially integrated in a design transformation for a particular case in Rotterdam.*	**Research by Design** At district level, on site.	Proposal for integrated spatial design transformation of particular case that enhances biodiversity and strengthens the sense of place in the TiB.

3. THEORETICAL FRAMEWORK

The aim of this chapter is to provide background information on the key theories and concepts that have been of inspiration and support for the vision and design strategy.

Image made by author

3.1 OVERVIEW OF KEY CONCEPTS AND THEORIES

This section briefly discusses the key theory domains that support this thesis project.
The primary research domains and their interrelationship is shown in figure 10. Placing these concepts and theories in the context of the TiB defines the scope of this thesis project. Section 3.2 and 3.3 provide in depth explanation on landscape ecology and sense of place theory, the relationship between them and their specific importance for the project.

TERRITORIES IN-BETWEEN

This concept describes the context of the design assignment of the thesis project. Therefore it discusses the specific challenges and potentials of these landscapes from the perspective of sense of place and ecology theories.
The theory paper elaborates on the definition of Territories in-between and related concepts and the integration of TiB in Dutch spatial planning tradition (Appendix V). This helps answering sub -research questions 1 and 2.

ECOLOGY

The research domain of ecology is very broad and encompasses many other related concepts and theories. This thesis project aims to improve biodiversity in the context of the TiB through the implementation of ecological design interventions. In landscape ecology the spatial configuration of the landscape and its resulting flows and process are the main focus of attention. (Forman, 1995) Ecosystem services (ESS) is one of the concepts that describes this interaction from the perspective of services provided by the natural environment (Carpenter et al, 2009). Sense of place is one of these services that people can enjoy from natural environments.

SENSE OF PLACE

Sense of place is a complex concept that describes the perception and attachment of people to their living environment. In this thesis project sense of place is considered as a quality of the physical environment that can be strengthened by ecological design interventions through the provisioning of ecosystem services.
The notion of sense of place, its different dimensions and its relationship to nature based design will be further elaborated on the next page.

NATURE-BASED PLACEMAKING

Placemaking is a design approach that aims at improving the spatial quality of spaces by means of engaging with the local community and using their place-based knowledge as fundamental input for the design (PPS, 2013). The idea behind this is that the local community knows what is best for the space. The overall aim of placemaking is to transform spaces into places. Placemaking is considered as an approach to strengthen sense of place (Wyckoff, 2014). Furthermore, involving local community in the design process benefits stewardship over the place (Ellery & Ellery, 2019).

The specific design approach of the thesis project is described as nature-based placemaking. The theory paper further elaborates on the potential and implications of such an approach for spatial planning and design practice with respect to the TiB. Nature-based placemaking is described as a design approach that aims to transform spaces into places by integrating not only the needs of the local community in the design process, but also the needs of local nature and looks at nature as a primary tool for placemaking Further explanation in theory paper. (Appendix V).

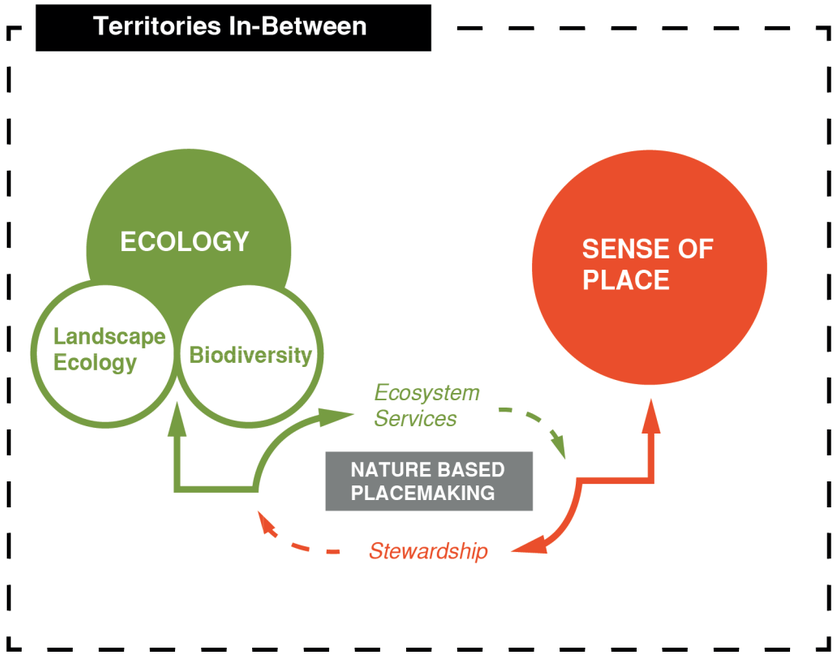


Figure 10: Theoretical framework of thesis project. Made by author.

Figure 11 : Abstract theory paper

RECONSIDERING THE TERRITORIES IN-BETWEEN

Understanding how an integrated placemaking approach can strengthen the ecological quality and sense of place of the territories in-between.

Abstract
Territories in-between (TiB) have gained increased attention the past decades. These territories are identified as territories somewhere in-between the urban and rural. Because of their unique spatial characteristics, they tend to be of great potential for the provisioning of ecosystem services. However, neglect of attention given to the TiB in spatial planning and decision-making does not only limit the ecological quality of these landscapes, but also causes these territories to be identified as placeless. Findings conclude that the open spaces of the TiB offer a window of opportunity for the improvement of spatial quality in the TiB from both a social and ecological perspective. Green space interventions for the open spaces of the TiB can improve the ecological quality and strengthen the sense of place through the provisioning of ecosystem services. In order to achieve this, a nature-based placemaking approach for the open spaces of the TiB is proposed to integrate not only the needs of local residents and stakeholders in the design process, but also the needs of the natural environment.

Key words: Territories In-Between, Ecosystem-Services, Sense of place, Ecological design, Placemaking, The Netherlands.

3.2 LANDSCAPE ECOLOGY THEORY

PATCH-CORRIDOR MATRIX MODEL EXPLAINED

Forman's patch-corridor matrix model is a fundamental research and design model used in the field of landscape ecology (Forman, 1995). The model describes the arrangement of different spatial landscape elements that together make up the greater landscape structure, the landscape mosaic. According to Forman, the landscape mosaic is composed of three universal type of elements; patches, corridors and the matrix (figure 12).
The patch corridor matrix model can be applied in both very anthropogenic or natural environments and also at different scales. This makes the model a very effective research and design tool for spatial planners and designers. Moreover, the model provides a way to compare very dissimilar looking landscapes on a landscape structural level (Forman, 1995).

Patches

Patches are individual, non-linear, landscape surface areas that have a different appearance from their surroundings. The patch itself is homogeneous in terms of structure and composition. Examples are: open field in a forest, or a park in the city. In order to recognize a patch the researcher should first define the scale at which the landscape is analysed.

Corridors

Corridors are linear landscape elements which connect patches. Examples are: river corridors or roadside vegetation.

Matrix

The matrix is the predominant type of land uses surrounding patches and corridors. Examples are: urban landscapes and agricultural or natural landscapes.

Designing edges and boundaries

The design of patch edges and boundaries deserves specific attention because their characteristics are of great influence to species migration and human - nature interaction. This change of behaviour near habitat edges is described edge effect (Forman, 1995) .
The edge is described as the outer portion of a patch where the environment differs significantly from the interior of the patch.
"*As human development continues its expansion into natural environments, the edges will increasingly form the critical point of interaction between human-made and natural habitats*" - Richard T.T. Forman, 1995
Landscape architects and urban designers can re-shape patch boundaries to achieve ecological objectives. The following principles that will be discussed illustrate how the design of patch edges and boundaries can influence ecological functioning of the landscape (figure 13). It can be concluded that: Urban-rural boundaries which have a high structural diversity, are irregularly shaped and provide a smooth gradient between urban and rural are essential for species richness, movement and interaction.

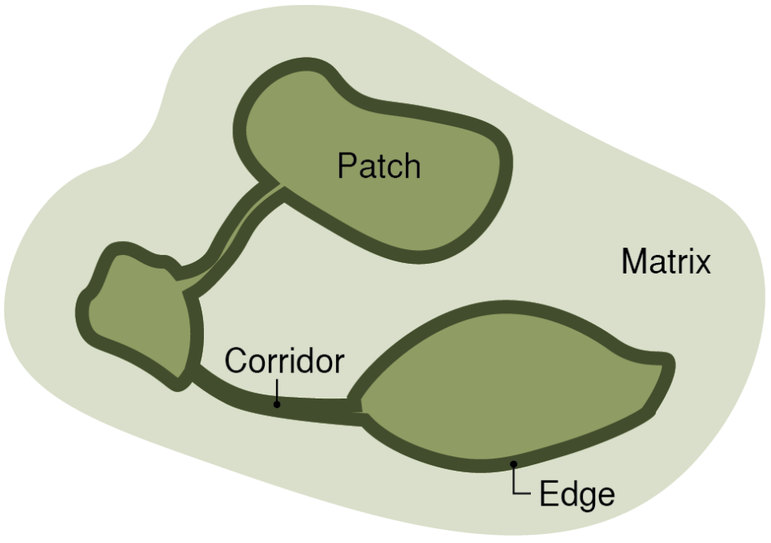


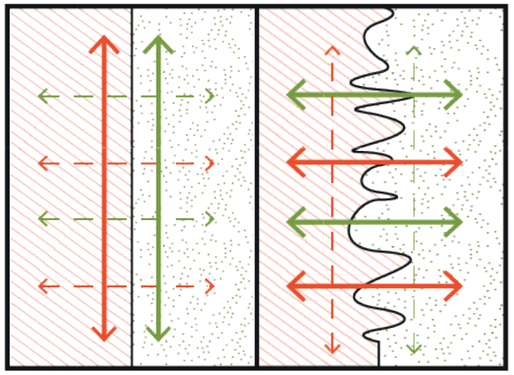
Figure 12: Conceptual representation of patch-corridor-matrix model.. Adapted from: Forman (1995)

1. Edge structural diversity

Vegetative edges with high structural diversity are richer in edge animal species. This concept is later described as landscape heterogeneity.
.

3. Straight and curvilinear boundaries

A curvilinear boundary tends to have more movement across it and provides greater habitat diversity which increases species richness.



2. Edge abruptness

Less edge abruptness tends to favour moment across an edge.

4. Interaction with surroundings

The more convoluted the shape of a patch the more interaction there is between patch and surrounding matrix.

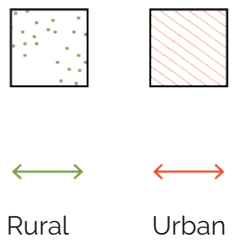


Figure 13: Conceptual representation of design principles for patch edges and boundaries. Adapted from: Dramsta, Olsen & Forman (1996)

LANDSCAPE HETEROGENEITY

The ensemble of multiple patches corridors and the matrix in the landscape is called the landscape mosaic. On a macro level, this mosaic of patches can be described by its degree of heterogeneity. The greater the diversity of patches and the greater the spatial mix of them within a specific area, the greater the landscape heterogeneity Landscape heterogeneity is a fundamental aspect of landscape ecology that aims to relate spatial patterns to processes (Fahrig, Baudry, Brotons, Burel, Crist, Fuller, & Martin, 2011).

Landscape heterogeneity is driven by two aspects: on the one hand the diversity of habitat types (compositional heterogeneity) and on the other hand the size, number and spatial arrangement of these habitats (configurational heterogeneity) (figure 14). Theoretically speaking, increased compositional heterogeneity leads to more biodiversity as a result of greater habitat diversity within the territory, but also creates added value as a result of the combination of resources provided within a specific territory. A greater diversity of land cover types provide complementary resources, such as food, places of refuge and nesting places for different times in an organisms life cycle. Additionally, greater configurational heterogeneity can also increase biodiversity as a result of increased connectivity and interspecies interaction (Fahring et al. 2011). The relationship between landscape heterogeneity and biodiversity is depicted in figure 15.

Even though, landscape heterogeneity studies have mainly focused on natural , semi-natural and rural landscapes the assumption in this thesis project is made that landscape heterogeneity principles can also be applied on more anthropogenic and semi-urban landscapes creating similar results. Moreover, it is assumed that increased landscape heterogeneity does not only increase biodiversity, but also social diversity (the diversity of humans).

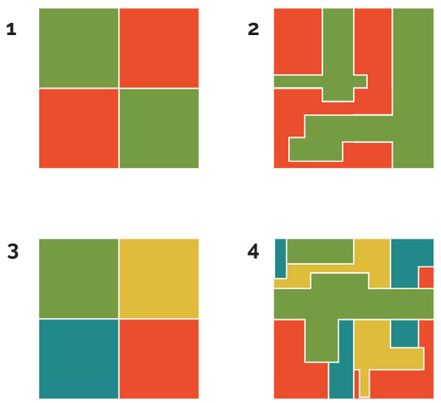


Figure 14:
Conceptual represenation of landscape heterogeneity patterns. Adapted from: Fahring et al. (2011) figure 3 pag. 104.

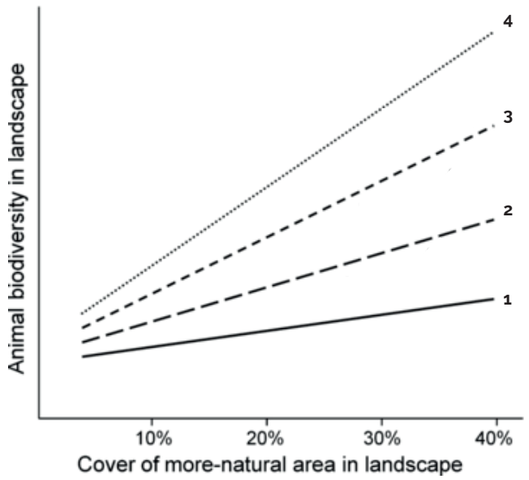


Figure 15:
Relationship between landscape heterogeneity and biodiversity. Numbers corresponding with figure 14. Adapted from: Fahring et al. (2011) figure 4 pag. 105.

3.3 SENSE OF PLACE

THE RELATIONSHIP BETWEEN SENSE OF PLACE AND NATURE

Sense of place can be described as the relationship between people, their imagination and the physical environment. The concept is rooted in both objective influences of the environment such as landscape design, form and sensory perceptions (smell, sound, climate etc.) and on the other hand subjective experiences such as memories, emotion and culture. **Therefore, sense of place is a complex concept about the emotional attachment of people to their living environment as a result of their interaction with the landscape** (Bush et al, 2020; Shamai, 1991). Facilitating human-nature interaction is therefore essential for sense of place (figure 16). In urban environments sense of place can be described by the qualities that contribute to the distinctiveness and uniqueness of the place. Consequently, transforming the space into a place. According to Canter a place is created by three main elements which are: form, function and meaning (Canter, 1977; as cited in Ghani, Rahman, Nayan & Bahaluddin, 2018) . These elements also describe the type of relationships between humans and the environment, respectively, cognitive, behavioural and emotional. These different dimensions of sense of place are shown in figure 17. The cognitive dimension describes the way in which people perceive elements of the physical landscape and use it to navigate through space. The behavioural dimension talks about the functional relationship and activities that people enjoy in the place. (Hashemnezhad, Heidari & Mohammad Hoseini, 2013). It is argued that good physical form and good function lead to good emotional response (meaning) which results in enhanced sense of place. The emotional dimension is therefore a result of the other two dimensions, the behavioural and the cognitive. (Ghani et al., 2018) However, it is also formed by cultural values and personal experiences.

This is crucial to understand for urban designers as landscape perception can differ among users of the spaces, therefore sense of place is very person dependent (Hashemnezhad, Heidari & Mohammad Hoseini, 2013) Understanding people's sense of place gives urban designers insight in the needs and wishes of different user groups.

By incorporating these meanings into the design for example trough a participatory design process the urban designer can create a design that fits people's sense of place and positively contributes to people's meanings of the place, which can in turn enhance stewardship.

Figure 16:
Kids interacting with the natural environment..
retrieved from: findasenseofplace.com

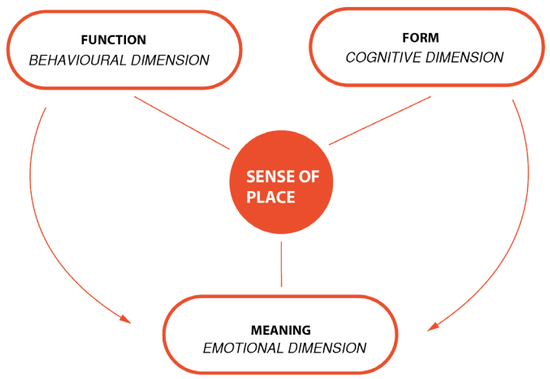


Figure 17:
Diagram of different components of a place and corresponding relational dimensions between people and places. Adapted from: Hashemnezhad, Heidari & Mohammad Hoseini, 2013, p. 6

Image made by author

4. SPATIAL ANALYSIS

This chapter discusses the spatial characterstics of the landscape of the region of Rotterdam. It will elaborate on the ecological and cognitive characteristics of the in-between territories at both regional and local scale.

4.1 THE LANDSCAPE

The landscape that surrounds the city of Rotterdam can be classified into several landscape typologies. Doing so gives an understanding of the ecological characteristics i.e. soil composition and species distribution that can be expected in different part of the region. It is important to understand what landscape structures and species are typical for a certain landscape typologies in order to construct a resilient ecosystem and design with respect to "sense of place". The key landscape typologies that surround the urbanised region of Rotterdam are the peat landscape in the east of the city (bright green), the large industrial reclaimed sea clay polders (droogmakerijen) in the north of the city, the Dune landscape at the coast at Hoek van Holland and the old sea clay polders of the river delta in the south (figure 18). The landscape unit map provides a guide for the selection of case study locations that differ from each other in terms of landscape morphology and ecological potential.

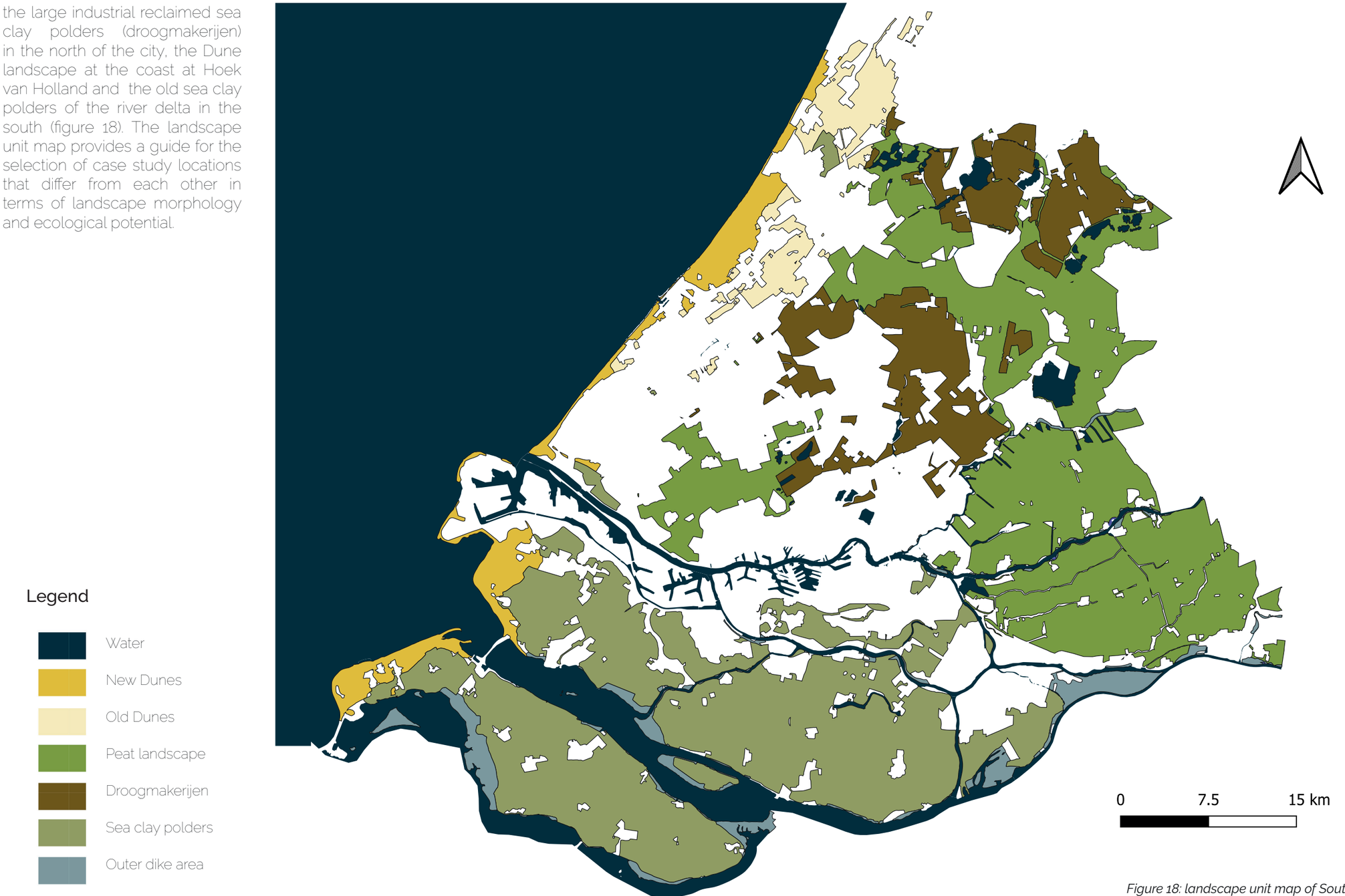


Figure 18: landscape unit map of South-Holland. Made by author based on GIS data.

ICON SPECIES IN THE LANDSCAPE OF SOUTH HOLLAND

This page shows 4 landscape types in the region of Rotterdam that have been identified and linked to specific icon species of the province of South-Holland. These species resemble specific landscape qualities and ecosystems. They are therefore an indicator of the landscape quality (van den Boogaard, Verbeek, Buizer, 2019). This page only shows a selection of icons species (figure 19).

Figure 19: Landscapes and (some) corresponding iconspecies, made by author. Image sources in bibliography.

Common Blackbird
Turdus merula

Early Bumblebee
Bombus pratorum

urban landscape

Hedgehog
Erinaceus europaeus

Common Swift
Apus apus

Tundra Vole
Microtus oeconomus

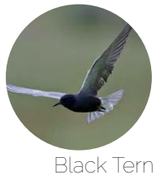
Bluethroat
Luscinia svecica

River and delta landscape

Barnacle goose
Branta leucopsis

Bumblebee
Bombus veteranus

Purple Heron
Ardea purpurea



Black Tern
Chlidonias niger

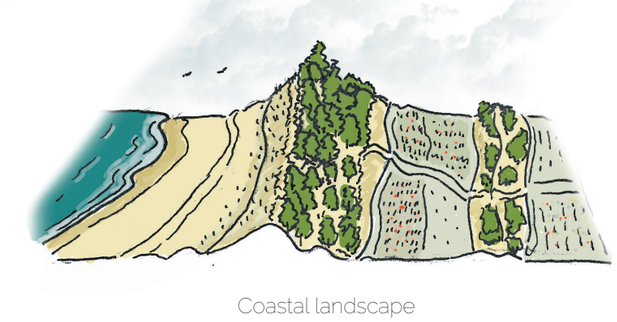
Peat meadow landscape

Wall Brown
Lasiommata megera

Grey Partridge
Perdix perdix

Song Thrush
Turdus philomelos

Natterjack toad
Epidalea calamita

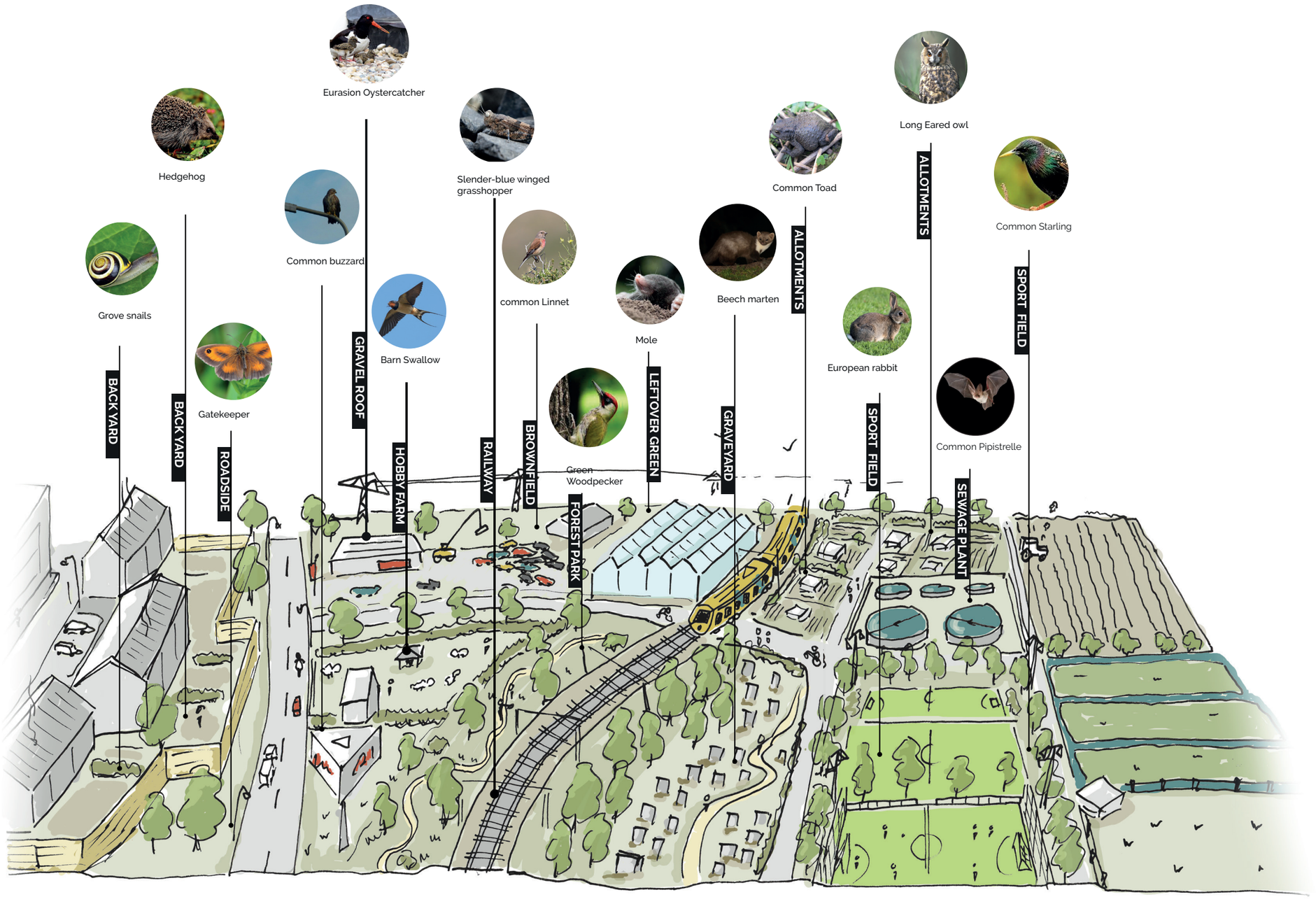


Coastal landscape

Grayling
Hipparchia semele

Sand lizard
Lacerta agilis

Figure 20: Proposed selection of habitats and iconspecies of the TIB.
Sources that have been used to come to selection:
zoogdierverengiging.nl
waarneming.nl
vogelbescherming.nl
Bureau Spoorbouwmeester (2012)
Dehavenloods.nl
Natuurpunt.be
Image sources in bibliography.



HABITATS AND SPECIES OF THE TERRITORY IN-BETWEEN

Figure 20 shows a selection of species and their habitats which are typical for the TiB. The TiB provides a habitat for general as well as endangered species. Species which are more often associated with urban landscapes, but also species which are more associated with the rural landscape. Therefore, the TiB provides unique habitats that are different from merely urban and rural landscapes. Unique interactions between species takes place that is not seen in urban or rural landscapes.. Therefore, we should make space for the TiB

MAPPING THE TERRITORIES IN-BETWEEN

The aim of the regional spatial analysis is to get an understanding of the widespread spatial distribution of the TiB across the landscape of Rotterdam at a regional scale. Furthermore, the task of mapping these landscapes gives insight in the spatial and functional characteristics which typify the TiB. Wandl has yet developed new territorial classification method to map the TiB and distinct them from the urban and rural. The province of South Holland was used as a case study to test and develop this mapping method. The resulting maps clearly show the widespread distribution of the TiB in the province of South-Holland and emphasises the network like structure of the TiB and the underlying connectivity of places with different functions (figure 21) (Wandl, 2020). Wandl's mapping method seems to be of specific interest at the regional scale. However, because this thesis project aims to investigate the TiB also at a district and local level it will useful to get a more qualitative understanding of the spatial characteristics of the TiB in different places, i.e what makes one TiB different from the other? In order to do so I propose an alternative mapping method that aims to create more qualitative and understanding of the TiB. By overlapping different typical characteristics of the TiB it is argued that certain place posses a higher degree of in-betweenness than others and are of greater interest to be elaborated in this thesis project. A shadow map is created based upon four typical features of the TiB which are: 1. Major road and rail infrastructure corridors (figure 22); 2. Transition zone between urban settlements and rural land (figure 23); 3. Degree of landscape protection by environmental protection policies (figure 24). The more environmental protection policies the less likely the landscape will developed as TiB; 4. Functional uses, either industrial, commercial or recreational (figure 25). These functions are often prone to transformation. Housing areas, nature and agriculture are excluded.

When comparing the shadow map in figure 26 with Wandl's map of South-Holland it can be seen that the dark brown areas show overlap with the TiB as they have been mapped by Wandl. For example the port and green house areas in the west which are clearly identified in both maps. The maps both have different purpose and intention and are therefore complementary to each other.

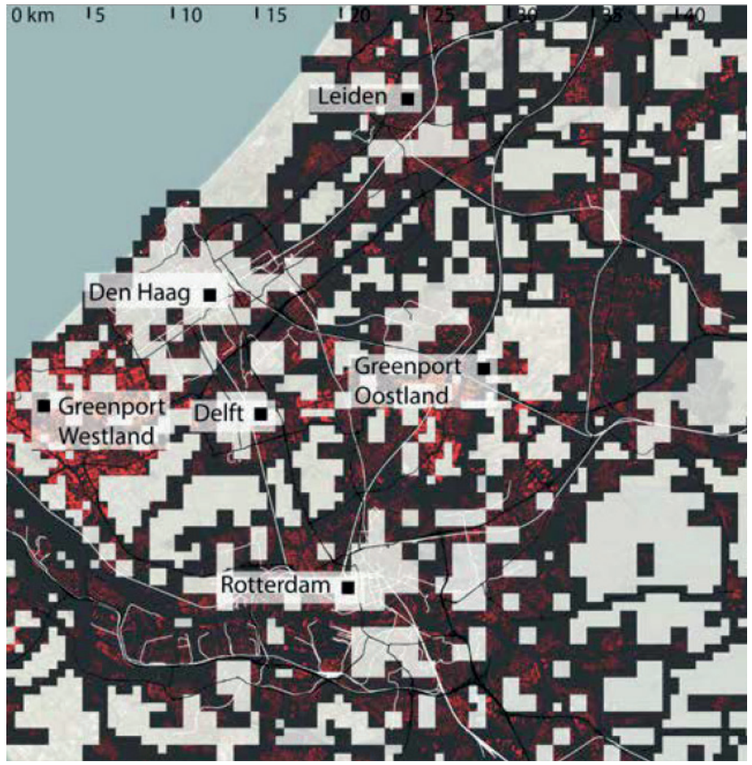


Figure 21: Map of TiB in South-Holland From: Territories -in- between: A cross case comparison of Dispersed Urban Development in Europe (p. 307) by A. Wandl (2020)

Figure 22: Infrastructure network including national roads, provincial roads and train railways. Made by author. with use of GIS data .

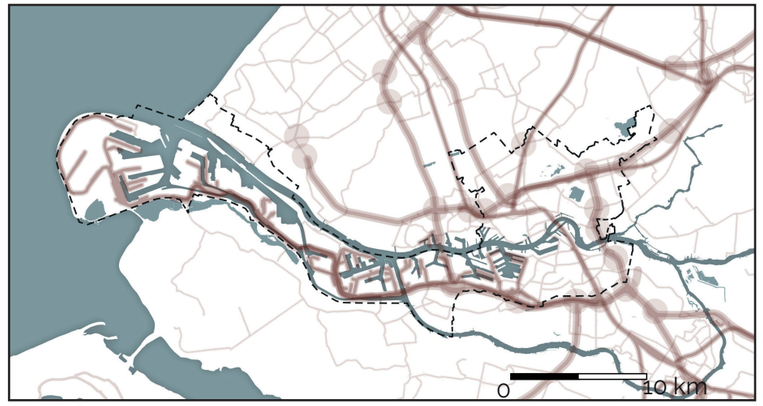


Figure 23: Map showing transition zone between the built and unbuilt evironment. Made by author, with use of GIS data.

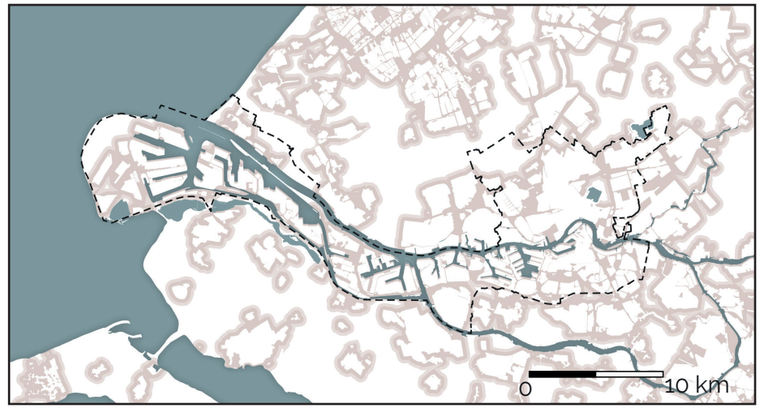


Figure 24: Degree of protection by environmental policies. Including Natura 2000, Stiltegebieden, Natuur Netwerk Nederland, areas with landscape archeological value (aardkundige waardevol). With use of GIS data.

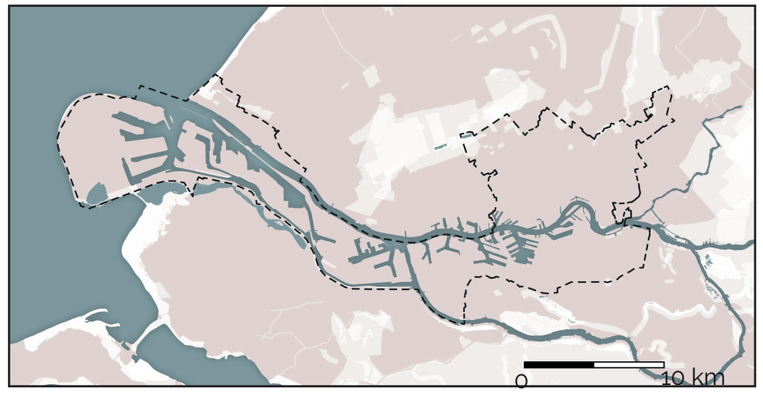


Figure 25: Functional landscapes: industrial, commercial or recreational (nature and agricultural areas excluded) Made by author, with use of GIS land use dataset.

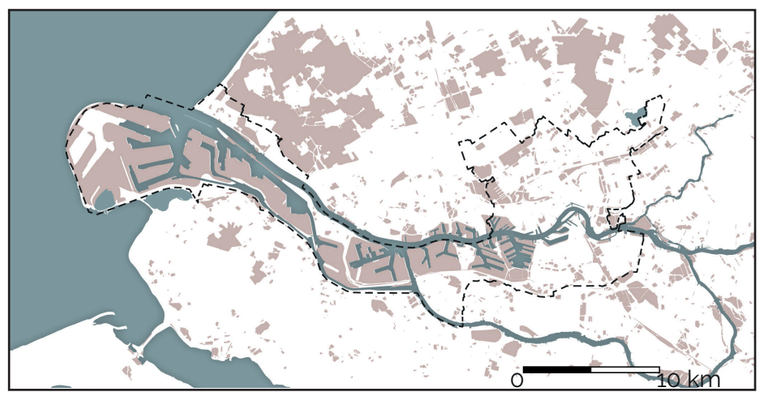
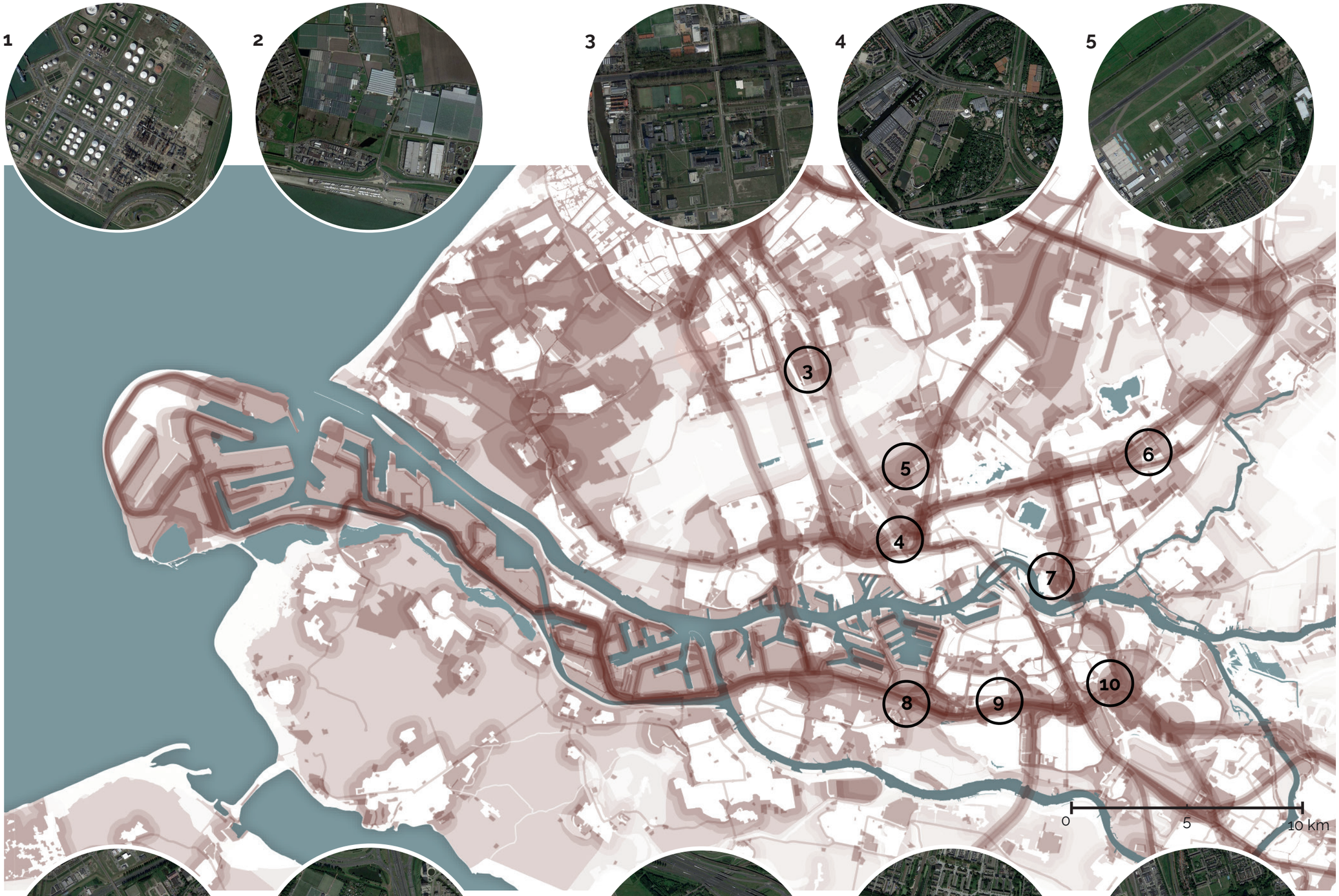


Figure 26:
Shadow map of TiB with circles showing the great abundence and diversity of TiB in the region of Rotterdam. Important landscapes that belong to the TiB in Rotterdam are the harbor area (1), the green house areas (2), the university campus sites (3), the airport (5) the area around the highway ring road (4, 8,9,10) and some mixed use recreational landscapes at the edges of the city with sportfields and allotment gardens (4, 6, 9)
source: Google Earth imagery.



Degree to which locations contain features of TiB.

Low

High

Administrative boundary of municipality of Rotterdam.

Water

REGIONAL GREEN STRUCTURE

As has yet been stated the TiB often posses a great amount of open spaces that can be of great ecological potential (theory paper, appendix V). Therefore, it is useful to look at environmental planning documents and gain insight on how the TiB are considered in these documents. Figure 27 shows the ecological structure of the region of Rotterdam. The map shows both the urban green structure of the city of Rotterdam, as it has been mapped by the municipality, as well as the national ecological structure (NNN). When comparing this map to the shadow map of the TiB from figure 26 it becomes clear that indeed quite some of the urban green spaces that are mapped are part of the TiB. However, it also seems that a significant amount of areas that belong to the TiB have not been included in the map, such as: green house areas, commercial districts and the harbour area which are an essential part of the TiB in Rotterdam. Therefore, these territories can be of specific attention for ecological improvement, especially as they are often located at the edges of the city and can provide an ecological link between the local and national green structures. In order to get better insight in the true green structure of the region of Rotterdam that transcends municipal boundaries, GIS data has been used to map the (true) spatial green structure of the region. This map is shown in figure 28. This map also distincts recreational green structures from leftover green spaces and agricultural green spaces. This map will be used as a base for the regional design proposal.

Figure 27: Ecological structure map region of Rotterdam. Information on green structure adapted from Natuurkaart Rotterdam from: https://rotterdam.maps.arcgis.com/home/webmap

Figure 28: True Ecological structure map region of Rotterdam. Made by author with use of GIS data.

LANDSCAPE HETEROGENEITY STUDY

In order to explore how landscape heterogeneity manifests itself in the TiB a simple spatial analysis of google earth imagery has been conducted (figure 29). This page shows the 4 types of landscape mosaics that can be found in the TiB of Rotterdam, ranging from homogeneous to very heterogeneous. The main conclusion that is derived from this analysis is that even though the TiB are generally considered to be mixed-use their landscape pattern at local scale is not necesserely heterogeneous in composition and/or configuration. Moreover, it can be concluded that there is a great diversity of landscape patterns within the TiB. All shown locations can be considered as territory in-between.
From a social and ecological perspective type 4 (right bottom of the page) is most favourable because of its great diversity of habitat types and high spatial complexity and strong sense of human scale.

Figure 29: Spatial analysis of landscape heterogeinity in the TiB with use of google earth imagery and conceptual diagrams adapted from: Fahring et al. (2011)

Businesspark Rotterdam-Albrandswaards

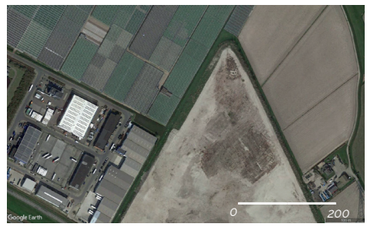
Rotterdam-Albrandswaard
Abel Tasmanstraat,

Tweede Maasvlakte, Industrial development site

Maasvlakteweg, industrial development site.

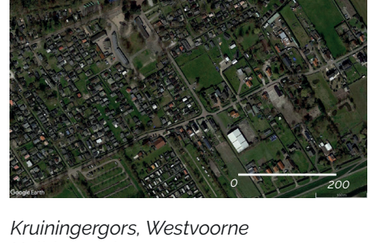
Schiedam
mix-use cluster of recreational facilities

Schiedam
Sporfields along Olympiaweg.



Hoek van Holland
clustering of industrial and agricultural land uses.

Hoek van Holland
Kulkweg



Kruiningergors, Westvoorne
Holiday park

Kruiningergors, Westvoorne
Zeehoeveweg

Broekpolder, Vlaardingen
Recreational area

Broekpolderpad, Vlaardingen
Recreational area

Stadsdeelpark, Capelle a/d IJssel
mixed-use area

Bermweg, Capelle a/d IJssel
mixed-use area

Zuidelijk Randpark, Rotterdam
mixed-use area

Charloisse Lagedijk, Rotterdam
mixed-use area

4.2 CASE SITE ANALYSIS

Selection of case study locations

Based on the three criteria that have been set for the case site selection and the results of the regional analysis the following three locations for local site analysis have been selected (shown in figure 30):

1. Hoek van Holland - De Haak
2. Nieuwekerk a/d IJssel - Parkzoom
3. Ridderkerk - Cornelisland

All the three locations possess the typical spatial and functional characteristics of the TiB and are therefore exemplary. Furthermore, they are all located in a different landscape typology and all three of them possess a certain degree of urgency because they are somehow subject of a proposed redevelopment project. Each case location is 2 km by 2 km. This size was determined, because it is just big enough to include most of the spatial features of the TiB in one frame, while still being able to visit most of the site by foot and comprehend the area as a whole within a reasonable time. For most cases defining clear cut spatial boundaries of the TiB is not possible therefore the 2 by 2 km frame is a strategically placed cut out of the landscape.

For each location the ecological structure will be mapped and analysed and a cogntive map will be created to understand the cognitive and perceptual qualities of the area.
Finally, the chapter will be concluded with a short comparison of the three areas. The findings from this chapter help refine and understand the spatial problems and potentials of the TiB in Rotterdam at local level.

Figure 30: Case site locations. Made by author.

HOEK VAN HOLLAND - DE HAAK

The location of Hoek van Holland - De haak is located at the most western part of the municipality of Rotterdam and is situated in a landscape that contains spatial features that are typical for the dune landscape as well as the sea clay polder landscape. It is located about 0.5 to 2m above NAP which is significantly higher compared to the rest of Rotterdam.

Figure 32: Location of case study area (google earth). Made by author.

Figure 31 Aeral image of selected case location Hoek van Holland - De Haak .Source: Google Earth (2020)

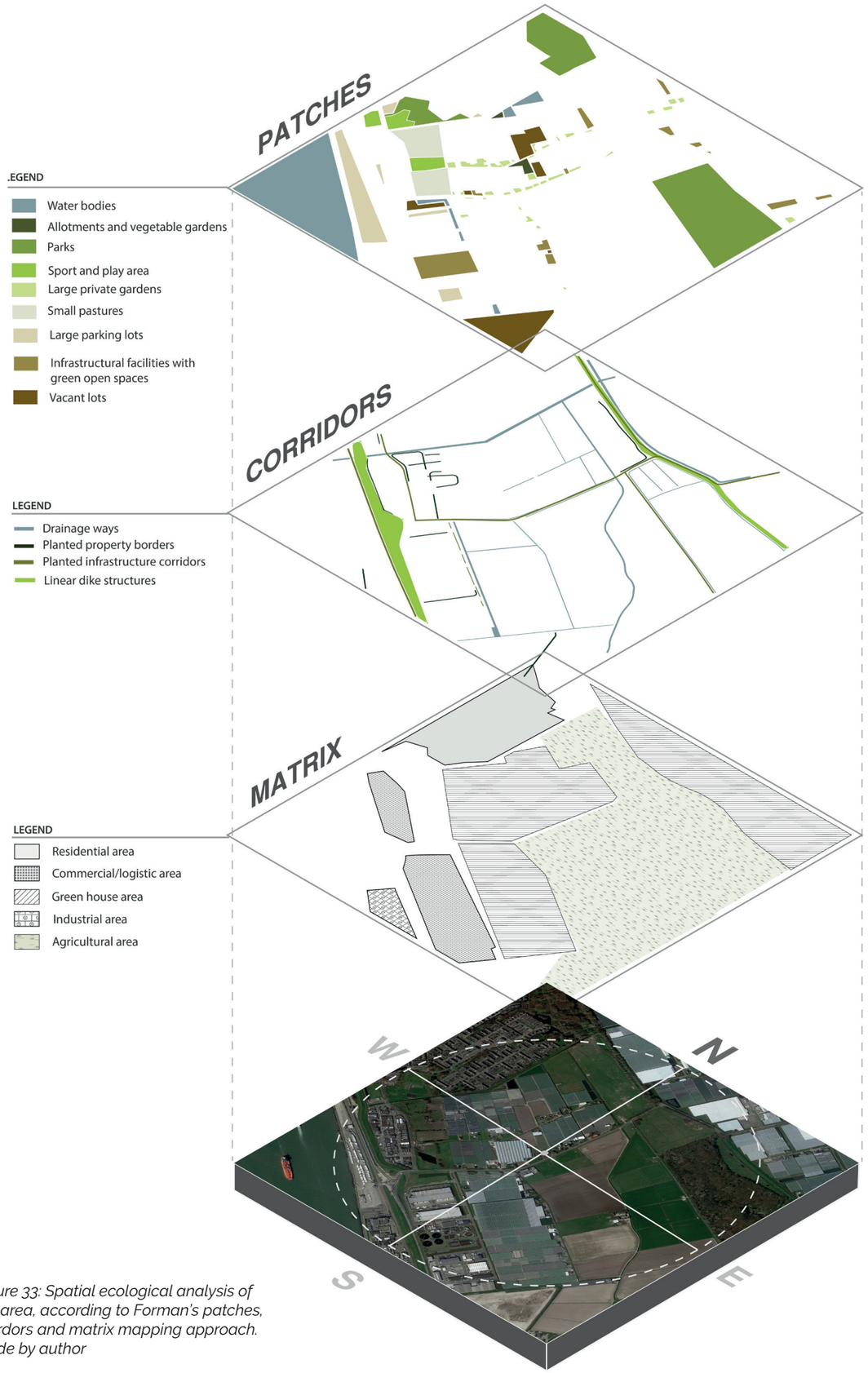


Figure 33: Spatial ecological analysis of the area, according to Forman's patches, corrdors and matrix mapping approach. Made by author

Figure 34: Photo on site showing a grass monoculture lawn functioning as recreational site. As a result of the very limited species diversity the place does not contribute much to biodiversity.

Figure 35: Photo showing planted road corridor on the site location. The roadsides are planted with multiple layers of vegetation, ground vegetation, shrubs and trees. Moreover, the species seem to be native to the dune area. This diversity of species planted along the roadside makes it a valuable ecological corridor for wildlife.

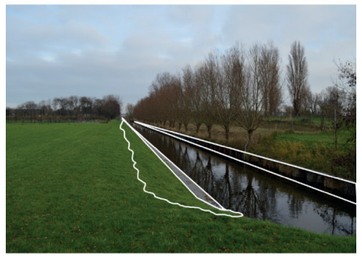


Figure 36: The photo on the right shows one of the drainage canals in the area that have been constructed with a hard straight edge. This artificially constructed edge limits the potential of the edge for ecological habitats.

Figure 37: Photo showing roadside planting along the water sewage facility. Compared to figure 35 this corridor contains less species diversity and adds less to biodiversity.

Figure 38: Photo showing rubber granules spread out around the artifical sports field. The rubber granules seem to spread up till 20 meters around the area of the sports field. This is harmful for wildlife, especially because the drainage canal is located just next to the field.

ECOLOGICAL ANALYSIS

The matrix of the landscape of this territory in-between is mostly defined by large scale green house developments, commercial (storage) facilities and large scale agriculture (figure 33). These land uses fragment the landscape at a large scale and have a very large grain size which makes the landscape very inaccessible for people and wildlife (more photos of the location can be found in appendix IV) As a result of this, the landscape seems to function as a kind of barrier between the urban and rural landscape. Nevertheless, there are several linear structures which can potentially function as important ecological corridors such as the dike connecting the park in the north west of the area and the park in the east of the site. Moreover, small drainage ways in between the green houses provide small ecological connections within the matrix of green houses. Furthermore, the area is characterised by an abundance of roadside vegetation that is native to the area (figure 35). The large front yards of the green house owners together form an ecological corridor in-between the matrix of green houses. Additionally, the small pastures and recreational spaces in the south west of the site can be an important habitat for species as it connect multiple aquatic and terrestrial corridors on the site.

COGNITIVE ANALYSIS

The sense of place experience of this territory was analysed through walk and car ride in the area through which I tried to consciously interpreted the surroundings and navigate myself through the area. I used my perceptions and experiences of this field visit to create a cognitive map of the area, for this I used the Lynch mapping method (lynch, 1960). The result of this cognitive mapping approach is shown in figure 39. The map portrays the difficulties of the area with respect to its physical form and sense of place. Key difficulties of this area are the poor walkability by foot. At many places I had to walk at the side of the road or on the bike track. Furthermore, the high dike in the south of the area acts as a visual barrier and blocks the view to the river. As a result one does not perceive the river as an element of this landscape.

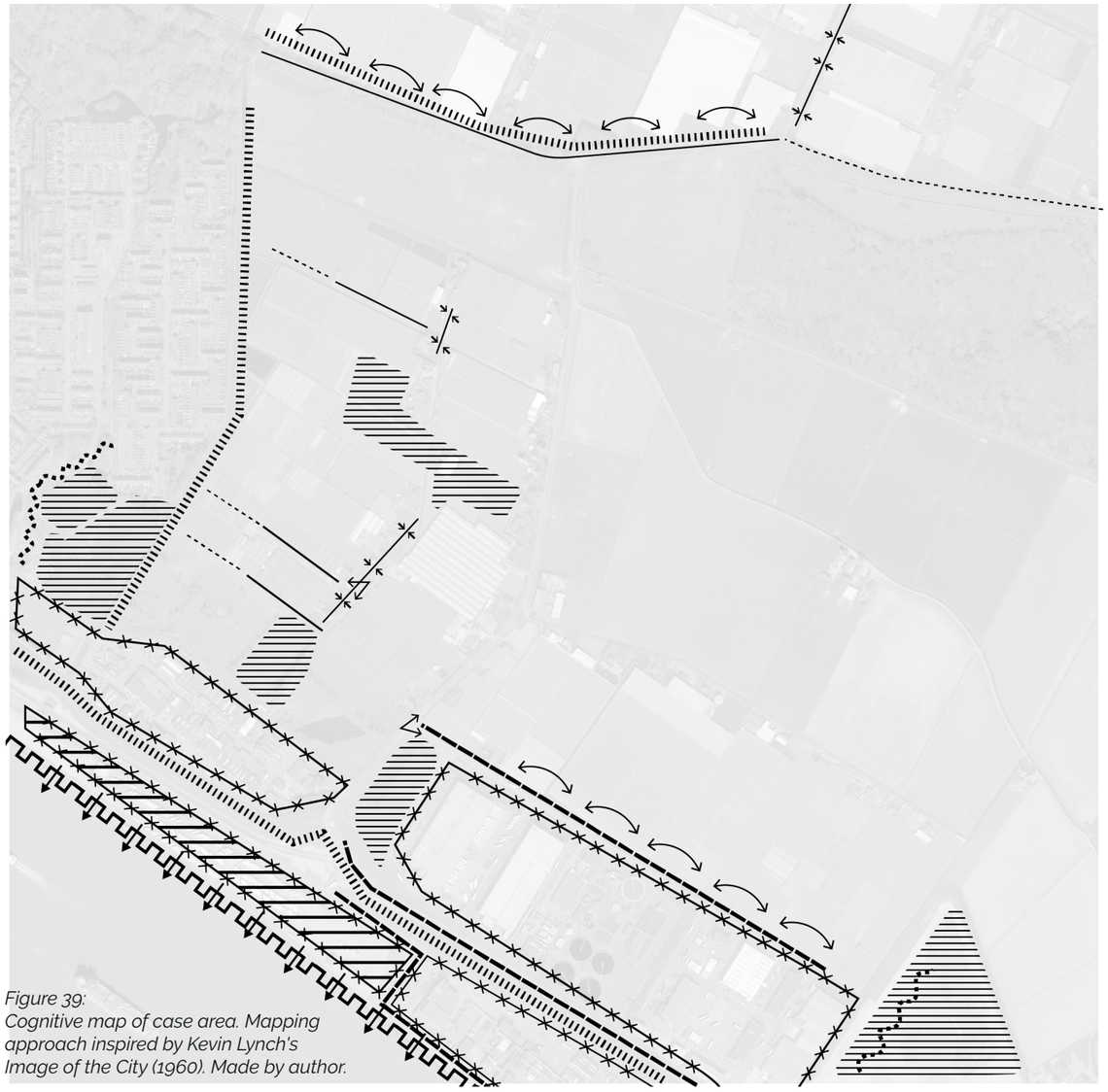


Figure 39:
Cognitive map of case area. Mapping approach inspired by Kevin Lynch's Image of the City (1960). Made by author.

Figure 40:
Photo showing the border between the sports fields and the parking lot at the edge of town. This border is somewhat messy and poorly maintained.

Figure 41:
This photo shows the recreational area at the edge of the town. The place is very open. lacks character and looks underused. More layerd vegetation would perhaps be benificial to provide more sense of enclosure and character.

Figure 42:
The photo on the right shows the backside of one of the green houses along a road and is perceived as a physical barrier in the landscape. More could be done to improve the spatial distinctiveness of the space between the road and the green houses to improve landscape legibility and identity.

Figure 43:
This photo was shown in one of the commercial sites with warehouses and parking lots. Because of the large grain size, limited permeability, lack of green and absence of sidewalks it is a very unfriendly place for pedestrians.

Figure 44:
Photo showing poorly maintained path at recreational site. The cracks in the path and the somewhat overgrown shrubs with thorns are unpleasend and create a sense of unsafety.

Furthermore, the backside of the greenhouses next to the streets are sometimes giving a feeling of enclosure and blocking the view to the surrounding landscape and act as a barrier. The monotonous and repetitive lay out of the green houses limits the legibility of the landscape. Orienting yourself in-between these green houses can be hard (figure 32). Finally the sports fields and playgrounds at the edge of the residential neighbourhoods in the west seem neglected and underused (figure 40 and 41). The paths (figure 44) and sports field are poorly maintained and are somewhat unpleasant to be. Across the street I met a man picking trash. He was the owner of the gas station nearby and explained to me that he is all the time busy with cleaning up the spaces around his gas station. This man was clearly annoyed by the lack of responsibility people take for their environment in this place.

"It is always one big mess over here, everyone throws their garbage out of the window and I have to clean up behind them"
- owner of nearby gas station (10 dec 2020)

NIEUWEKERK A/D IJSSEL - PARKZOOM

Image made by author

Compared to the case site at Hoek van Holland this area is located in the peat landscape and is under current redevelopment of housing expansion projects. The open landscape in the middle is enclosed by three municipalities, Rotterdam (North), Capelle aan den IJssel (West) and Zuidplas (East). Compared to the previous site the area seems to have a high recreational value to nearby residents while it is still also in use for small scale industrial activities and highly fragmented by the highway in the north, railway in the middle and provincial road in the south.

Figure 45:
Case location (google earth). Made by author.

Figure 46:
Aeral picture showing case site area.
Source: Google Earth, 2020.

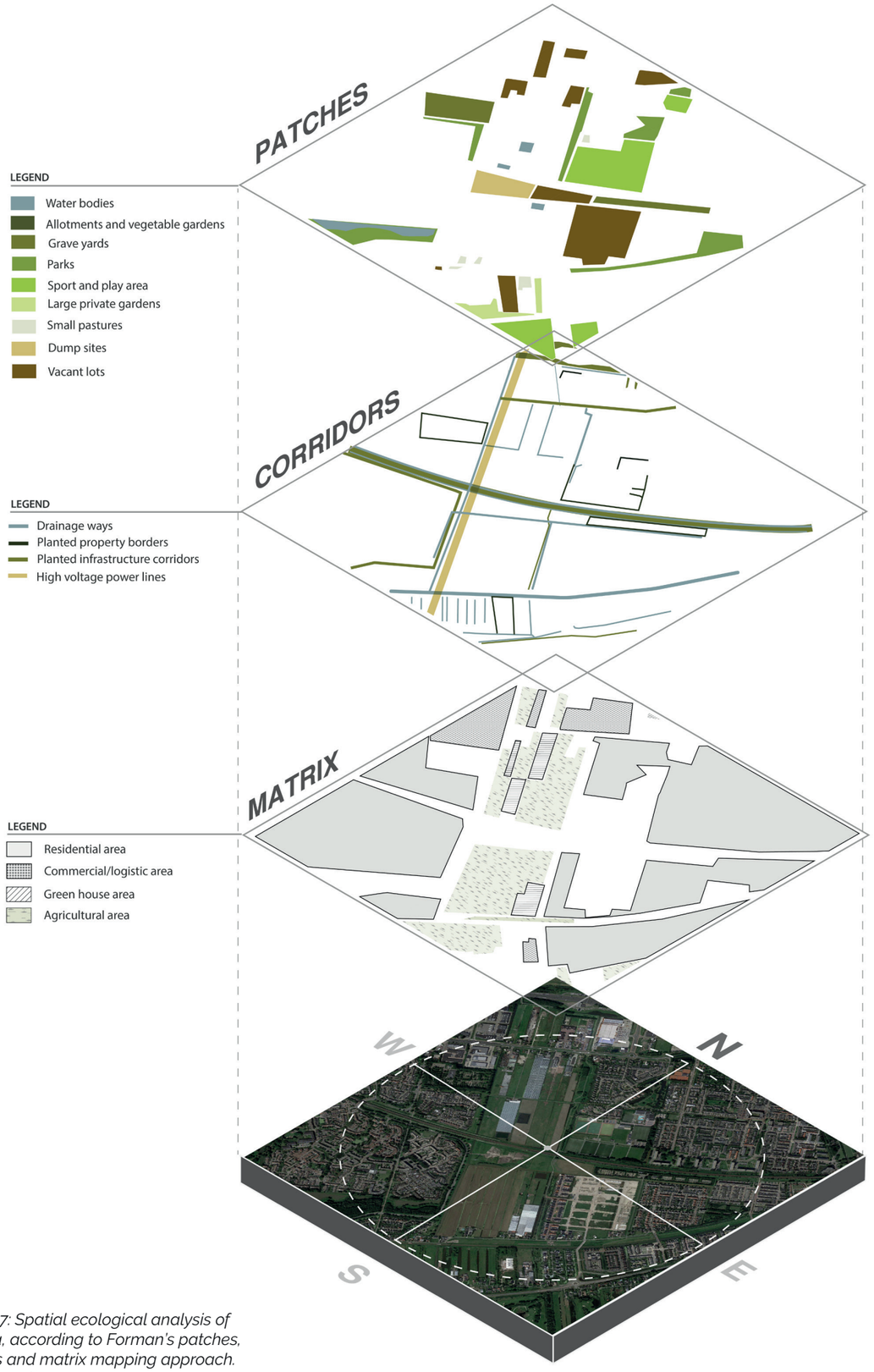


Figure 47: Spatial ecological analysis of the area, according to Forman's patches, corrdors and matrix mapping approach. Made by author

Figure 48: Brownfield at industrial complex. Area in process of redevelopment. The hard quay has the potential to be removed in order to improve ecological gradient.

Figure 49: Small animal farm below high voltage power lines.

Figure 50: The extensively used agricultural patches provide a habitat for birds.

Figure 51: A linear waterway parallel to the high voltage powerlines provides an important aquatic corridor between the north and south of the area.

Figure 52: The elevated railroad provides an ecological corridor through which species can migrate between the east and west of the area.

ECOLOGICAL ANALYSIS

The semi-open landscape of this territory separates the three urban districts of Capelle a/d IJssel and Nieuwekerk a/d IJssel and Rotterdam Alexander. Therefore, this territory functions as a border landscape that defines the physical and cognitive boundaries of the surrounding urban areas. The area is mainly characterised by it's mix of small scale industrial and agricultural activities with a strong recreational use of the landscape for residents of surrounding urban districts. The area seems to be in the process of urban redevelopment. The abundance of vacant lots, extensively used agricultural patches and presence of small recreational areas such as parks, graveyards and sports fields makes this area very divers in terms of ecological habitats (figure 47). Furthermore, the railway track, high voltage power line structure, road infrastructure and drainage ways create multiple east-west and north-south connections that connect the urban biotopes of the three districts with the ecological patches of this territory in-between. At an even larger scale it seems that this area can function as an ecological corridor between the Zevenhuizerplas in the north and the Hollandse IJssel in the south. The A20 highway seems to be the main barrier.

COGNITIVE ANALYSIS

Legend

- lack of differentiation
- characterless/underused area
- isolated area
- characterless path
- enclosed path
- broken path/ missing
- physical barrier
- unclear boundary
- hidden waterfront

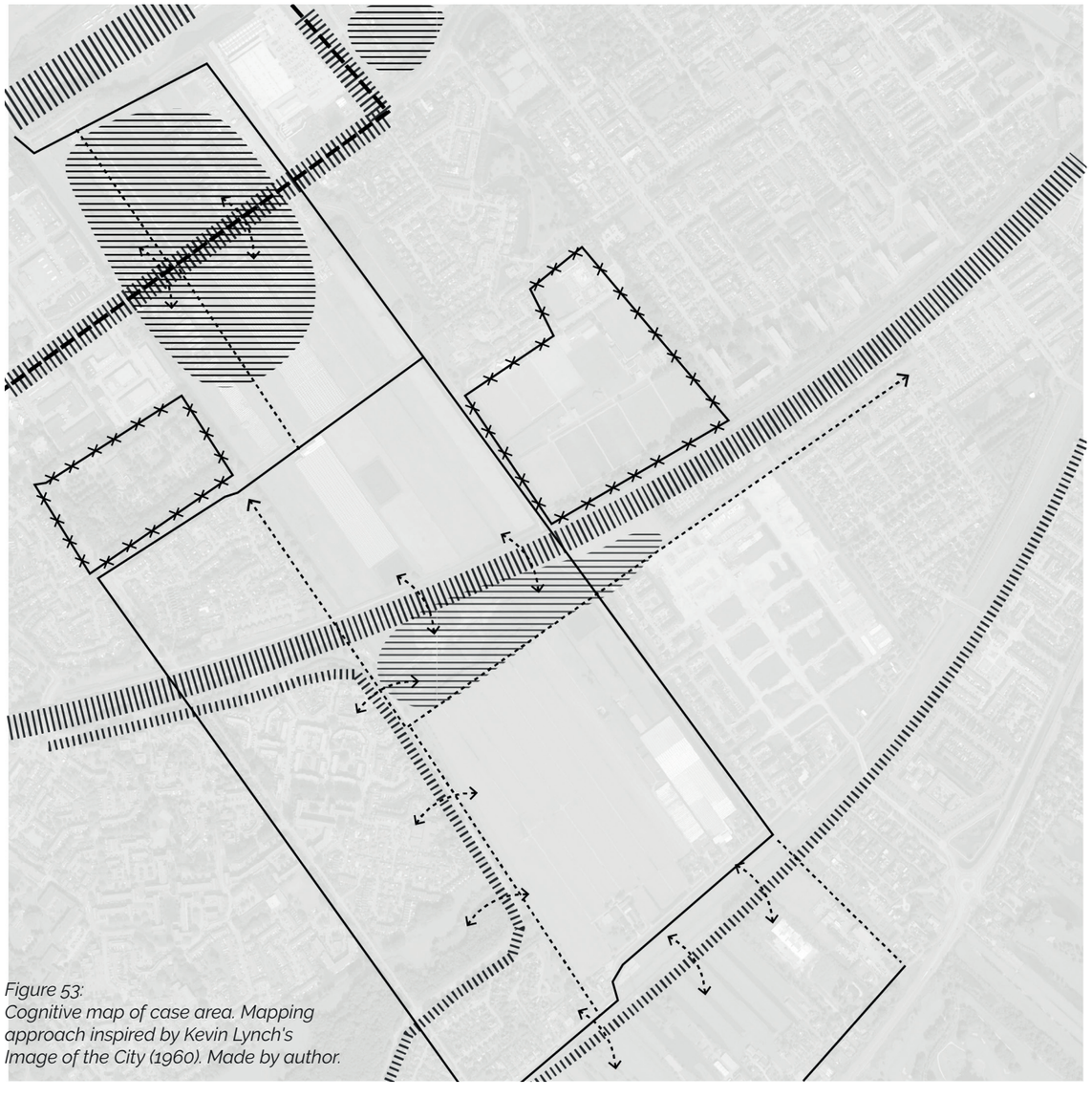


Figure 53:
Cognitive map of case area. Mapping approach inspired by Kevin Lynch's Image of the City (1960). Made by author.

Figure 54: A dog and loose chickens on the driveway of a private property. This is a typical view in the area where there is a great abundance of large properties with domestic/hobby animals. Made by author

Figure 55: A dilapilated greenhouse, plants and vegetation seem to take over. The site is most likely being redeveloped. Made by author.

Figure 56: A dilapilated house to be demolished. Made by author.

Figure 57: View from edge of Capelle a/d IJssel. The green house blocks the view to the new built residential neighborhood of Nieuwekerk. Made by author.

Figure 58: A wall is placed at the edge of Capelle a/d IJssel, most likely functioning as a sound barrier. However, it also blocks the view to the surrounding open landscape, which limits the sense of place. Made by author.

As said in the previous section this territory in-between provides an important cognitive distinction between Rotterdam, Capelle a/d IJssel and Nieuwekerk a/d IJssel. The abundance of open spaces in the landscape is a determining factor defining this boundary. Nevertheless, the boundary between these three urban districts is not everywhere as clear as it could be, especially in the north of the area the appearance of the landscape seems chaotic and undefined at first sight. The industrial activities such as recycling companies, car dealers and green houses along the Hoofdweg block the view to the open landscape and blur the boundary between the two urban districts of Nieuwekerk and Rotterdam. However, according to some residents, the industrial land uses and the dilapidated state of some buildings is part of the identity of this landscape (figure 55 and 56). Another resident points out that she really enjoys the hobby animals in front of people's houses, such as loose chickens, goats and horses (figure 54). I visited this area during lunchtime and I was surprised by the great amount of people walking here. It seems that the somewhat chaotic appearance of this landscapes as a result of the great mix of land uses benefits the spatial complexity and human scale of the area which makes it more pleasant to recreate.

RIDDERKERK - CORNELISLAND

Image made by author

This location is located in the south of Rotterdam and is under rapid transformation. The area is located in the landscape of the old sea clay polders which are the result of a century long process of river flooding and land reclamation. The irregular shapes of the old dikes and old housing settlements along these dikes are still visible in the landscape. However, the rapid and large scale commercial development in this area is at odds with the historical and small scale and refined character of this historical polder landscape.

Figure 59:
Case location. Made by author.

Figure 60:
Aeral picture showing case site area.
Source: Google Earth, 2020.

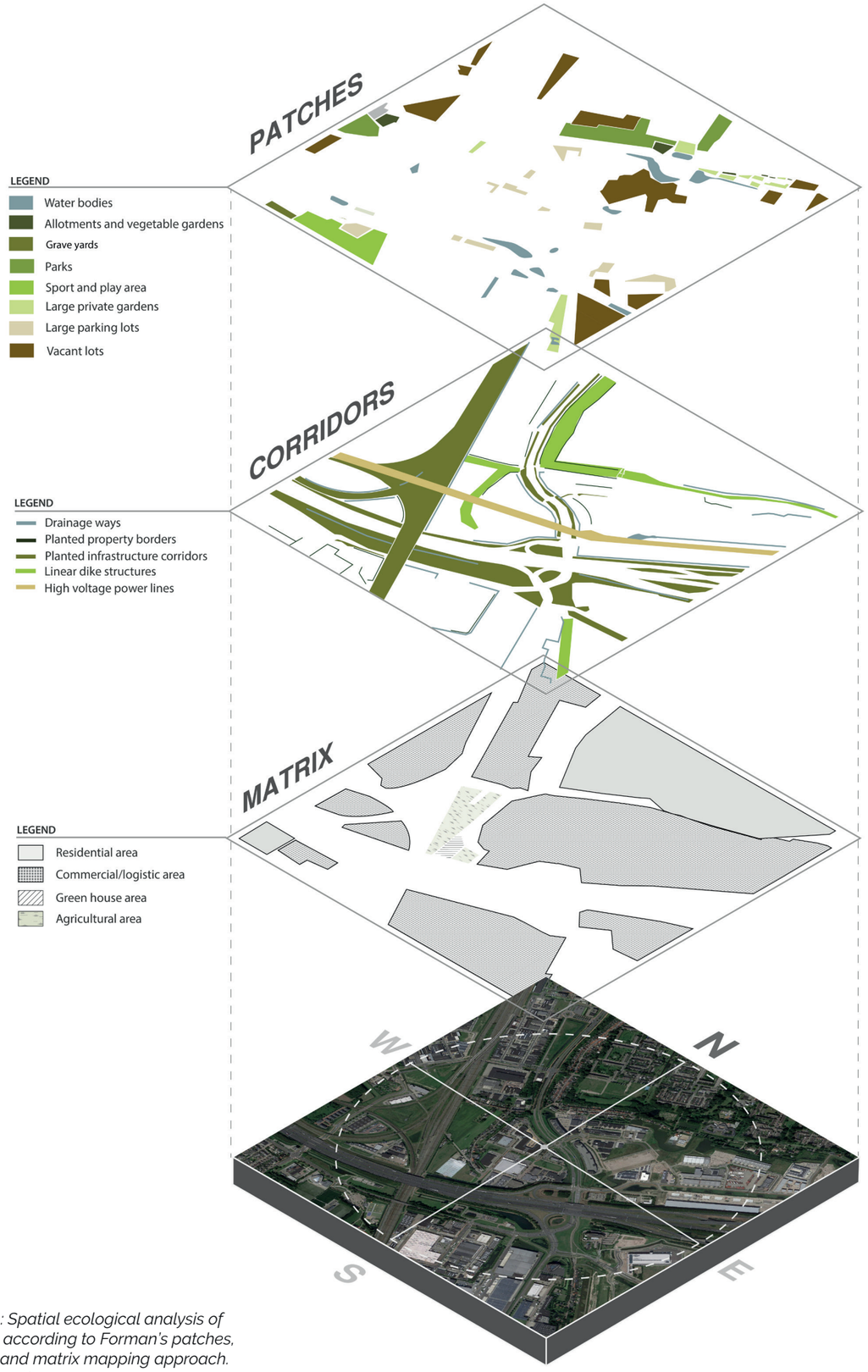


Figure 61: Spatial ecological analysis of the area, according to Forman's patches, corrdors and matrix mapping approach. Made by author

Figure 62: View from old dike to railway line with in-between an agricultural field and a high voltage power line. By author.

Figure 63: Roadside vegetation. A typical monoculture of species, with limited ecological value. By author.

Figure 64: Small brownfield at industrial area. Higher ecologial value compared to figure 66. However, its purpose is unclear. The area is polluted as a result of the lack of maintenance and stewardship of the place. By author.

Figure 65: Small informal used park below powerlines. By author.

Figure 66: Anonymous green space along infrastructural corridor of the highway A15. The lack of species diversity limits the ecological value of this place, but also limits the cognitive experience of the landscape. By author.

ECOLOGICAL ANALYSIS

This landscape is signified by large scale infrastructures and logistic and commercial facilities. As a result of this the landscape is highly fragmented le (figure 61). At local scale there is a lack of fine grained ecological corridors, because of the large monofunctional building structures. The large scale infrastructures such as the railway and highway do not only fragment the landscape, but they also provide new ecological connections parallel to the infrastructure. However, the roadside vegetation is still very generic and does not add much to the ecological diversity of the area (figure 66). Moreover, the vacant lots and undeveloped sites provide a habitat for pioneer species that is unique to the urban environment where most of its green spaces are so well maintained that there is no room for pioneer species to thrive. Therefore, these vacant lots are of high ecological value.

COGNITIVE ANALYSIS

Figure 67:
Cognitive map of case area. Mapping approach inspired by Kevin Lynch's Image of the City (1966). Made by author.

Figure 68: View on an old farm house on the left and a new built industrial flower market. It illustrates the scale conflict between the new and old buildings and landscape structures.

Figure 69: The vacant lot seems to be used as a dumpsite as well as a result of lack of stewardship over the place. Pollution further increases this problem.

Figure 70: The small scale and well maintained character of this old dike structure is in sharp contrast with the highway and commercial district by which it is surrounded.

Figure 71: View of commercial district. This picture clearly illustrates the lack of spatial differentiation in a commercial district as a result of the large size of the warehouses. This results in poor walkability and navigation of the area.

Due to the extreme spatial fragmentation of this area it can be divided into several cognitive units which are separated by these infrastructure barriers (figure 67).
As a result of this the landscape is not perceived as one unit, but more like a set of islands which are visually and physically enclosed by roads, railways and large logistic facilities. Furthermore, the logistic facilities are mostly fenced and inaccessible, there are no footpaths and in combination with their large plot sizes it makes the logistic cluster feel like an enclosed entity. Furthermore, the large scale of the new built facilities conflicts with the existing old landscape and building structures. These old structures which evoke a sense of place seem to disappear within these loud and bold structures (fig 68). This co-existence of space and place is shown in figure 72. In figure 67 it can also be seen how the old dike structures (broken paths) are fragmented by new large scale infrastructures.
Additionally, the lack of activity and accessibility for the public makes the place feel anonymous and placeless. As a result of this there is a lack of stewardship over the place which results in littering and pollution of the open spaces which is further aggravates the cognitive experience of this territory.

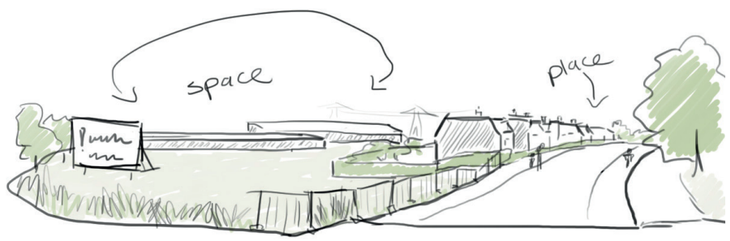


Figure 72: Sketch of co-existence of space and place within one view at Rijkstraatweg near Zwet. Made by author.

4.3 COMPARISON AND CONCLUSIONS OF LOCATION ANALYSIS

Comparison of locations

From the analysis it can be concluded that the three locations all posses different spatial characteristics. Nevertheless there seem to some re-occurring spatial problems in these landscapes. Such as poor walkability, large grain size, poor legibility and lack of human scale, especially at locations 1 and 3. Location 3 seems to be most challenging in terms of spatial quality. The overwhelming size of commercial and logistic land uses makes the area extremely unpleasant to walk. The first location is more intermediate and has some potential with respect to its mix of recreational and industrial land uses, however the clustered spatial arrangement and lack of spatial differentiation between the greenhouses is problematic. The second location at Nieuwekerk a/d IJssel seems to be of significant greater spatial quality compared to the other two. The area has a greater social and ecological quality as a result of high spatial heterogeneity. Therefore, it can be concluded that higher degrees of spatial heterogeneity generally benefit both the cognitive as well as the ecological quality of the area.

Landscape elements of TiB

Figure 73 gives an overview of different landscape elements that are typical to the TiB. They are classified according to Forman's patch-corridor-matrix model in order to gain a systemic understanding of the open spaces of the TiB and their positioning as part of the landscape ecological structure, in terms of patches and corridors. This toolbox has been developed as a visual legend for the spatial analysis of the ecological mosaic of each of the case areas, each element represents one feature of the legend. The ecological quality of these spatial elements can vary a lot. Therefore, this overview is not an assessment of ecological quality of the landscape, but merely an understanding of the components that make up the mosaic of the TiB. The toolbox can be used by designers to think about the improvement of these land uses individually or/and improve the spatial arrangement between them in the landscape. This overview of patches and corridors is not finished, it can be further extended by other researchers in the future.

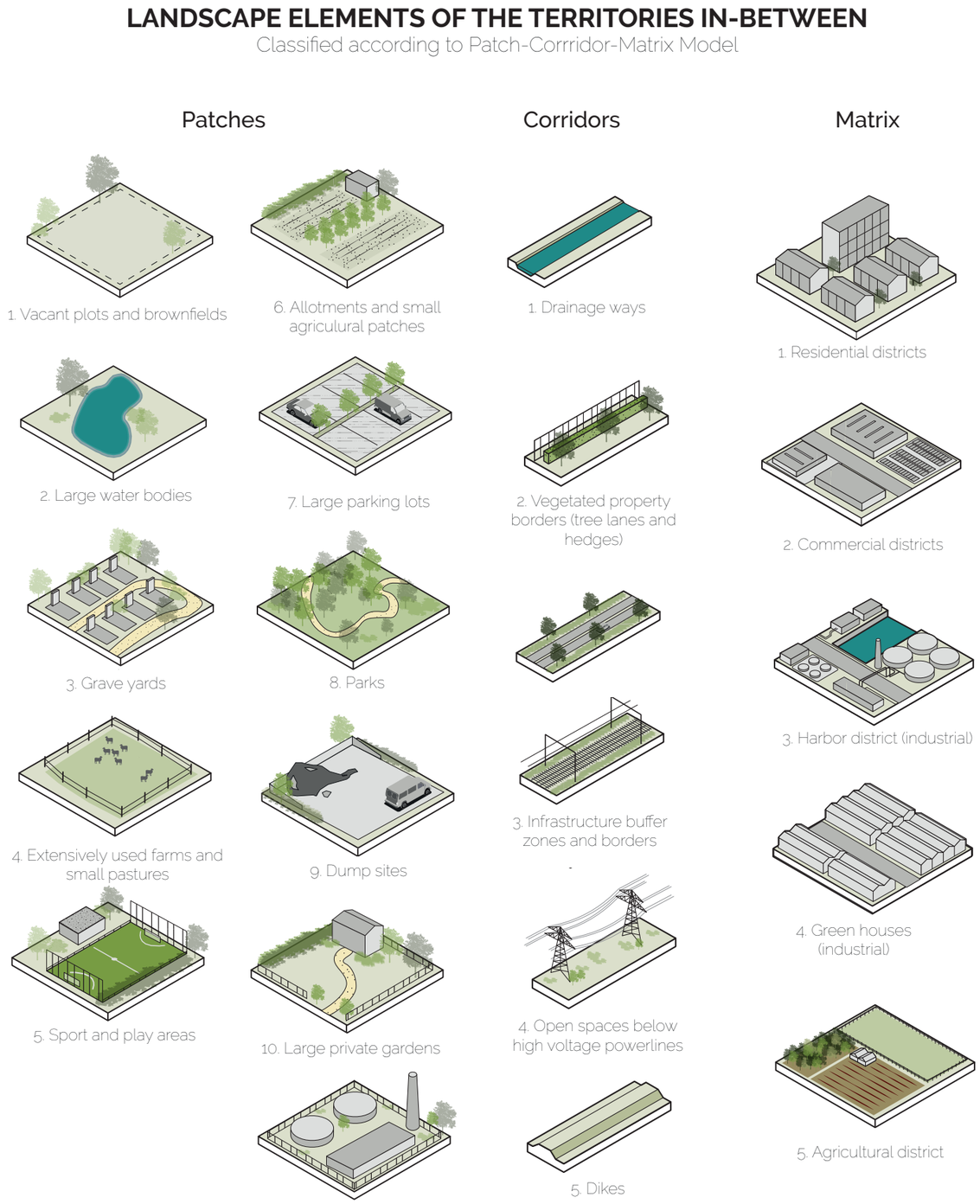


Figure 73: Landscape elements in the TiB classified according to Forman's patch-corridor matrix model (1995). Made by author

Image made by author

5.DESIGN PRINCIPLES

This chapter introduces cognitive and ecological design principles which are derived from theory and supported by findings from the spatial analysis. They are general design principles, but address a specific issues that has appeared to be of specific interest for the TiB. Thereafter, these principles are combined with some spatial components (patches and corridors) of the TiB that have been discussed in the previous chapter and are developed into nature-based placemaking elements. These elements will later be applied in the local design proposal.

5.1 COGNITIVE DESIGN PRINCIPLES

The aim of the cognitive principles is to improve the sense of place in the TiB by improving the cognitive experience for local visitors and residents. These principles have been based on urban design qualities related to walkability because walking is often seen as a predicate to sense of place (Lo, 2009).

1. Legibility and imageability

Improving legibility of an area makes it more easy to navigate ourselves through the space. Legibility is improved by a good pedestrian network in combination with physical elements that serve as a point of reference and are distinctive from their surroundings, such as landmarks, therefore legibility talks about the physical form of a space. (Erwing, Handy, Brownson, Clemente et al. , 2006) As a result, the area becomes more distinctive from its greater surroundings which improves legibility and imageability at regional scale. Imageability is the quality of a place to be distinctive, recognizable and memorable.
This is especially important in the TiB because at local scale there seems to be a clustering of monofunctional land-uses which have poor legibility. On the other hand there is often a disconnect between landscape geomorphology and land use which limits landscape imageability at larger scale.

2. Activity and interaction

In order to enhance people's sense of place we should not only seek to improve physical form, but also the function of the place. Program should be provided to transform anonymous spaces into places of meaning. As has been discussed in chapter 3 interaction between people and the natural environment is crucially important to enhance peoples sense of place (Masterson, 2017). The territory in-between finds itself in a unique position in-between man and nature. The positioning of the TiB at the edge of the city makes one experience the relaxing, liberating and recovering qualities of nature while also feeling a sense of social security and safety which is absent in merely rural environments. Therefore, urban design in the TiB should focus on enhancing this human-nature interaction by providing activities and program that make people interact with the natural environment, such as sport and play facilities, but also educational program and spaces to socialize. Doing so makes the TiB much more of a destination for people rather than a pass-through area and enhances people's stewardship over these spaces.

3. Accessibility and transparency

Another issue that came up from the spatial analysis was the limited accessibility of the TiB by foot. Transparency talks about the degree to which people can perceive what lies beyond certain physical elements such as streets, buildings and walls. The large grain size in the TiB generally limits the transparency and accessibility of the area which limits people's ability to read the landscape and make sense of the place (Erwing, Handy, Brownson, Clemente et al. , 2006). Large greenhouses and warehouses are an example of large grain obstacles that limit readability and accessibility of the landscape. Moreover, improving accessibility and transparency is important to activate the TiB and improve liveliness and interaction within the landscape. Therefore, it is a crucial asset to activate program, as discussed in the previous section. Typical land uses such as sport fields and allotment gardens are often surrounded by fences and unaccessible to the public (non-members) and therefore limit the overall accessibility of the area. Therefore, it is not only about providing program, but also making that program accessible for a divers group of residents and visitors.

4. Complexity and human scale

Complexity refers to the visual richness of a place. High visual complexity is created by a great number and diversity of physical landscape elements and activities at different scales. Places which are visually complex are often considered to also have good human scale and as a result are pleasant to walk because they correspond to the speed at which humans move through space. Spaces designed at human scale and with high degree of complexity are often more comfortable to stay and walk around. (Erwing, Handy, Brownson, Clemente et al. , 2006). The diversity of landscape elements provides different shelter opportunities for different weather conditions. As a result we tend to feel more comfortable and safe in landscapes that are designed at human scale and with high degree of complexity.
Some of the monofunctional, large scale land use clusters in the TiB significantly lack human scale and spatial complexity. In order to make people feel more comfortable in the TiB we should improve landscape complexity and design for human scale.

5.2 ECOLOGICAL DESIGN PRINCIPLES

The aim of the three principles is to enhance biodiversity and overall ecological resilience of the TiB. These principles apply at both local and regional scales.

1. Connectivity

Ecological corridors can enhance connectivity between habitats and facilitate movement of particular species across the landscape mosaic which enhances overall ecosystem resilience (Forman, 1995). The abundance of infrastructures in the TiB significantly fragment ecological patches. Designing ecological corridors is therefore a crucial design task in the TiB.

2. Local Nature

Design habitat conditions that fit the landscape geomorphological context and support resources for local species. This supports overall ecosystem resilience. Allowing natural dynamics, disturbance and succession to take place can reduce maintenance and enhance biodiversity. Doing nothing is often the best way to allow native plant species to pioneer and succeed, this is process is called re-wilding. Open spaces in the TiB could be potential spaces for local species to thrive and support the local ecosystem.

3. Habitat diversity (heterogeneity)

Creating a diversity of habitat types (habitat heterogeneity) and enhancing habitat complexity contributes to species richness (Pierre & Kovalenko, 2014). Plenty of open spaces in the TiB have a great potential to improve structural habitat complexity of the landscape. Additionally, the clustering of certain land-uses limits habitat diversity and species richness in the TiB at a larger scale. Providing a differentiation in abiotic conditions creates a diversity of habitat types. For example providing not only on-ground habitats, but also nesting facilities at greater altitudes with different abiotic conditions.

Figure 74: ecological fragmentation by infrastructure. Made by author.

Figure 75: Natural succession of pioneering species at vacant plot. Made by author.

Figure 76: Area with very low structural diversity and complexity. Made by author.

THE RELATIONSHIP BETWEEN ECOLOGICAL AND COGNTIVE DESIGN PRINCIPLES

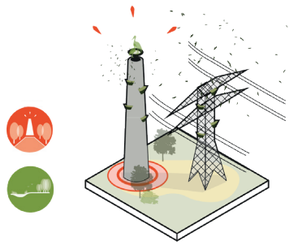
The cognitive and ecological design principles that have just been discussed complement and support each other. For example, areas with strong ecological connectivity can also be expected to have higher degrees of accessibility. Furthermore, strengthening native vegetation patterns that reflect geomorphological conditions will likely enhance legibility of the landscape. Also, increased habitat diversity will likely benefit spatial complexity of the landscape. It can be concluded that landscape ecological design principles are mutualistic with cognitive design principles and should therefore be considered in relationship with one another.

5.3 NATURE BASED PLACEMAKING ELEMENTS FOR TIB

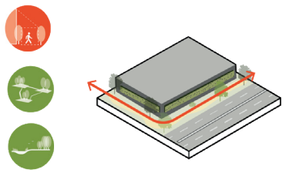
The pictures on the page on the right (figure 77) are proposed nature-based placemaking interventions that aim to improve the spatial quality of the TiB with relatively simple and short term interventions. They are organised according to three placemaking categories, namely comfort & image, linkage & access and uses & activities (PPS, 2013). Each of these spatial interventions propose an ecological as well as a cognitive improvement of space, which corresponds with the targeted design principles discussed in the previous section. Therefore, these design interventions illustrate how we can think in an integrated way about nature-inclusive design as a tool for improvement of the cognitive experience of the space. Moreover, these interventions aim to enhance biodiversity and sense of place at very local level.

The placemaking elements are generic and provide inspiration for local governments, project developers and land owners on how to improve spatial quality in the TiB. It addresses spatial elements which are often neglected in urban design but are very prevalent in the TiB, such as large warehouse boxes, large parking lots, green houses and industrial sites. Chapter 7 illustrates how these placemaking elements can be integrated into a design proposal for a particular site.

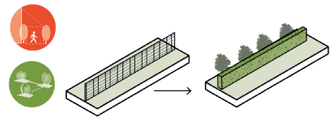
COMFORT & IMAGE



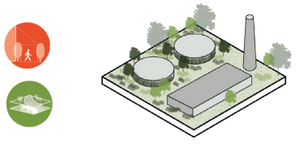
1. *Nesting facilities on tall infrastructures*



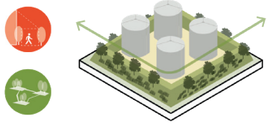
2. *Green walls on warehouses and industrial facilities*



3. *Vegetated property borders.*

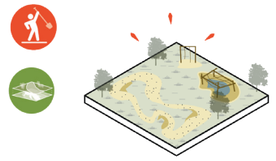


4. *Re-wilding of open spaces in-between infrastructural facilities*

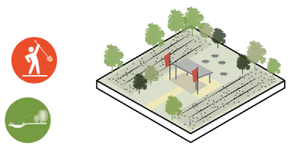


5. *Planinting on bund walls, dikes, sound barriers etc.*

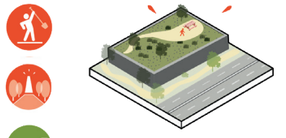
USES & ACTIVITIES



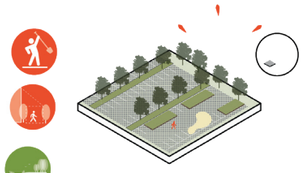
1. *(temporal) recreational use of brownfields and development sites*



2. *Local consumers and recycling point at allotment gardens.*

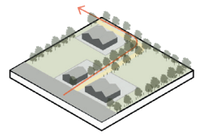


3. *Accesible rooftop parks on large commerical and logistic buildings.*

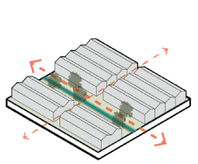


4. *(temporal) public greening of grey leftover spaces and parking lots.*

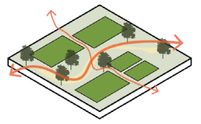
ACCESS & LINKAGES



1. *Informal (semi-public) acessible corridors in-between private lands.*



2. *Paths and green corridors in-between open spaces between green houses.*



3. *Planting corridors and semi-public access in-between sport fields on private property.*

Figure 77: Overview of nature based placemaking elements for the TiB. Made by author.

Image made by author

6.REGIONAL VISION AND STRATEGY

This chapter discusses the spatial vision and strategy that is proposed with respect to Rotterdam's TiB. This vision is a synthesis of the findings from the literature review and the spatial analysis.

6.1 CONCEPT AND VISION

The regional vsion is the result of a creative design process with support of the findings from the spatial analysis and literature review. Based on this creative process the decision has been made to aim the design on the TiB that find themselves at the edge of the urban structure of Rotterdam (geographically in-between urban and rural) , because of their specific potential for ecological and social development. Therefore, monofunctional territories such as the harbour ara and the greenhouse in Westland are excluded from the design proposal. The main (theoretical) concept that has been of inspiration for the vision for the membrane are Richard Forman's theories on designing edges and boundaries (see chapter 3) in order to enhance movement and interaction between different living environments. From these theories the idea has been developed that the TiB that surround the urban structure of Rotterdam should be considered a transition zone between two biotopes that should therefore also be recognized and designed as such. Just like we consider patch edges and edge effects at micro level, we can also consider this at macro level. In order to do so, we should not design high contrast edges, but we should aim at creating low contrast edges that maximize cross border movement and interaction. Thus, maximizing the area of interaction between urban and rural (figure 79). This is a spatial quality that is already inherent to some of the TiB with high degree of heterogeneity. The following pages will further elaborate on the spatial strategy of this vision.

ROTTERDAM'S
RECOVERING MEMBRANE:

The TiB that surround the urban structure of the city of Rotterdam will be an accessible and heterogeneous landscape with high quality green spaces that provide unique social and ecological needs for people and wildlife from both in and outside the city and facilitates interaction between people and nature. Thus, functioning as a kind of membrane (place of interaction and exchange) around the city.

This membrane around the city will not merely be an area to pass through, but a landscape to experience as a unique type of landscape in which people can actively participate and interact with the environment and build lasting memories. Hence, enhancing people's sense of place and stewardship over the landscape.

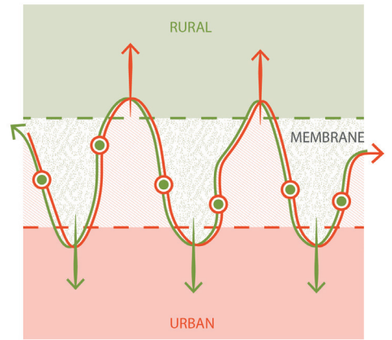
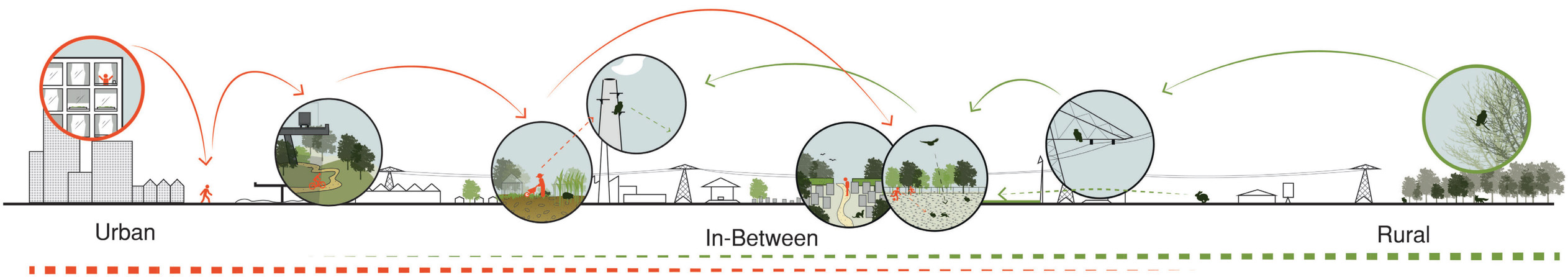


Figure 79:
Conceptual illustration of the functioning of the TiB as a membrane; an exchange and interaction area for human and non-human species between the urban and rural biotope.

Figure 78:
Conceptual represenation of movement of people and animals in the TiB



6.2 THE MEMBRANE STRUCTURE

In order to realise the vision and create a landscape that functions like a membrane four spatial strategies have been developed. These strategies are applied at regional scale of Rotterdam and developed into a comprehensive regional vision.

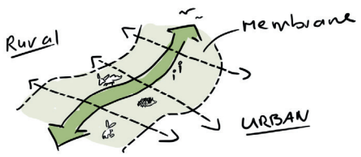


Figure 80:
Conceptual represenation of movement of wildlife along and across the membrane.

1. The enclosed membrane

The first step towards the vision is to create an enclosed ring around the urban structure. Just as we consider a membrane in micro biology, this membrane should also be an enclosed structure that surrounds all edges of the urban landscape.
From ecology theory we understand that transitional borders generally increase species movement and interaction along **and** across the edge (figure 80) (Forman, 1995). Therefore, it is especially important that the membrane is designed as a continuous landscape around the urban edges. The membrane structure integrates existing recreational land uses and open green spaces as they have been mapped in figure 28, chapter 4. The membrane should be approached as a regional ring park that is of very high structural diversity, through providing a great mix of dispersed extensive land uses. Therefore, this landscape becomes even more in-between than it might already be. The spatial structure that is proposed in figure 81 is only a sensible recommendation based on existing landscape features and primarily functions as an inspiration to planners and urban designers. The structure is debatable and can be altered based on particular interests of local municipalities. The spatial form of the membrane allows people and species in the urban biotope to access the membrane within a reasonable distance from their homes.

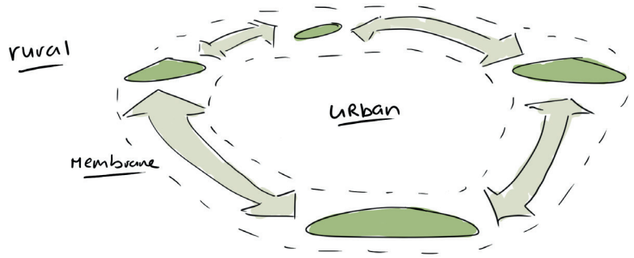


Figure 82:
Conceptual represenation of connection of green patches within the membrane.

Figure 81: Map of proposed membrane structure for the region of Rotterdam. Made by author.

2. Ecological connectivity

In order to facilitate exchange between species from inside and outside the urban landscape the membrane should establish and enhance ecological connections between the urban and rural landscape. Currently, the existing landscape within the membrane is characterised by a great amount of infrastructural barriers that must be overcome in order to stimulate species movement and interaction between the urban and rural landscape. The design and planting structure of these corridors should match with the greater landscape typology that it is connected to. However existing infrastructure corridors also have the potential to function as ecological highways, connecting the inside of the city to the rural landscape. This can be highways, waterways and railways. These main corridors are illustrated in figure 81. The red dots indicate spatial barriers in longitudinal direction of the membrane. Ecological infrastructure is needed to overcome these barriers.

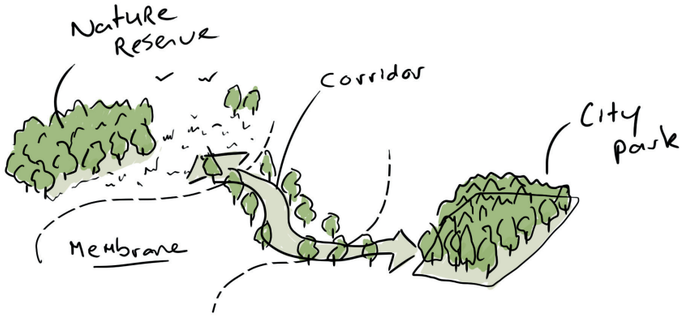


Figure 84:
Sketch of ecological corridor through the membrane connecting inner city green spaces with nature reserves outside the city. Made by author.

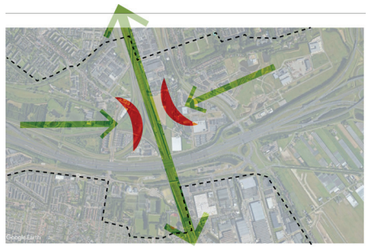


Figure 85: Representation of railway corridor that crosses the membrane and creates an ecological connection between the inside and outside landscape. However also creating a barrier in longitudinal direction. With use of Google Earth imagery.

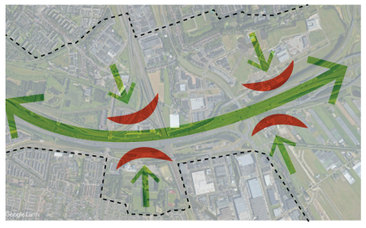


Figure 86: Representation of highway corridor that interconnects the membrane in longitundinal direction. However, also creating a barrier in other direction. With use of Google Earth imagery.

Figure 83:
Map of infrastructural corridors that can provide important ecological connections from the city towards the rural landscape. While at the same time also obstructing the spatial continuity of the membrane. The square is the zoom in location of figure 85 and 86. Made by author.

3. Human-nature interaction

In order to activate the membrane and enhance interaction between people from inside and outside the city and enhance their interaction with wildlife we should not only construct ecological corridors, but also enhance and establish social corridors. These social corridors should particularly facilitate active transportation modes, because we have learned that this is most important for the improvement of peoples place experience.
As a result of the great amount of large infrastructures and abundance of large scale developments that spatially segregate the landscape the aim of the social corridors should be to provide a fine grain network of bike and footpaths and create a strong interconnected recreational structure at the edges of the urban landscape by also providing additional outdoor recreational program such as sport fields, playgrounds, camp sites.
The map of figure 87 shows the existing network of bike routes within the membrane that should be upgraded. It also indicates some proposed new bike connections in places where there seem to be missing links. Furthermore, it indicates locations for potential new recreational program. This could be program that is currently under pressure of densification and is in need of re-allocation in the membrane.

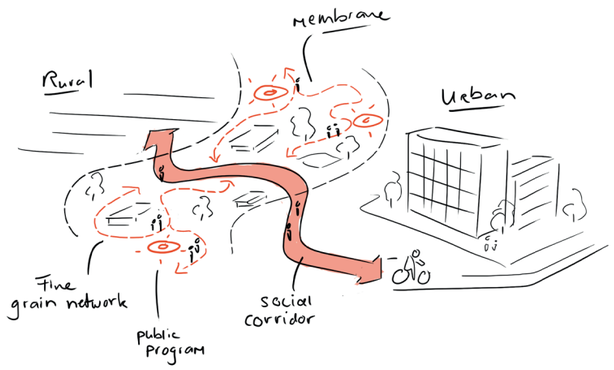


Figure 88: conceptual representation of social corridors and fine grain social network that shoul be developed in the membrane. Made by author.

Legend

- Gardening and outdoor education
- Park and nature reserve
- Outdoor sport and play
- Other recretional (graveyard, zoo, camp site)
- Relative size of program (estimated amount of visitors)
- Not publicly accessible
- Public and free accessible
- Proposed location for additional recreational program
- Existing recreational route in membrane.
- Proposed link in recreational network. Exiting path not part of recreational routing.
- Important cycling connection between city and countryside, surpassing membrane.

Figure 87: Map of important recreational routes based on hoofdfietsnetwerk Zuid Holland and recreational program in the membrane. Made by author.

4. Re-distribution of land uses

In order to create a balanced and recognizable landscape with high spatial quality in every location there is a need to redistribute existing monofunctional land use clusters.
Firstly, in order to enhance the compositional heterogeinity of the membrane there should be a great mix of land uses present at both local and regional scale. Secondly, in order to enhance the configurational heterogeneity there should be a great pattern complexity of the different land uses at local and regional scale.
The map on the right, figure 89, shows what areas are currently homogeneous and in need of spatial re-distribution. The map also indicates potential flows of pressured land uses within the urban territory that can be relocated to the membrane.

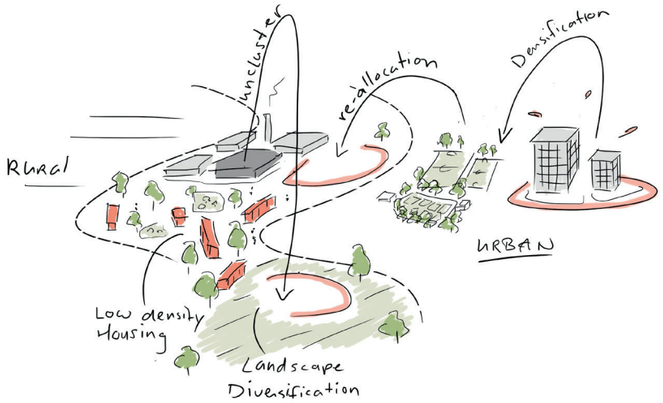


Figure 90: Conceptual sketch of land use re-distribution in the membrane. Made by author.

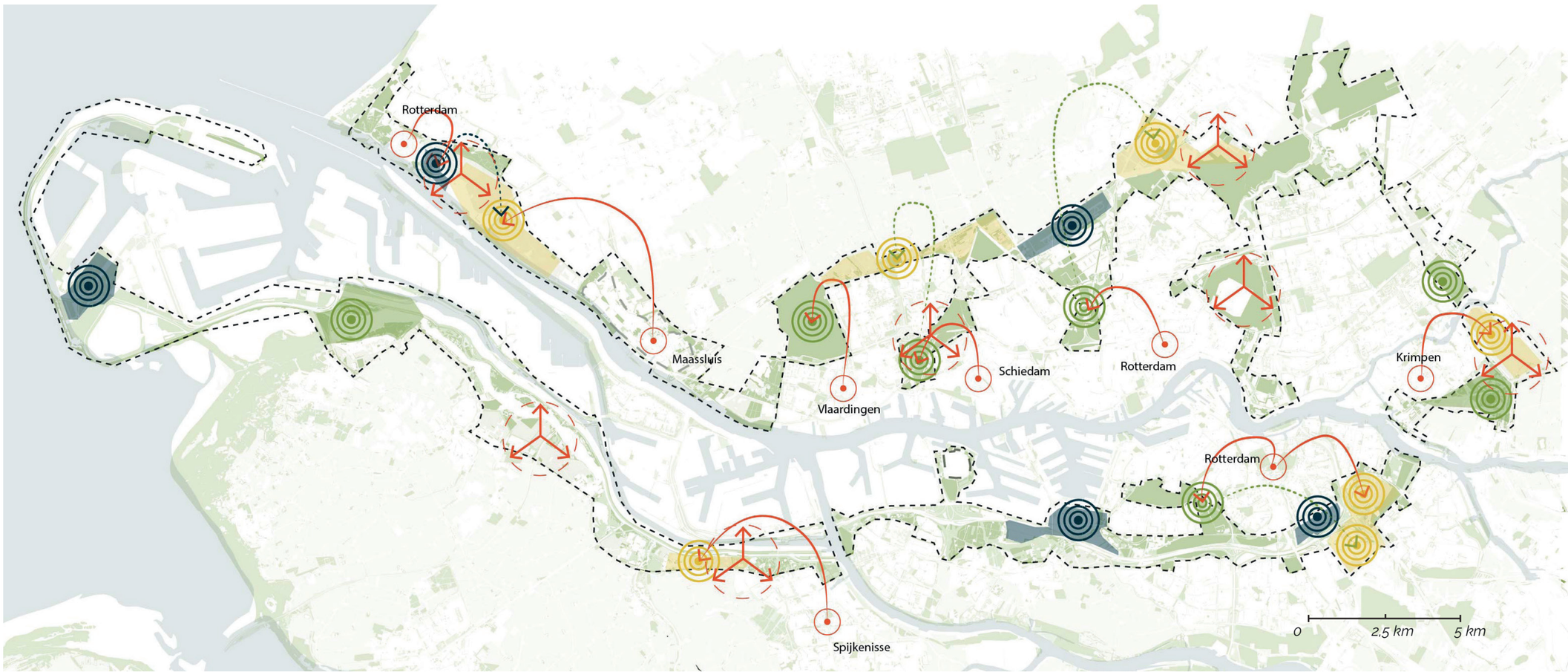


Figure 89: Map of proposed zones for improvement of spatial heterogeneity.

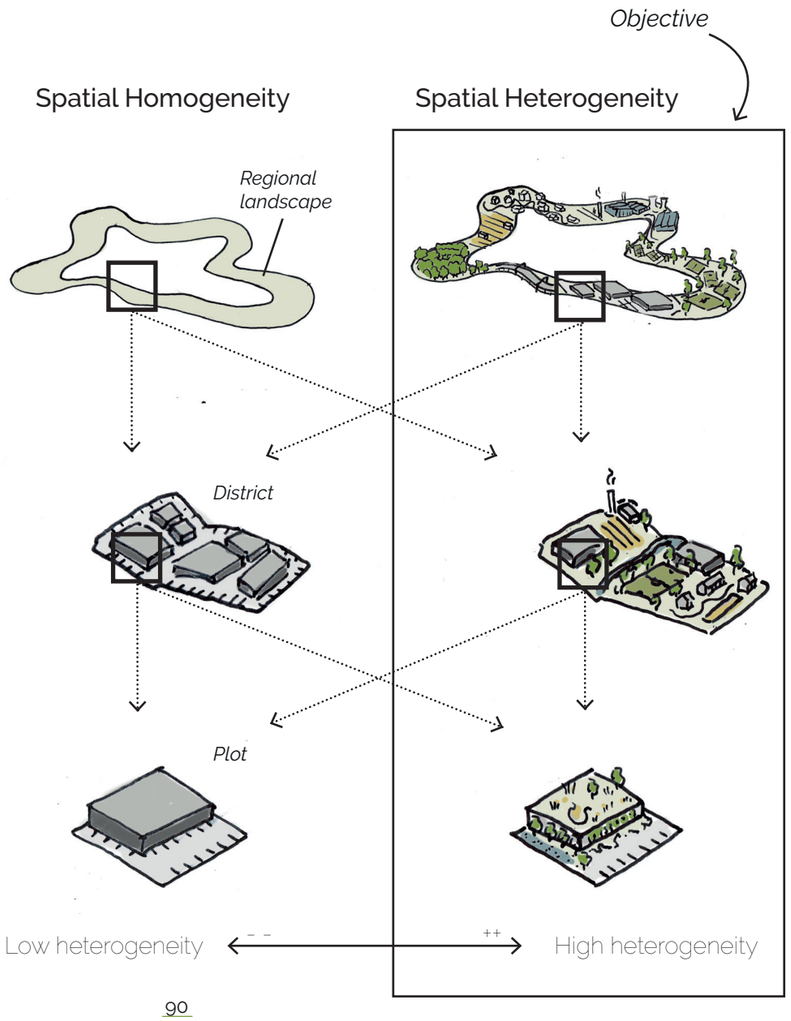
Legend

- Recreational cluster
- Logistic/industrial cluster
- Agricultural cluster
- Zone for improvement of compositional heterogeneneity (Ehanced mix of land uses).
- Zone for improvement of configurational heterogeneity at local scale (enhanced spatial complexity of land use pattern).
- Proposed accomodation of new extensive housing developments from nearby urbar core.
- Proposed re-allocation of some clustere (recreational, industrial or commercial) landuses within the membrane

INTERSCALAR HETEROGENEITY

Landscape heterogeneity is a concept that can be considered at different spatial dimensions, at macro (regional), meso (district) and micro level (plot). Therefore, the vision that is proposed for the membrane landscape discusses and integrates these three spatial dimensions. The landscape can be considered to be a membrane when it contains high degrees of spatial heterogeneity at all scales. Over time, change in landscape heterogeneity can be measured at each spatial level, by measuring the diversity of landscape elements and spatial distribution at different scales (figure 91). Each scale requires different data gathering methods. In practice, it is possible that the landscape only shows heterogeneity at micro scale, but not at macro scale and vica versa, however the objective for the membrane landscape is to show high degrees of spatial heterogeneity through all scales. As can be seen in figure 91, the membrane landscape already consists of high degrees of spatial heterogeneity at macro level, it includes many different districts, such as recreational, commercial and agricultural sites. However, the spatial analysis concluded that at meso scale heterogeneity seems to be lacking in many places in the TiB. Therefore, the design task with respect to spatial heterogeneity in the TiB will focus on design for heterogeneity at meso and micro scale. The placemaking principles that have been discussed in chapter 5 generally strengthen heterogeneity at plot level whereas chapter 7 will discuss more about the heterogeneous planning and design approach at district level. The pictures on the right page show some examples of homogeneity and heterogeneity at different scales.

Figure 91: Representation of spatial heterogeneity and homogeneity at different scales. Made by author.



MACRO

This scale describes degree of spatial heterogeneity at landscape regional level. The greater the amount of different district types in the landscape the greater the spatial heterogeneity at macro scale.

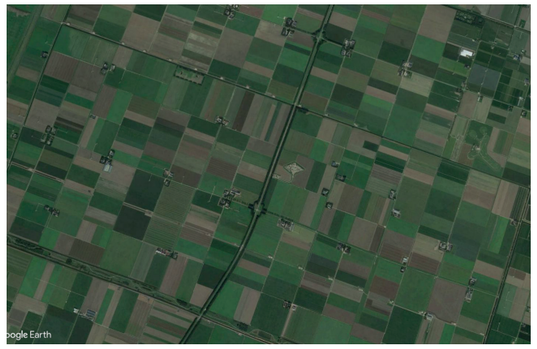
MESO

This scale describes the degree of spatial heterogeneity at district level. The greater the diversity of different land uses the greater the spatial heterogeneity at meso scale.

MICRO

This scale describes the degree of spatial heterogeneity at the level of a single plot. The greater the amount of different land cover types, built, unbuilt, grass, trees etc. the greater the spatial heterogeneity at micro scale.

Figure 92: Pictures showing appearance homogeneity and heterogeneity at different scales.



Homogeneity at landscape level.
Picture: Flevopolder (google earth)

Heterogeneity at landscape level.
Picture: Urban fringe of Rotterdam North (google earth)

Homogeneity at district level.
Picture: Business area Rotterdam North-West (google earth)

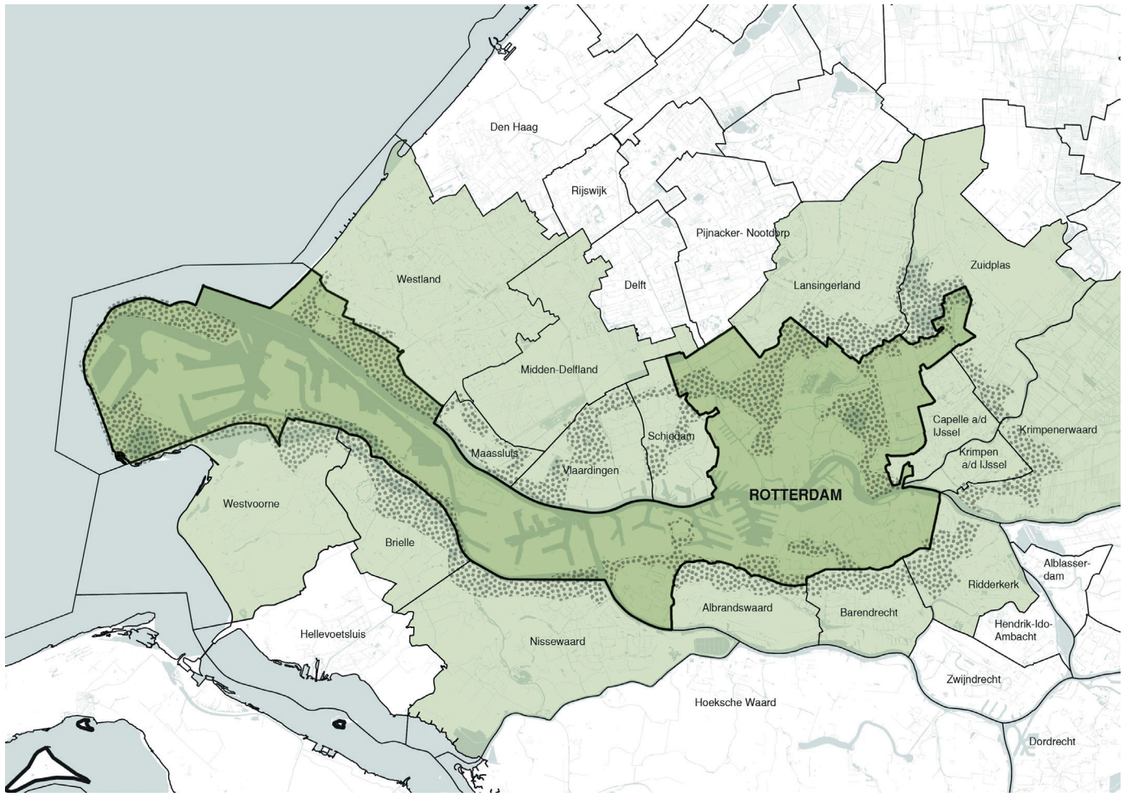
Heterogeneity at district level.
Picture: Rotterdam Zuidelijk Randpark (google earth)

Homogeneity at plot level.
Picture: Distribution warehouse (source: th.optimal.co.th/copy-of-our-facilities)

Heterogeneity at plot level.
Picture: Nike warehouse, Belgium (retrieved from: www.business-school.rwth-aachen.de)

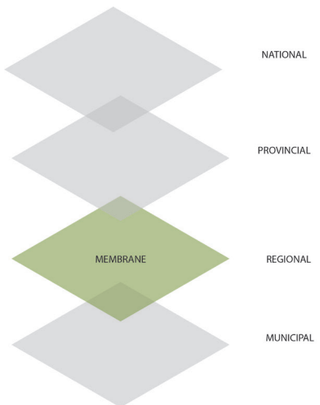
6.3 GOVERNANCE STRUCTURE

Figure 93: Map of municipalities that are involved in the spatial development and management process of the membrane. Made by author.



Municipalities involved

The membrane structure finds itself at the edges of the main urban structure that includes not only the city of Rotterdam, but also Schiedam, Vlaardingen, Maassluis, Capelle a/d IJssel and Krimpen a/d IJssel. Consequently, the membrane landscape should be governed and managed at regional scale. In order to manage the spatial quality of the landscape of the membrane and achieve the vision, municipalities in which the membrane is located or which are directly connected to the membrane should cooperate and manage the spatial development in the membrane together (figure 93). These municipalities are brought together in the Membrane Management Group (MMG) together with urban ecologists and a representative from one of each recreation boards (figure 95). At local level municipalities will be responsible for the spatial development of the membrane within their territory. They bring together civic and private parties. Ecologists need to be involved early in the design process so that the ecological quality of the landscape can be addressed early in the design process and form ecological preconditions for project developers. Existing institutions and partnerships for spatial development at sub-regional level do not sufficiently address the issue of spatial quality (appendix I). They seem primarily interested in economic development. Therefore there is an urgency for a distinct governance body that is primarily focused on improving spatial quality at sub-regional level within the territories in-between at this scale.



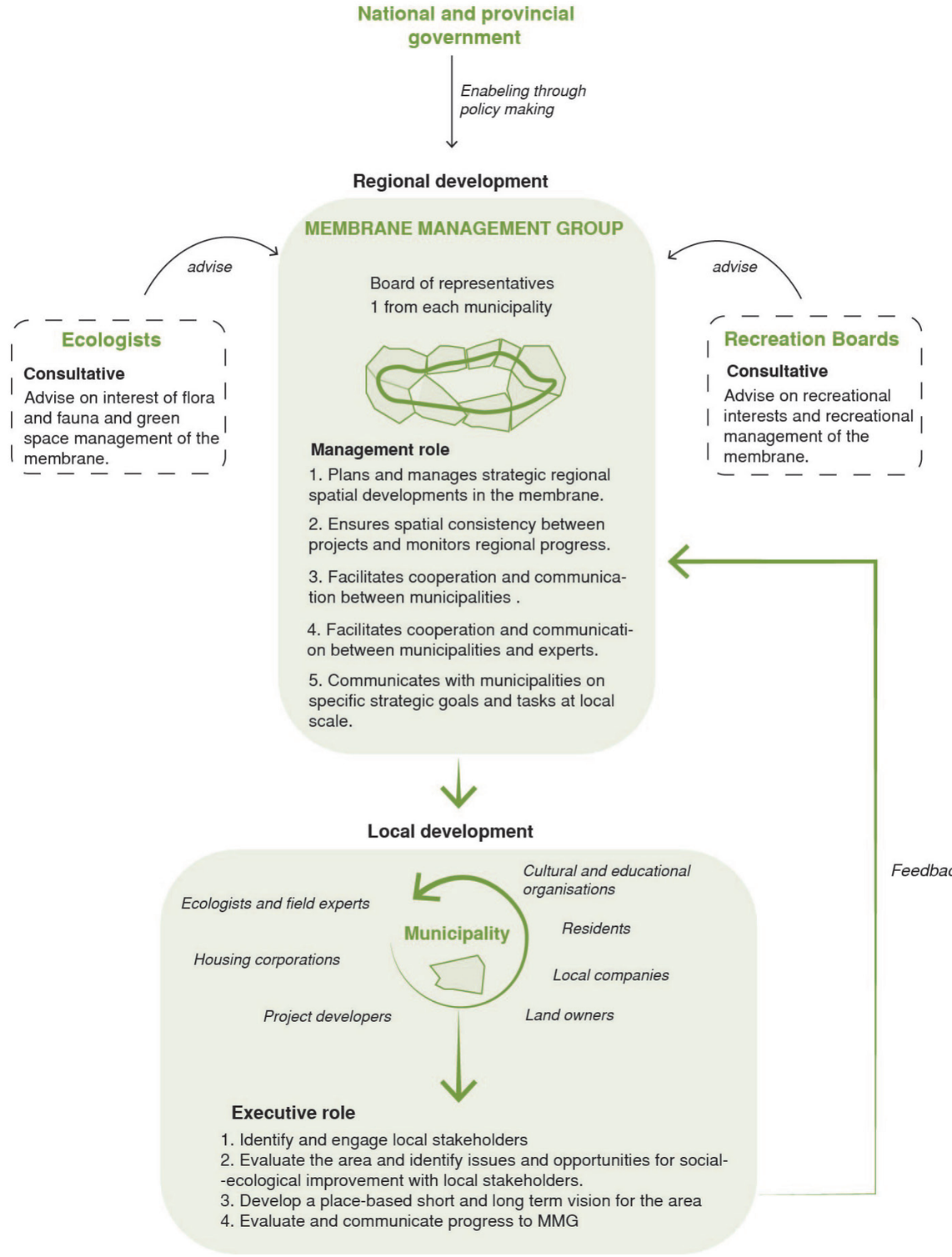


Figure 94: Representation of scale level of the membrane Made by author..

Figure 95: Proposed governance structure for the membrane. Made by author

6.4 TIMELINE

DEVELOPMENT PROCESS

In order to achieve the regional vision the strategy has to be translated into local spatial interventions. These local interventions can then generate impact at regional scale. Therefore, the regional vision cannot be achieved at once, but is the result of many local spatial interventions and developments in the membrane. These projects are managed by local municipalities. This different spatial interventions can be subdivided into 3 stages of development, with each of them addressing a specific problem and targeting a specific goal from vision. Figure 96 describes the type of spatial interventions, its approximate time span, spatial scale and goal of each of the project stages. After finishing stage 3 the site is evaluated by the Membrane Management Group. It is assessed whether all the objectives have been achieved and from then on the main task is to preserve the spatial quality that has been established. Therefore the project is essential never finished. Next chapter will give an example of what this spatial transformation process can look like for a particular case in the membrane.

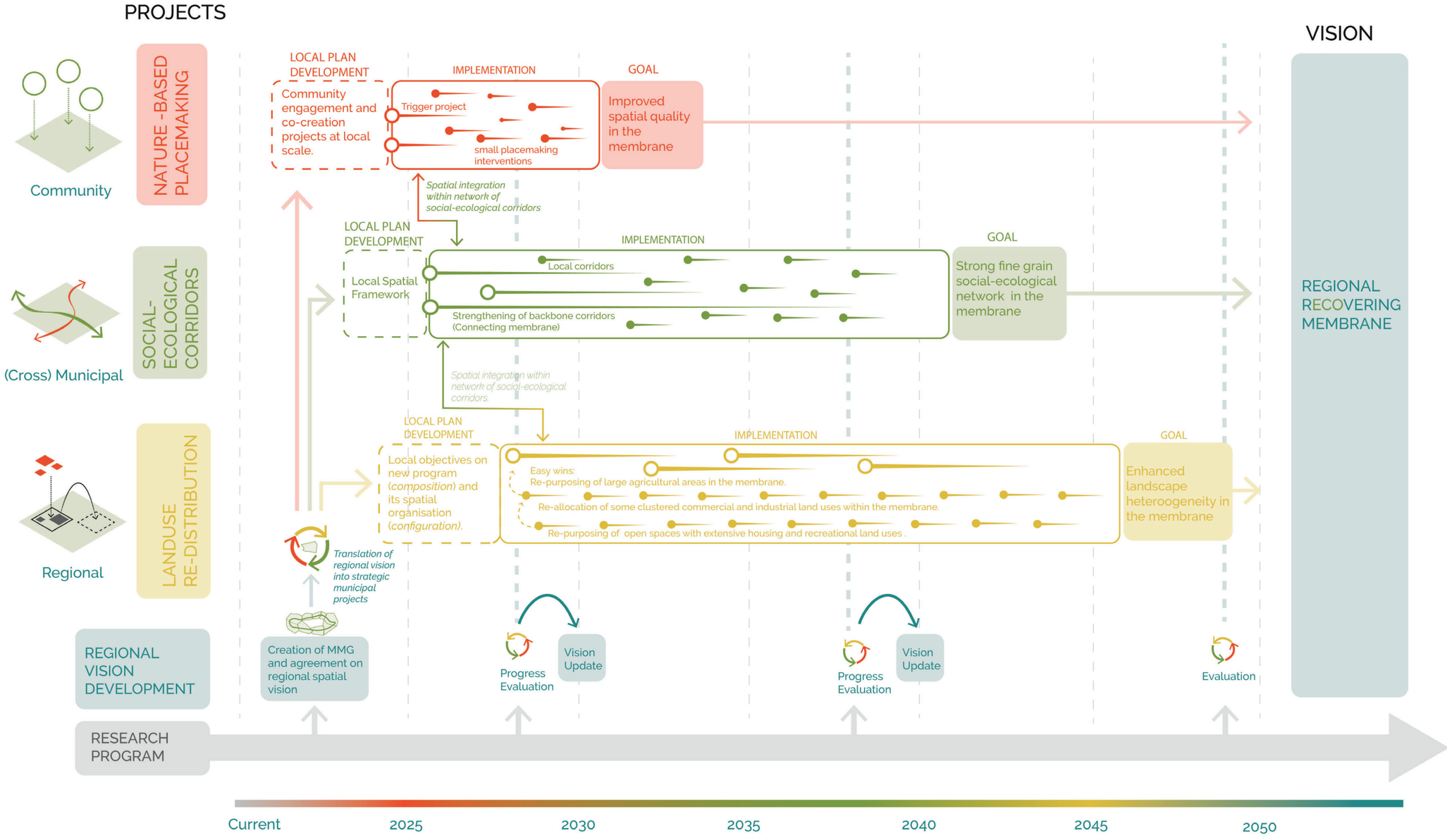


Figure 96: Conceptual timeline of projects.

7. DESIGN INTERVENTION

This chapter will illustrate how the vision can spatially manifest itself at local scale in one of the case sites. The area of Hoek van Holland has been chosen because of its high degree of in-betweenness and because of its high potential to be improved from both a social and ecological perspective.

Image made by author

7.1 CONTEXT OF THE LOCATION

First some relevant background information will be discussed to get a better understanding of the historical development of the area which can also be of inspiration for the design.

History and Geomorphological conditions

The location of Hoek van Holland-De haak is located in an area that has been under great influence of both maritime and fluvial processes. These geomorphological process are still apparent in the soil composition of the area, which consists of a combination of sandy dune soils (orange) and river clay soils (light green), as can be seen in figure 100. This mix of dune and clay is also visible in the today's landscape topography of the area. The agricultural fields are located on the clay soils and the forested areas are located on the sandy ridges.

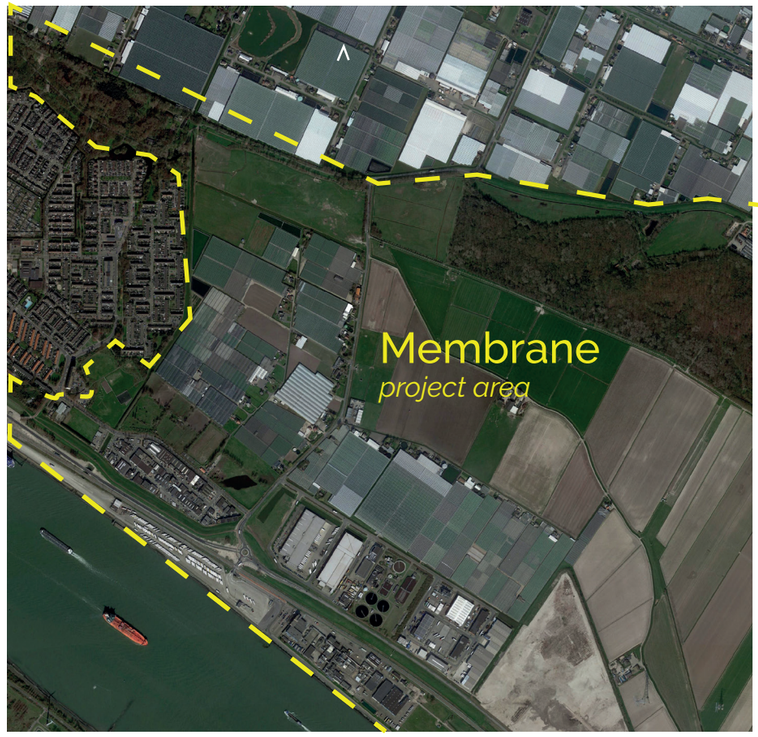


Figure 97: Areal photo of case location. Source: Google earth.

Recent developments

The development of the area for agricultural and industrial purposes started at the end of the 19th century. Starting with mostly crop cultivation when later in the 1980's commercial and logistic facilities settled. Recently, the greenhouse horticulture is in increasing conflict with the need for housing development in the area. In 2011 the municipality of Rotterdam developed a long term vision for the area in which they proposed to remove a significant amount of the greenhouses and existing recreational activities to make place for housing development (Gebiedsvisie Hoek van Holland 2011-2020). This area is illustrated in figure 98. It is clear that the municipality does not aim to mix land uses.

The next pages will discuss the design proposal for the area through the discussion of 3 development stages.

Figure 98: Spatial vision map Hoek van Holland, 2030. The yellow areas are identified as potential future housing development areas. Retrieved from: Gebiedsvisie Hoek van Holland 2011-2020.

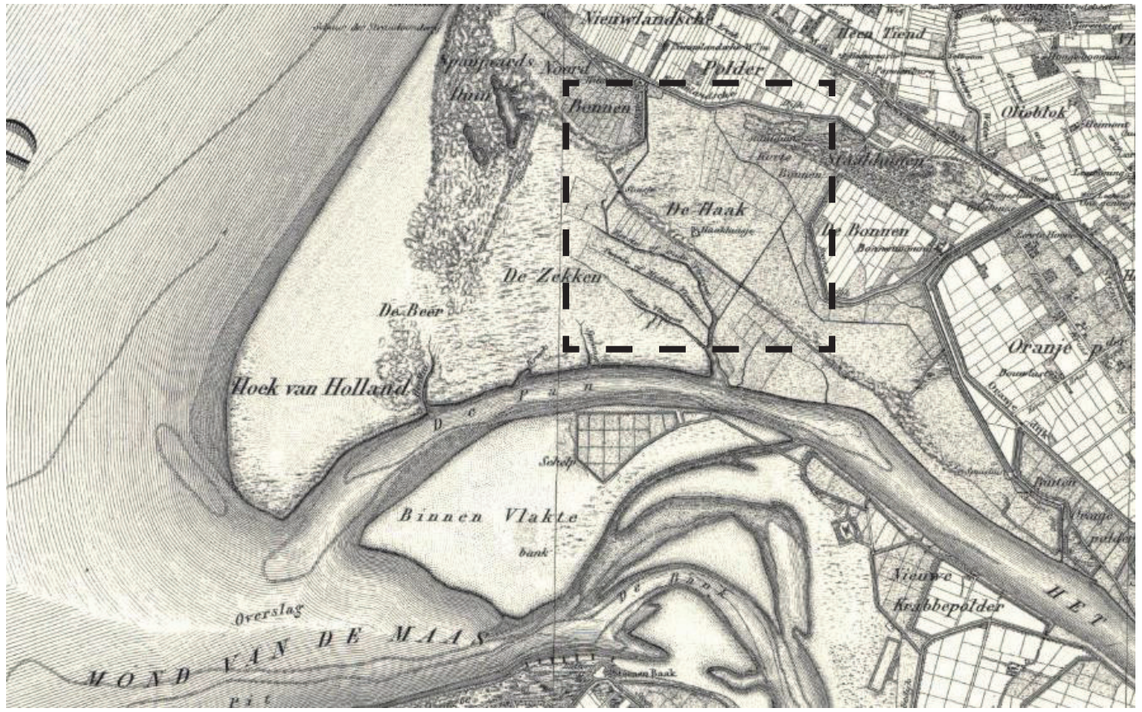


Figure 99: Historical map Hoek van Holland
Source: Topotijdreis.nl

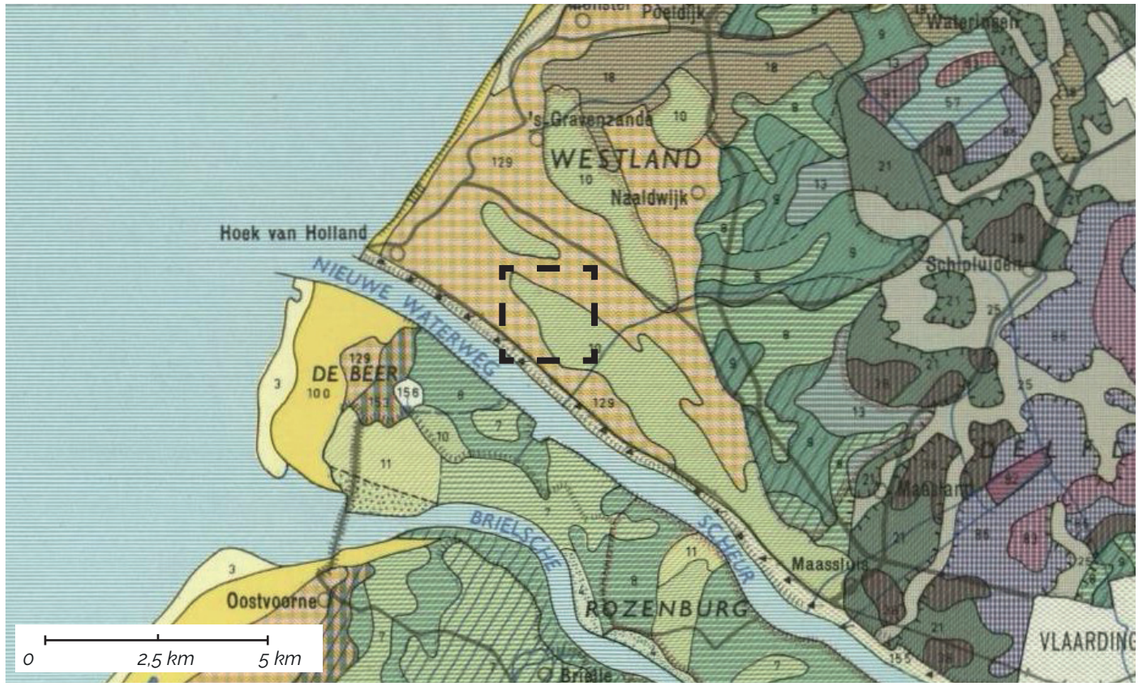
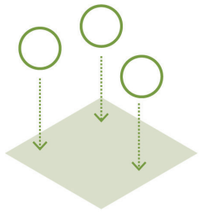
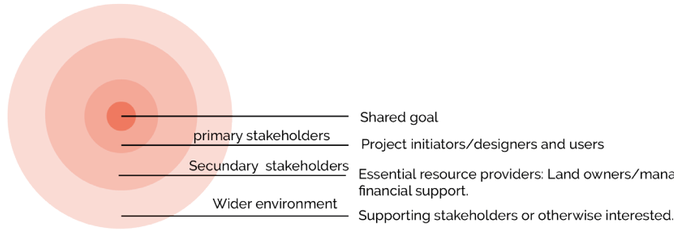


Figure 100: Soil map Hoek van Holland
Source: Soil Map of the Netherlands Zuid-Holland and Utrecht by Stichting Bodemkartering. Retrieved from: WUR digital library.

7.2 STAGE 1 NATURE-BASED PLACEMAKING



The first stage of development aims to improve the spatial quality of the existing landscape structure from a social and ecological perspective within a relative short period of time (<10 years). This stage will be initiated by the local municipality, in this case Rotterdam. The municipality will engage local stakeholders in a co-creation process. The municipality will share the vision and ambitions for the area with local stakeholders and ask them to think about their role and interest in the project. Under guidance of the municipality the local community will be encouraged to propose nature-based placemaking interventions for the area. Figure 101 and 102 show the stakeholders in the area and their role and importance in the co-creation process. Primary stakeholders need to be engaged in the plan creation process from the beginning on. Secondary stakeholders need to be informed and engaged in the plan making process when their specific engagement is required because of certain resources they provide. The wider environment needs to be informed about the progress from time to time.
The next pages explore the kind of nature-based placemaking interventions that can be applied in this area. The next pages also show some eye level impressions of the spatial improvements.



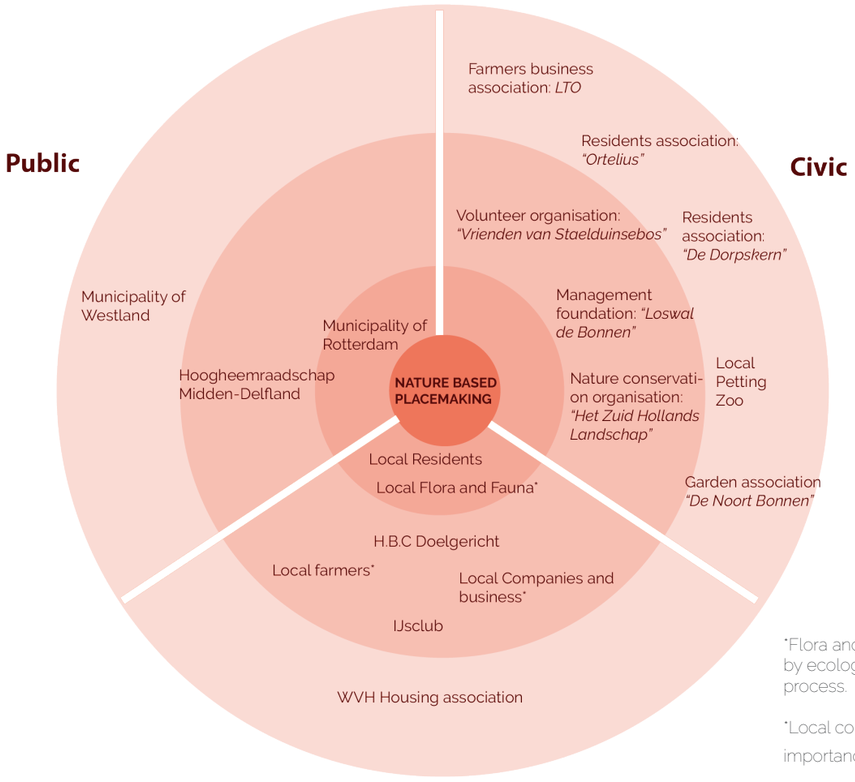


Figure 101: Onion diagram of stakeholders in the area. Made by author. Image inspired by: Czischke, 2018

*Flora and fauna: interests will be represented by ecologists from the beginning of the process.

*Local companies and businesses of specific importance:

1. Stena Line
2. Slib en Grondbank Waterweg - Dura Vermeer
3. Camping Antoniushoeve
4. Synres B.V. Chemical Production Company
5. Water treatment company RWZI Nieuwe Waterweg

Figure 102: Stakeholders in the project area on the map. Made by author.

Figure 104 shows the project area and a selection of possible nature-based placemaking elements that can be implemented within the existing spatial structure of the area. These interventions will improve the quality of the area from both an ecological as well as a social perspective. As discussed engagement of stakeholders is a crucial aspect in the realisation and management of these of interventions. Co-creation with stakeholders will strengthen the sense of place experience among the local community and enhance stewardship over the area, which is essential for the management of new green space elements. .

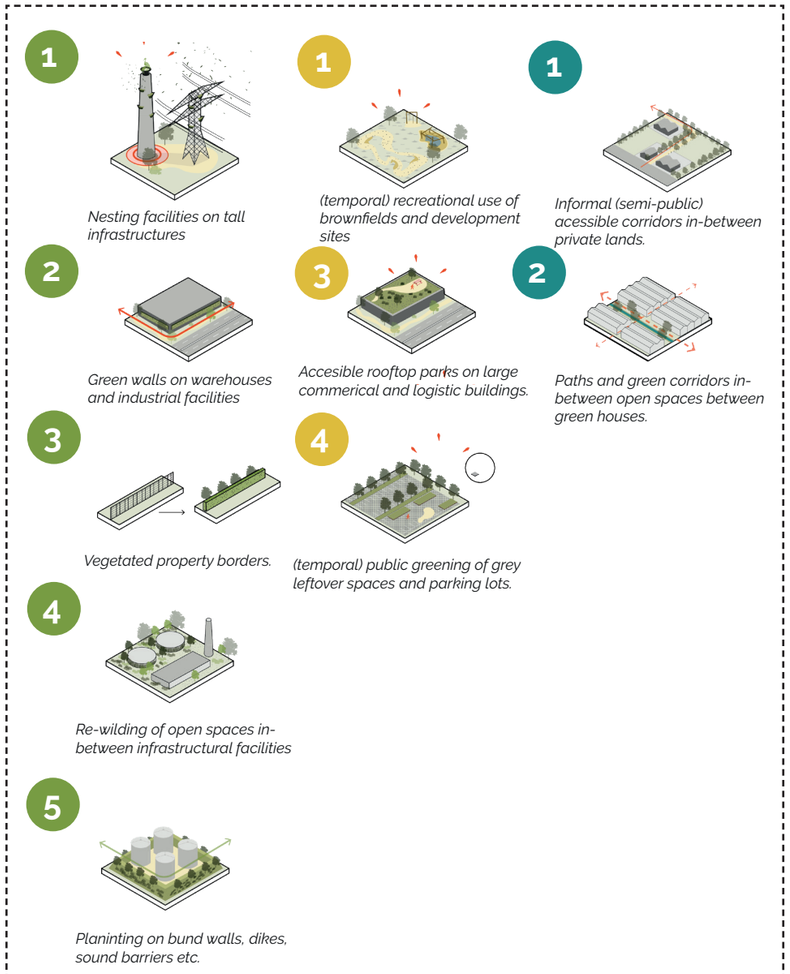


Figure 103: selection of nature based placemaking interventions that can be applied on the site.

Figure 104: Placement of interventions in the area. The circles and numbers indicate what kind of intervention is proposed at the specific spot. The circles with an extra outline are developed into an eye level impression on the next pages. The map has been rotated 90° clockwise.

2

Figure 104: Existing situation, Kulkweg.

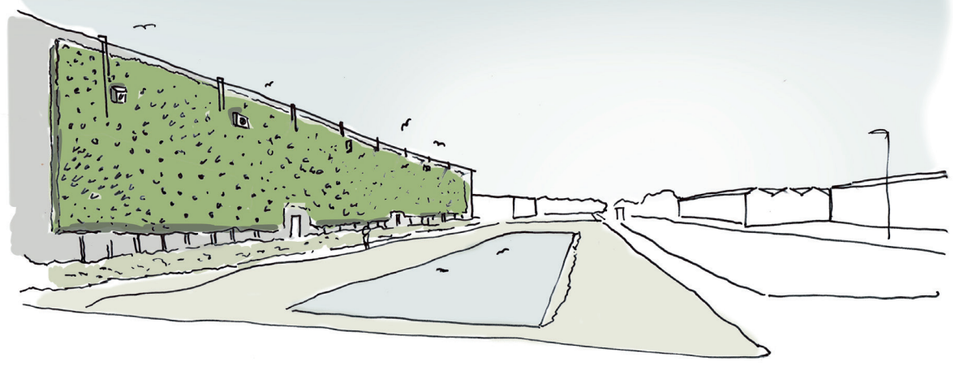


Figure 105: Impression of proposed placemaking intervention at Kulkweg..

Space Improvements

+ Spatial complexity

+ Legibility

+ Habitat diversity

The drawing above (figure 105) illustrates how the quality of the spaces in this specific area can be improved through the creation of a green wall against the warehouse building. Within the planting nesting facilities for bads and birds can be situated. This spatial interventions will improve sense of place by strengthening spatial complexity and legibility of the landscape. Through this intervention the surrounding area becomes is more pleasant to be and becomes more memorable to the user. The reference pictures of the species give some sense of what kind of new or extra species might be expected after the intervention.

Construction

Bird and bad boxes

Steel frame

Climbing plants

Vegetation

Hedera Helix

Clematis vitalba

Humulus lupulus

Species

Bads

Bees and other insects

Insect eating birds, among which Eurasion Wren and Dunnock.

106: Reference images.
Various openweb sources: references found in bibliography.

1

Figure 106: Existing situation along Prins Hendrikweg.

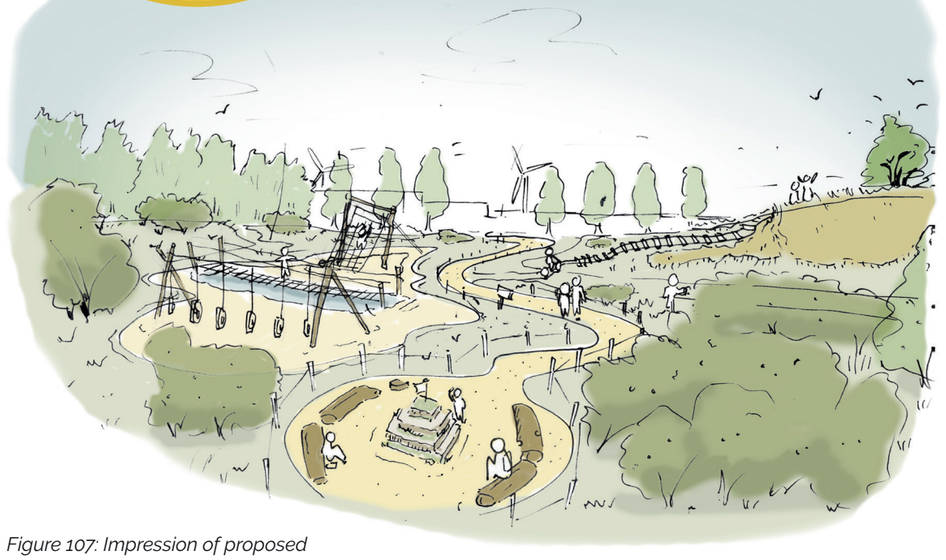


Figure 107: Impression of proposed placemaking intervention.

Space Improvements

+ Activity and interaction

+ Habitat diversity

The drawing above (figure 107) shows how the anonymous open space can be improved by the construction of a nature-inclusive playground. This playground is constructed of natural materials such as logs, natural ponds, insect hotel and a shell path. Consequently, the area challenges the user to interact with the natural environment and strengthen the users sense of place.

Construction

Insect hotel

Obstacle parcours

Seating logs

Vegetation

Salix Repens

Rubus Fruticosus

Rosa Canina

Species

Amfibious animals such as toads and salamanders

Bees and butterflies

Berry eating birds among which thrushes such as the Redwing.

108: Reference images.
Various openweb sources: references found in bibliography.

Figure 110: Existing situation Haaklaan (streetview)

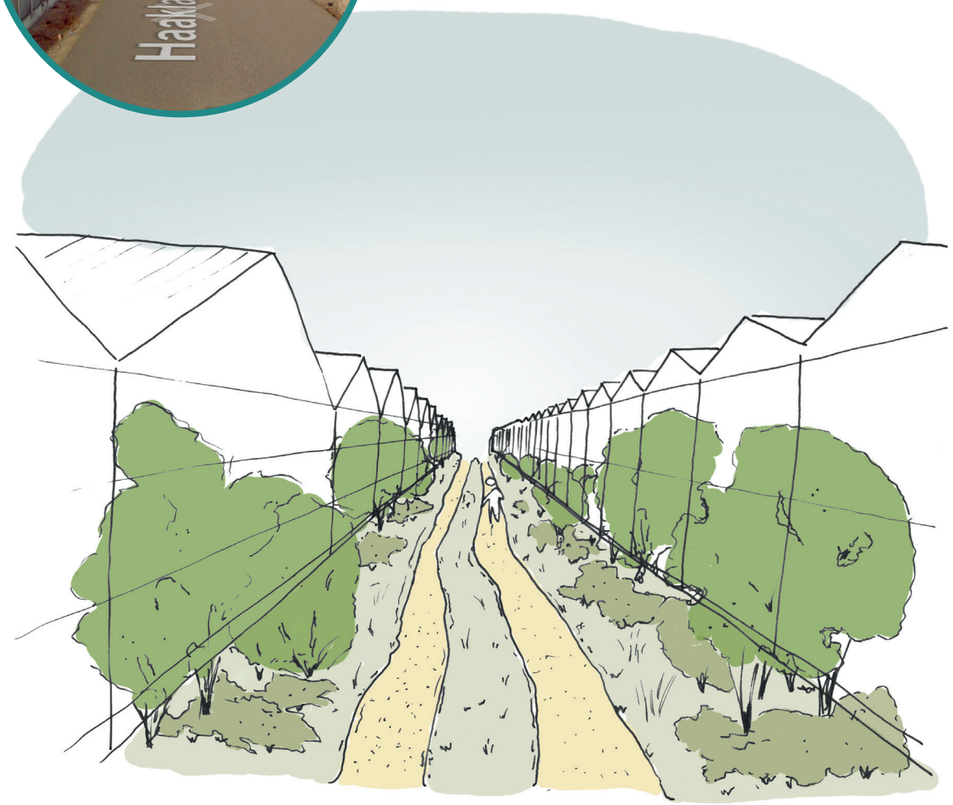


Figure 109: Impression of proposed placemaking intervention.

Space Improvements

+ Accessibility

+ Spatial complexity

+ Ecological connectivity

The drawing above illustrates how an existing road in between two green houses can be transformed in an ecological corridor. In order to achieve this the road needs to be closed of for motorized traffic, and existing asphalt should be removed. From there on small bushes can be planted and a path can be created. The transformation adds significant value to the legibility, accessibility and spatial complexity of the area.

Construction

Shell path

Mixed hedge

Cart track

Vegetation

Acer campestre

Viburnum Opulus

Fagus sylvatica

Species

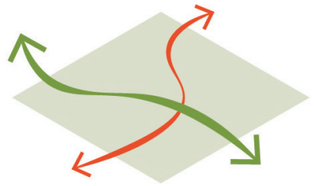
Birds such as common blackbird

Insects

Small mammels such as hedgehogs

110: Reference images. Various openweb sources: references found in bibliography.

7.3 STAGE 2 SOCIAL-ECOLOGICAL CORRIDORS



The primary aim of this stage of the spatial transformation of the area is to enhance the ecological connectivity and social accessibility within the area and to its wider surroundings.
This stage is developed in coherence with the placemaking initiatives from the previous stage. This spatial framework will be developed by the local municipality in collaboration with neighbouring municipalities to which the proposed corridors should be connected. Figure 112 shows a proposed social-ecological framework for the particular case at Hoek van Holland. At local level there is a need for improved active transportation. The icons indicate the kind of active transportation is stimulated by means of spatial interventions. At larger scale there is a need to strengthen the spatial quality and connectivity of recreational (bike) routes. From an ecological perspective there is specific need to connect the green structure all the way to the dune landscape. This allows terrestrial species to migrate to the area all the way from the dune landscape. These larger scale connections can be seen in figure 111. Strengthening of the ecological connectivity at local and regional scale increases the likelihood of more specialised species (or icon species) to migrate and settle in this part of the membrane landscape.

Figure 111: Connecting green corridors at regional scale. Made by author.

Figure 112: Social-ecological network map. Made by author.

Figure 113: reference images. Sources in bibliography.

Species rich herbaceous vegetation on dike ridges

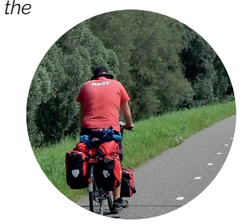
Fysical enclosure of space with willow trees along waterway

Continuous roadside planting with thorn hedges marking public-private border.

Naturel vegetated waterway banks with reed collar.

Unpaved walking trails through the fields.

MTB trails through the fields.



New cycling routes on old dike structure.

Figure 114:
Existing situation along kulkweg.
Google streetview.

Figure 115:
Proposed improvement of corridor at eye level at kulkweg.
Made by author.

Space Improvements

+ Interaction

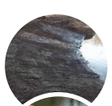
+ Spatial complexity

+ Ecological connectivity

+ Local nature (sponteneous growth)

Figure 115 shows how the roadside and waterway can be transformed in a way that it creates an ecological corridor. Moreover, the drawing illustrates how the placemaking intervention can be connected and integrated within the ecological network.

Construction



eco friendly river bank

platform

shell path

Vegetation

Phragmites australis

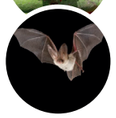
Nuphar lutea

Salix alba

Species

Waterfowls such as Mallard

Various insects such as goat moth



Bads

116: Reference images.
Various openweb sources: references found in bibliography.

Figure 117:
Current situation at Bonnenweg, Google streetview.

Figure 118:
Proposed improvement of corridor at eye level at Bonnenweg.
Made by author.

Space Improvements

+ Spatial complexity

+ Legibility

+ Accessibility

+ Ecological connnectivity

+ Local nature

Figure 118 shows how the current street and waterway can be transformed into an ecological corridor that is of greater ecological and recreational value. Broadening the waterway and creating a more gentle slope alllows wetland and aquatic vegetation to develop and provide valuable habitats for birds and fish species.

Construction

eco friendly river bank

shared street

boardwalk

Vegetation

Phragmites australis and other

Nuphar lutea

Salix alba

Species

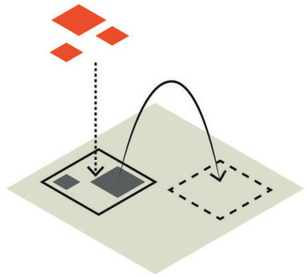
Birds of prey such as litlle owl.

Fish eating birds and waterfowls

Fish such as the Rudd

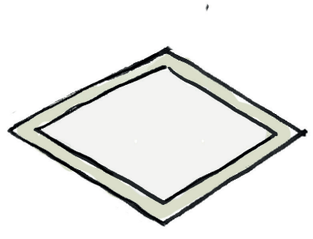
119: Reference images.
Various openweb sources: references found in bibliography.

7.4 STAGE 3 LAND-USE RE-DESTRIBUTION

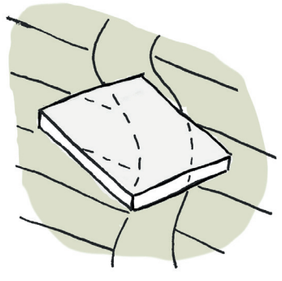


As has been concluded yet from the spatial analysis of this area (see chapter 4). The location can be characterised by its predominance of commercial, agricultural and industrial land use clusters. Figure 121 indicates the current composition and configuration of the land-uses in the area. Consequently, the location can be typified as a type of TiB with significant compositional heterogeneity, but lack of configurational heterogeneity. The spatial problems that come with this are shown in figure 120. The clustering of these land uses creates a large grain size and limits the accessibility of the area (1). Furthermore, the large plot sizes and clustering of land uses covers underlying landscape patterns and limit the overall legibility of the landscape (2). Additionally, many plots are turned inward and face the public street with the backside of the building (3). This causes for streets which lack public life and identity.

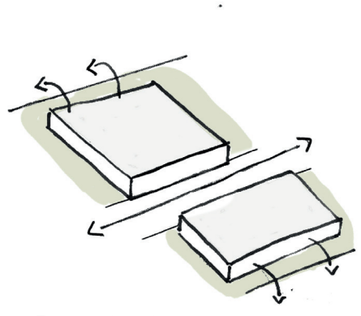
In order to overcome these spatial problems the third stage of the area transformation should aim at increasing the configurational heterogeneity of the landscape. This is further explained on the next pages.



1. Large grain size due to clustering of land uses.



2. Invisble landscape patterns



3. "Dead streets" enclosed by blind walls and backsides.

Figure 120:
Key spatial challenges as a result of spatial configuration of the land uses in current situation.

Land cover composition

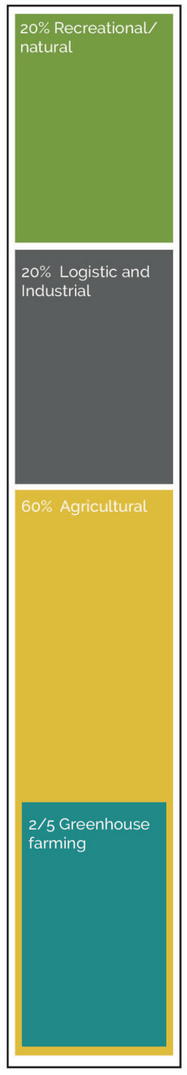
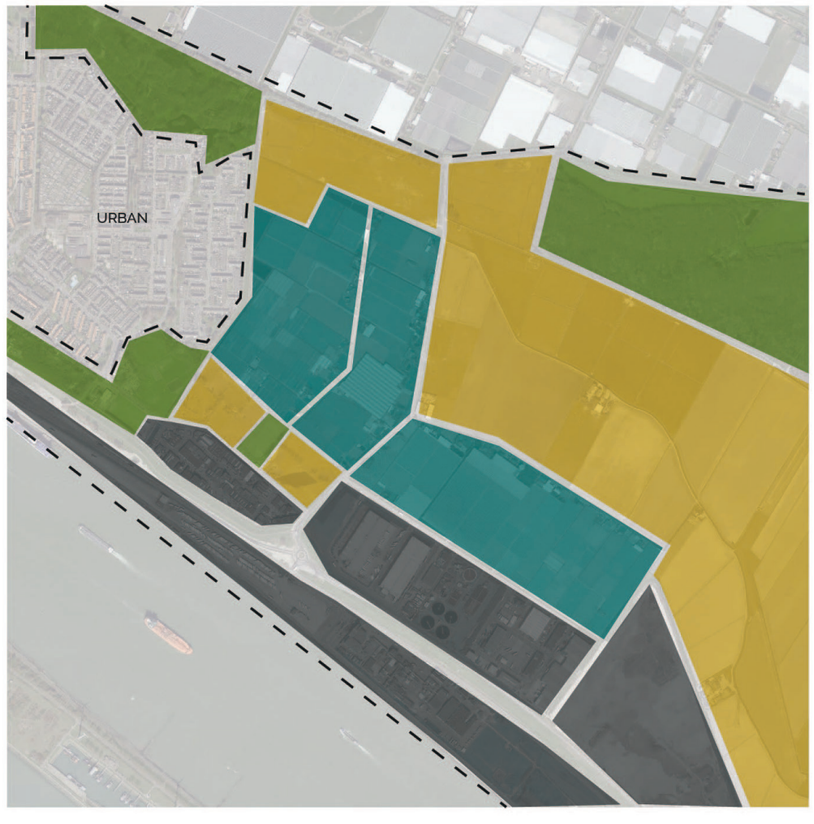


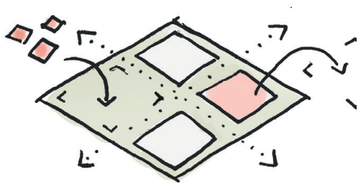
Figure 121:
Current spatial composition and configuration of land uses in the area.

Land cover configuration

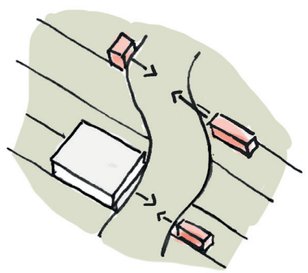


In order to improve the compositional heterogeneity of the area it is proposed to add residential activities and reduce the amount of logistic and agricultural land cover by this type of land uses. The proposed land cover composition is illustrated in figure 123. New housing development in the area can function as a driver of the spatial re-configuration of the landscape. In order to achieve greater configurational heterogeneity in this area the mean patch size of each type of land use should be significantly reduced (Fahring, 2011). Patch size is considered to be the spatial dimension of one single land cover type, such as green houses. Additionally, there are three guidelines shown in figure 122 that provide some additionally guidance for the placement of new land uses.

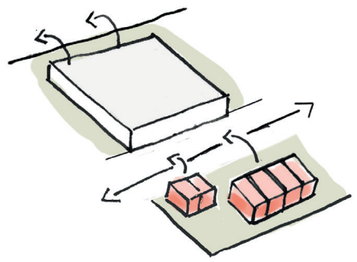
First, reducing grain size and improve accessibility by taking out some clustered land uses with large plot sizes and replacing them for small scale developments, which allows for the creation of a more informal infrastructure network. Secondly, strengthening underlying landscape patterns by placing new land uses and buildings in relationship with underlying patterns and the social-ecological corridors that have been defined in section 7.3 This strengthens the legibility of the landscape. The third guideline is to activate streets by placing front sides and entrances to all of the streets.



1. Reducing grain size by replacing clustered land uses for other fine grained developments, such as housing.



2. Strengthen underlaying landscape patterns by building placement and orientation.



3. Activating streets by changing front side orientation of new land uses.

Figure 122:
Design guigelines for heterogeneity.
made by author.

Figure 123:
Proposed change of land use composition inthe area. Made by author.

Proposed land cover configuration

Heterogeneous landcape

Figure 124 shows a potential outcome of the heterogeneous planning approach to the transformation of the landscape. The proposed landscape is significantly more spatially heterogeneous in terms of its diversity of land uses and the mixed spatial arrangement of them within the landscape. Figure 125 shows some references of potential new program in the area. Recreational land uses that are currently under pressure in the urban territory will find a place in this landscape. Space is created for extra allotment gardens, an extra sports field, a mountain bike trail and camp site and many other pressured land-uses.

Now, after the three stages of spatial development have been implemented the area can be considered to be a membrane landscape. In other words, the territory has now achieved the three main objectives of the vision.

1. Strong engagement and interaction of people and the natural environment through nature-based placemaking activities and added recreational program.

2. Strong social-ecological connectivity and integration of the area with both is regional as well as its local context.

3. High degrees of spatial heterogeneity at both plot/ building level as well as district level.

The next pages shows a section of the area (figure 126) before and after the spatial interventions and the resulting habitats and species.

Figure 124: Spatial design proposal for improvement of spatial heterogeneity of the landscape. Made by author.

Allotment gardens

Eco Housing project

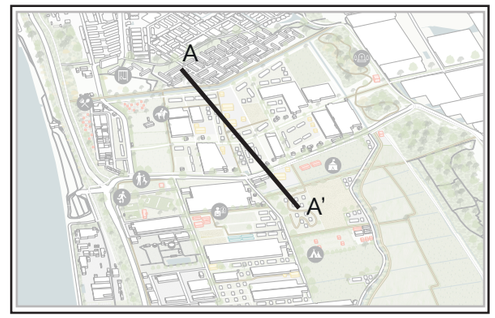
Natural burial

Daycare farm

Camp site

Figure 125: Reference images of new proposed land uses and activities in the area. Sources in bibliography.

Figure 126: The section illustrates the overall increase of habitat types and biodiversity as a result of the spatial re-configuration of land uses. The species shown in the "current" situation have been selected based on observations reported at waarneming.nl sources of images in bibliography.



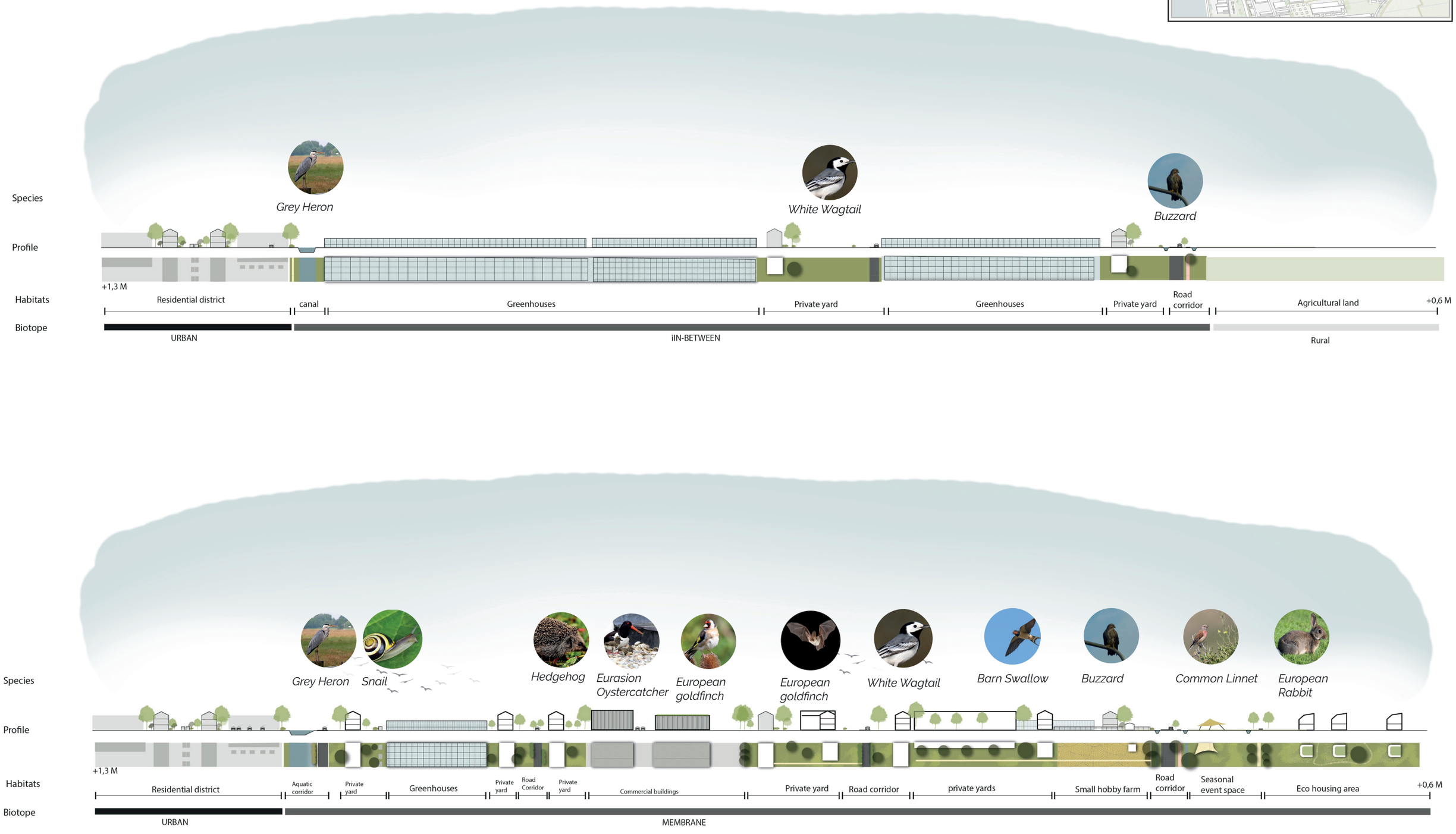


Figure 127: Existing situation Haaklaan. (google streetview)

Figure 128: Proposed situation Haaklaan.

Space Improvements

+ Interaction

+ Spatial complexity

+ Habitat diversity

Figure 128 shows an impression of what the spatial transformation for the third stage can look like at eye level perspective. This is the same location as was shown in figure 110, but then in a later stage of the area transformation. In this stage one of the green houses has been removed and made space for new extensive housing developments. The extensive nature of these developments allows for other informal routes and activities to emerge. There can be space for small scale hobby farming in-between the new housing developments. Making space for this is important as it adds significant value from a recreational and ecological perspective. The attract insects and therefore might attract other birds. Moreover, hobby farming animals can play a very important role in strengthening people's sense of place because passers-by are able to interact with them to a greater or lesser extent.

Construction

eco friendly housing

hobby farming

cart track/ nformal path

Species

Birds, such as house martin and barn swallow

small mammels such as moles and mice.

Insects such as flies, bees and others.

129: Reference images. Various openweb sources: references found in bibliography.

Figure 130: Existing situation Kulkweg, right side of the street.

Figure 131: Proposed situation Kulkweg.

Space Improvements

+ Interaction

+ Spatial complexity

+ Habitat diversity

Figure 131 shows the potential eye level design outcome along the Kulkweg when another green house and distribution warehouse makes space for a daycare farm, housing development and a sportsfield. The new land uses significantly reduce the grain size of the area and also activate the street by the placement of new entrances and program along the street.

Construction

day care farm and local food selling point

eco friendly housing

Sport field

Species

birds, such as little owl

small mammels such as hedgehogs

larger mammels such as foxes and martens

132: Reference images. Various openweb sources: references found in bibliography.

8. CONCLUSIONS

This chapter will answer the research questions, reflect on the limitations of the project and discuss the main lessons that the research puts forward.

8.1 CONCLUSIONS

This chapter will answer the (sub) research questions as they have been formulated in chapter 2.

The thesis project has attempted to gain understanding of the challenges and potentials of in-between territories in the region of Rotterdam with respect to biodiversity and sense of place experience. The hypothesis that followed from the literature review was that ecological design principles can have a positive mutualist effect on biodiversity and sense of place experience in the TiB. The relationship between these theories and its applicability in the TiB was explored through a research by design process at both regional and local scale for the region of Rotterdam. The main research question that was answered through this research is:

How can a nature based planning and design approach strengthen biodiversity and sense of place in Rotterdam's TiB?

The main research question is twofold. Firstly, the research seeks to explore what a nature-based planning and design approach can look like. Secondly, it aims to investigate how such an approach can strengthen biodiversity and sense of place specificly in Rotterdam's TiB. Regarding the first aspect the research sought to understand the links between landscape ecology theory and urban design practice.
The research has put forward a nature-based planning and design approach that applies and integrates landscape ecological

Figure 133: Impression of possible transformation of area at Nieuwekerk a/d IJssel, same location as cover image. Made by author.

design principles (such as connectivity and heterogeneity) within the (semi) urban context with the aim to improve the ecological quality of the landscape at both local and regional scales.
Regarding the second aspect of the research question the research has showed that the TiB which find themselves literally in-between the urban and rural landscape, at the edge of the urban structure, have a unique potential to bridge the urban-rural divide and strengthen interspecies interaction for both human and non-human species. This type of landscape is described as the recovering membrane. This membrane is acknowledged as a unique type of landscape at the edge of the city that is recognizable, experiencable and memorable to people and therefore enhances people's sense of place. Moreover, it will likely also benefit the region's sense of identity and branding. In order to successfully achieve the regional vision for the membrane an interscalar design approach is proposed that is driven by bottom up initiatives and local interventions that eventually progress towards regional objectives and vision for the membrane landscape.

Next paragraphs provide more elaborate insight in the research findings by answering of the sub-research questions.

SRQ1:
What are the spatial characteristics of Rotterdam's TiB?

From the literature review on the work of Alex Wandl it was learned that TiB in general, can be typified by three spatial characteristics.
1. The abundance of infrastructures
2. Intermingling of built and unbuilt spaces
3. Mix of land uses.

Based on the spatial analysis at regional and local level several additions and nuances can be made to the spatial characteristics of TiB in the region of Rotterdam specifically. The main findings are listed below.
First of all it was discovered that there is a great difference in spatial quality between TiB. Based on the spatial analysis the TiB in Rotterdam can be roughly divided into 4 types.

- **1.** TiB with an emphasis on industrial activities such as green houses and harbor activities. This is especially prominent in the region of Rotterdam.
- **2.** TiB with an emphasis on recreational activities such as sport complexes, allotment gardens, grave yards and holiday parks. Often located at the urban edge of the city.
- **3.** TiB which are mostly defined by commercial activities such as runshopping centres and large warehouses and logistic facilities (location 3). Often located directly next to large infrastructure corridors.
- **4.** Finally, there are in-between territories that seem to be a strong mix of the previous mentioned typologies. These landscapes are often located more closely to the urban tissue and are of greater social-ecololgical potential because of their high degree of spatial heterogeneity . These type of in-between territories have been the main inspiration for the design proposal.

Because of the great differences in spatial quality between the different type of TiB in Rotterdam that have just been discussed it is hard to come to generalised conclusions. Nevertheless, there are a few common spatial problems in the TiB of Rotterdam that seem to require special attention in the design process. These issues are discussed at the answering of sub research questions 3 and 4t.

SRQ 2:
How are Rotterdam's TiB addressed in local and regional spatial planning processes?

This research question is answered through a review of primary and secondary literature. Some of these findings are part of the theory paper (appendix V).
Dutch planning process at both national and local scales are primerily focused on the distinction between the urban and rural and especially the preservation of this distinction. The TiB is not yet considered as a distinct typology. As a result of the neglect of the TiB in spatial planning the spatial qualities and potentials of the TiB for social and ecological development are generally underestimated. In spatial planning documents the landscape of the TiB usually gets a negative connotation which makes them prone to spatial redevelopment, especially for urban densification. However, it is expected that densification of the TiB will likely only shift the "undersired" land uses of the TiB towards other places outside further outside the city. Therefore, TiB are ever existing and dynamic part of the landscape. Additionally, the strong emphasis of the national government on economic and infrastructural development in combination with globalization processes the TiB will likely only become a more fundamental part of the Dutch landscape. Hence, sustaining the spatial quality within the TiB is an issue of conflict between regional and local planning processes. An inter scalar and cooperative design approach is therefore needed to improve the spatial quality of the TiB. Furthermore, existing (social and ecological) qualities and potentials of these type of landscapes should be valued accordingly by engaging the local community and local nature in the redevelopment process.

SRQ 3:
What are the ecological opportunities and challenges of Rotterdam's TiB?

This research question was answered through a spatial analysis of the landscape structure of the TiB for three case locations. This was investigated by the identification of ecological patches and corridors in the landscape. A site visit to each of the locations provided additional information on the quality of the green spaces in terms of species richness and maintenance. Several conclusions can be deduced from this analysis.

- Firstly, the unbuilt spaces of the TiB form an essential part of the local and regional green structure and should therefore be valued accordingly. Especially when urban densification is proposed.
- At regional scale there is an opportunity to strengthen the ecological green structure of the TiB, and establish a

regional connection between the urban green network and the provincial and national protected nature areas.

- As a result of significant fragmentation by large infrastructures and large grain size in the TiB specific attention should be given to the connectivity of green spaces within the TiB at local scale.
- The green structure in the TiB is unique because of its composition of wild, semi-wild and cultivated species as a result of the great diversity of land uses and management regimes. This high degree of structural diversity makes the TiB a place of high ecological potential Consequently, the landscape can provide a great diversity of complementary resources that support both generic "urban" species as well as more specialised species that are generally found outside the urban environment. In other words, the TiB has the potential to be a territory of high biodiversity that facilitates interspecies interactions.
- In order to utilize this potential more attention should be drawn to the improvement of semi open spaces in the TiB at local level. Spaces such as, parking lots, recreational sites and infrastructure borders are often planted with little species diversity and add little ecological value to the local ecosystem. Hence, there is a significant opportunity to improve the habitat diversity and ecological quality of these open spaces in the TiB with small scale and low cost interventions.

SRQ 4:

What are the opportunities and challenges with respect to sense of place experience in the TiB.

With respect to the cognitive experience of these landscapes several common problems are identified.

- Firstly, the TiB are often not a true destination, but merely a pass trough area for people as a result of the lack of public program. This lack of interaction with the space limits people's place experience in the TiB.
- Secondly, there is a lack of imageability in the TiB, especially at monofunctinional commercial and industrial sites it is hard to identify what makes the area unique or site specific.
- The grain size of the TiB is generally much higher compared to urban residential structures. As a result of this walkability and accessibility of the TiB from local neighbouring areas is often poor.
- Furthermore, most TiB have poor legibility of the landscape as a result of lack of routing and navigation for active transportation modes. This is especially problematic at industrial and logistic sites where there is a lack of spatial differentiation and complexity at human scale.
- At most locations there seems to be a scale conflict between old landscape structures such as creeks, old dikes and old settlements with new large scale developments such as large road infrastructures and industrial activities, which are poorly integrated in the landscape, this also limits landscape legibility.
- There is a need to improve safety and comfort for people in the TiB. The lack of footpaths, public furniture and vegetation cover in many TiB make it generally unpleasant to walk and recreate in these landscapes.
- The location of the TiB in-between urban and rural landscapes makes it especially promising for recreational activities. The semi open landscape creates a balance between social control and sense of freedom. Design for the TiB should therefore aim at strengthening the cognitive experience and recreational value of these landscapes.

SRQ 5:

What kind of ecological design interventions can strengthen sense of place in Rotterdam's TiB?

From the research it was concluded that relatively small scale spatial interventions can have a mutual positive effect on both ecological performance as well as sense of place experience. In the thesis project these type of interventions are identified as nature-based placemaking interventions.
In order to strengthen sense of place experience in the TiB the green space interventions should aim at strengthening the following 4 key aspects of the landscape.
1. Legibility and imageability
2. Acitivity and interaction
3. Transparency and accessibility
4. Complexity and human scale
The interventions can be implemented at different scales. For example a green wall on a warehouse strengthens spatial complexity and human scale at short term at very local level, whereas a structural change of the land uses in the area will eventually have a much greater effect on the landscape complexity. Therefore, interventions and objectives should be placed within a spatial and temporal context.

SRQ 6:

What kind of spatial planning strategy ensures biodiversity and the provisioning of ecosystem services in the TiB at local and regional scale?

This question was answered through a research by design process. . The strategy (described as "the recovering membrane) that is proposed is developed at both regional as well as local scale. This strategy proposes a regional vision for the TiB, surrounding the city of Rotterdam, that will be achieved through a process of local spatial transformations. This inter scalar approach aims to achieve coherence and identity at regional scale between the TiB while also considering local conditions and stakeholders. The coherence between the regional and local scale is maintained through the establishment of a distinctive management group for the membrane landscape that will facilitate communication and feedback between the scales and ensure progress towards vision achievement. This kind of strategy will increase attention that is given to the spatial quality in these landscapes that are currently often underestimated and poorly integrated in their surroundings.

SRQ 7:

How can ecological design interventions that strengthen biodiversity and sense of place in the TiB be spatially integrated in a design transformation for a particular case in Rotterdam?

This question was answered through the design exploration of one of the case site at Hoek van Holland.
The proposed spatial interventions were organized into three development phases.
These phases of development correspond with either short term, mid term and long term development of the area. the first phase aims at enhancing the social and ecological quality of the area through small scale. low cost and short term interventions. The second phase aims to strengthen the social and ecological integration and connectivity of the area with its surroundings. The third phase aims at re-structuring the landscape in order to strengthen the structural heterogeneity of the landscape. This is the longest and most complex phase of development.
This kind of phased approach is needed because of the great objectives of the regional vision that require great investment of local communities and governments that cannot be achieved at once. It also gives the opportunity for local governments to engage with local stakeholders and increase public support of the project slowly over time. Moreover, to have time to connect the project to existing development plans, for example housing development projects.

8.2 REFLECTIONS

RELATIONSHIP BETWEEN GRADUATION TOPIC, MASTER TRACK AND GRADUATION LAB

The master track of Urbanism within the faculty of architecture aims to create social, economic and environmentally resilient living environments for people and wildlife. Especially, the past decade the importance of wildlife for our health and well-being has gained increasing attention. The new urban ecology graduation lab is primarily focussed on ecosystem resilience within urbanised areas. The studio considers humans as an integrated part of this (urban) ecosystem. In this graduation project I also aimed to bridge the gap between landscape ecology research and anthropogenic environments and cultural processes. I believe urban designers and landscape architects have the urgent task to bring together the fields of ecology and social development through an integrated design process. In my opinion this will make our cities more inclusive to both people and wildlife.

RELATIONSHIP BETWEEN RESEARCH AND DESIGN

This thesis project has aimed to combine the research domains of landscape ecology and sense of place. The first 5 sub-questions of the project are research oriented and establish a link between the theory domains and the spatial context of the territories in-between (TiB). The other 2 sub-questions are design oriented and have translated the findings from the research-oriented questions into an integrated design proposal. In other words, the design aspect of the project is used as tool to explore the links and synergies between landscape ecology and sense of place within the spatial context of the TiB. Overall, I conclude that the proposed vision and strategy for Rotterdam's territories-in-between is mostly research driven. However, the proposed spatial interventions at local scale are to a greater degree the result of a creative design process. This creative design process did not follow sequentially after the research, but more or less ran in parallel to it. Consequently, the research and design aspect of the thesis project have been interacting and supporting to one another.

RELEVANCE

Scientific

The past decade the discourse of urban ecology has gained increased attention. Especially from the point of view of human well-being and liveability in urban environments. As a result of the growing number of people living in cities and the ongoing urbanisation, ecology cannot merely be seen as something that is excluded from the urban environment. On the contrary, urban environments can be seen as entire ecosystems (Forman, 2014). As a result of the increased attention given to ecology in cities local governments are improving the green quality in their cities not only for liveability reasons, but also for economic benefits (Haq, 2011). So far, it seems that most attention for improvement of spatial quality through green space interventions is drawn to city centres and tourist hotspots, mostly excluding the TiB. Even though, these landscapes can provide a crucial ecological connection between the urban and rural environments (Wandl, 2014). Furthermore, spatial quality in these landscapes has proven to be an issue of concern in the territories in-between, which can also be improved by green space interventions. Consequently, the scientific relevance of this thesis project lies in the link that is established between landscape ecology and sense of place theory and the attention that is given to landscapes in-between the urban and rural which are often not at the centre of attention in urban design practice and pose unique challenges and opportunities. Moreover, bridging landscape ecological design principles with the placemaking and urban planning gives new insights on synergies that can emerge as a result of the integration between the professions of ecologists and urban planners and designers.

Social

As a result of the limited attention given to the spatial quality of the TiB people living and working in these landscapes are disadvantaged. Moreover, the need for improvement of spatial quality of the TiB from an ecological perspective is not only relevant for the people living and working in these territories, but also for residents of the entire city region. The need for high quality (public) green spaces in the vicinity of our living environment has proven to be of special importance during the covid-19 crisis. Furthermore, strengthening the sense of place through spatial design interventions benefits the sense of community and ownership over the place, especially when stakeholders' interests are taken into account in the design process. In turn this will contribute to the sustainability of the local community and will provide local stewardship over the spatial interventions which is also of economic interest for local governments (Masterson et al, 2017). The thesis project addresses multiple sustainable development goals of the united nations (SDG, 2015):

Goal 3: Good health and well-being

This project aims to improve (mental and physical) health and well-being by means of improvement of the physical living environment of people.

Goal 11: Sustainable cities and communities.

In the project this goal is addressed from the perspective of improving social resilience and inclusivity through a collaborative planning and design approach that engages local stakeholders.

Goal 15: Life on land

This sustainability goal is about restoring and protecting terrestrial ecosystems (SDG, 2015). In the project this goal is addressed through the ecological design approach for the TiB which aims to improve biodiversity and ecosystem resilience through green space interventions.

METHODOLOGY AND DATA COLLECTION

The applied approach and methodology to the research has shown several advantages and limitations to the project. As a result of limited previous research on territories in-between identifying and delineating the problem field was difficult in the beginning. However, the explorative nature of the research and design process provided insights that enriched the understanding of the problem field throughout the research process. For example, the field research (site visit and small talk with people), the desk research on news articles and spatial planning vision and a spatial analysis of three case locations through the use of patch corridor matrix theory helped grasping the scope and complexity of the problem field. Nevertheless, these research methods also have some limitations. In order to get a better understanding of the spatial qualities and spatial problems of the TiB I decided to visit three case locations, areas that could be identified as in-between. These locations do not fully represent the great diversity of TiB in the region of Rotterdam. Therefore, the conclusions that have been derived from the spatial analysis and fieldwork on these locations is not inclusive and transferable to all types of TiB in the region of Rotterdam. Additionally, the research by design process was focused around TiB with an already existing potential for mix-use and recreational value as a result of a close geographic location near the urban fringe of Rotterdam. This also excluded large (more) monofunctional TiB such as the harbour district, green house areas and some large agricultural landscapes. Further research on the potential of these territories for biodiversity and sense of place is recommended.

One of the methods that was initially planned but not executed was in-depth interviewing of some users of the case areas. At first this data collection method was proposed to get an in-depth understanding of the experienced sense of place in the TiB. Initially it was assumed it was best to use targeted questions in order to measure sense of place in the location. However, when first visiting one of the areas I noticed it was not easy getting in contact with people on the street in these locations. First of all because there where not many people residing in public space or on the street. Secondly, because of the large size of the area and limited accessibility on foot. Eventually, I decided that it would be too time consuming, while at that moment I already retrieved some valuable qualitative information on people's perception of these places by some of the informal talks with people that I encountered during my first visits. When re-visiting one of the areas during nice weather I also learnt that the covid situation was for several people the main reason they were outside in these territories, whereas they would normally be at work or at the gym. This indicates that some of these areas might be used differently in the situation before the coronavirus. Therefore, this informal method gave some room to new insights that might otherwise be missed. This exemplifies the explorative approach of the research.

Additionally, some difficulties where also experienced in the process of gathering data for the spatial analysis. It seemed that

some environmental data on landscape and species especially, was restricted to the municipal border of Rotterdam. For example, the map of Potential ecological connections (based on GIS data) from the document Natuurkaart Rotterdam does not transcend municipal boundaries. In order to overcome this provincial data and national data was used to re-create similar information sources for regional spatial analysis. However, this was not always available, therefore some assumptions had to be made based on general knowledge, experience or on other spatial information sources such as google earth.

TRANSFERABILITY

The research and design of this thesis project has exclusively been focused on the urbanised region of Rotterdam. However, it is expected that the proposed vision and strategy can be applied to other cities in the Netherlands, especially because they are affected by similar spatial planning processes and because the vision relies on combination of general theories. Therefore, the regional strategy can be applied to other cities in the Netherlands. However, at local level the design will likely differentiate very much based on different environmental and social conditions. Transferability of the strategy outside the Netherlands is also possible, but more uncertain. because of different planning approaches in these countries, In appendix II. a transferability study was conducted.

ETHICAL REFLECTION AND FUTURE RESEARCH

The first ethical consideration that is apparent in this project is the consideration of different perspectives by which the research and design can be perceived. In this project the aim has been to look at TiB from both a social (human) and non-human perspective and combine these in a shared vision and strategy. This has been done by combining theories on sense of place and landscape ecology. However, within these theories different perceptions and nuances are present. Sense of place is a very complex concept shaped by personal experiences and cultural values. Eventhough, some generalisations can be made the local design proposal should be placed in a cultural context and is perceived differently by different users of the space. This part of the research and design is also significantly shaped by my personal perception and experience of the landscape. A similar effect accounts for the ecological component of the design strategy. The theory on landscape heterogeneity that is used as a design inspiration in order to enhance biodiversity at regional scale should be nuanced. Such a strategy prioritizes certain species above others. In the design proposal more general wide-ranging species are likely to benefit most from the design approach, whereas some narrow ranging species might even be disadvantaged. Therefore, the design is never all inclusive and the designer should ask oneself the question what species (including humans) do I design for and what species may I harm? This question is especially relevant for the TiB because existing landscape ecological studies and ecological management plans, such as the classification of icon species in South-Holland still focus exclusively on urban and rural biotopes. The TiB is not yet acknowledged as a unique biotope with unique species that specifically thrive in these types of landscapes. Consequently, this might result in an overall neglect of landscape ecological management and underused potential in these territories. Preferably, this kind of follow up research should be done in close collaboration with a team of ecologists.
Furthermore, specific attention should concern the applicability of landscape ecology theories in urban design and planning practice. The majority of landscape ecological research and theories (still) focus on rural and natural landscapes. However, the design ideas and strategy that is proposed in this thesis project transfers and applies these principles onto very anthropogenic and semi-urban landscapes. Moreover, it relates concepts like monoculture and biodiversity to terms that apply on the cultural system such as mix-use and social diversity. The question can be raised whether this creative interpretation and conceptualisation of theory is justifiable. Further research on the transferability of these theories between disciplines is therefore also recommended.

EVALUATION OF DESIGN PROPOSAL IN RELATIONSHIP TO CURRENT DUTCH PLANNING PRACTICE.

The vision for the recovering membrane is unconventional and in several ways conflicting with current planning practices.
Firstly, the spatial membrane structure that is proposed in this thesis project is not bounded by administrative municipal boundaries, but is based upon actual urban boundaries that includes several more municipalities besides the city of Rotterdam. This approach is more reasonable from a system thinking perspective that this thesis puts forward. Social and ecological flows are shaped by actual spatial characteristics and not by administrative borders. Therefore, implementation of the vision for the recovering membrane requires intense collaboration among these neighbouring municipalities and shared vision forming. Urban and economic developments at the urban fringes of these municipalities need to be addressed at sub-regional level otherwise we are unable to achieve spatial coherence within the membrane and we lose the greater overall social and ecological benefit that the membrane has to offer at larger scale. Secondly, there seems to be a general underestimation of ecological and social value of in-between territories in spatial planning practice at both local and regional scales. At national and provincial level there is plenty of attention for the protection of natural (rural) landscapes, such as Natura 2000 and Natuur Netwerk Nederland. The protection of these areas is stressed from an ecological as well as a cultural perspective. Nevertheless there remains little attention for the importance of in-between territories from ecological (biodiversity) and cultural perspective. This is unfortunate because in-between territories can add significant social and ecological value that has the right to be protected. Therefore, there is not only a present dichotomy between urban and rural in spatial planning, but also between natural and anthropogenic (man-made). In order to achieve the vision for the membrane a more nuanced understanding of human-nature system and its crucial territories of interactions within the context of spatial planning is required. This way of thinking can provide a new perspective towards existing urbanisation challenges within protected rural landscapes that becomes more apparent as a result of decentralisation measures. Thirdly, the notion of heterogeneity that is proposed as an inspiration and guideline for land use planning and zoning in the TiB is not easily implemented within the existing planning system. Over the past centuries many in-between territories with high degrees of spatial heterogeneity have emerged as a result of limited to no top down planning and were the result of sponteneous growth. With existing planning regulations this is not anymore the case and active planning for heterogeneity is most likely the only way to achieve this heterogeneous landscape typology. Existing zoning plans (bestemmingsplannen) and environmental protection zones (milieuzones) however restricting the degree to which true function mix and spatial heterogeneity can develop. Zoning based on intensity of use (for example low density housing and low intensity industry/agriculture) instead of functional zoning might therefore be more suitable for the membrane.

PERSONAL REFLECTION

Overall, this thesis project was like a journey to me with quite some obstacles and difficulties on the way. Never before in my life I have been so dedicated to one single project for so long. Already from the beginning of my studies I know I enjoy working in teams mostly. Therefore, I knew this thesis project would be (mentally) challenging to me from the beginning. The covid-19 situation made the whole process even more lonesome and challenging. At times I felt like quitting the thesis. Therefore, I am very grateful for the support and faith of my mentors, parents and friends during these difficult times. Even though the process has been challenging sometimes, the thesis topic itself was of great interest to me up until the very end. Before starting on the thesis project, I did not ever hear before about the TiB, it was a complete unknown topic to me. Dr. Marcin Dabrowski introduced me to it when I told him my fascination for urban edges, landscape ecological gradients and human-wildlife interactions. I would like to thank him for this valuable recommendation that eventually ended up to be the focus of my thesis project. Throughout the thesis project my understanding and conceptualization of the TiB has significantly changed. At the beginning project I was mainly concerned with the spatial problems in the TiB. This was a preconception. However, halfway the project my perspective changed. I learned that the spatial quality of the TiB can vary a lot and is the result of small spatial nuances and differences in spatial complexity and configuration. Therefore, I certainly believe that more conscious design of in-between territories with greater attention to human scale, multi functionality and ecological quality can significantly improve the spatial quality and social-ecological performance of the territories in-between. This is something that I would very much like to take along in my future career.

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Fig. 20
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Stone Marten by: Harskamp, van, H from: http://www.henkvanharskamp.nl/index.php/nggallery/page/5?page_id=455
Bad from: Pinterest.com, original source unknown.
Green woodpecker from: https://waarnemingkaart.nl/kaart/?group=vogels&family=spechten&species=groene-specht
Common toad by: Dijksterhuis, K from: www.trouw.nl/nieuws/waarom-we-padden-alleen-in-het-voorjaar-helpen-met-oversteken~bc0c1e7a/
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Fig. 106
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Bad, retrieved from: Pinterest.com, original source unknown.
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Fig. 108
construction:
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Parcours: https://www.25gradennoord.nl
Logs, retrieved from: Pinterest.com, original source unknown
vegetation:
Salix Alba. retrieved from: www.destralendezon.nl
Rubus, retrieved from: www.appeltern.nl
Rosa canina, retrieved from: www.appeltern.nl
species:
Toad retrieved from: www.ecopedia.be
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Bird. https://www.rootsmagazine.nl/podcast/notenkrakers-koperwiek

Fig. 110
Construction
Mixed hedge, retrieved from: www.brabantslandchap.nl
shell path retrieved from: https://zoom.nl/foto/932446/schelpenpad
trail: retrieved from: www.wandelknooppunten.be
vegetation:
Acer campestre, retrieved from: www.gardens4u.eu
Viburnum, retrieved from: kruidenkast.com
Fagus sylvatica, retrieved from: www.natuurmonumentenshop.nl
species:
Blackbird, retrieved from: www.geloofstoerusting.nl
bee retrieved from: www.arcgis.com/apps/MapJournal/index.html?appid=7fae896330654190bec6e55c8e49be52
Hedgehog,retrieved from: https://www.mijntuin.org/articles/egel

Fig. 113
Herbaceaus dike vegetation from: www.w aternatuurlijk.nl
Willow trees from: www.route4you.com
Roadsie planting: pinterest. org. original source unknown.
Natural waterway from; www.multifunctionelelandbouw.net
Walking trail from: www.wandelnetwerknoordholland.nl
Mountainbiktrail from: www.ridersguide.nl
Cyclist from: www.reisblogger.nl

Fig. 116
construction:
river bank, retrieved from:www.multituin.nl/natuurvriendelijke-oevers-in-landgoed-ockenburgh/
platform, retrieved from:www.buitenschrijnwerk.eu/houten-steiger
path: source unknown
Vegetation:
Common Reed, retrieved from: https://www.np-lauwersmeer.nl/waarom-waterriet/
Yellow water lily retrieved from: www.ecopedia.be
White willow retrieved from: Groenelong.weblog.nl
Species:
Duck retrieved from: www.animalrights.nl
Goat moth, retrieved from, www.groenlijn.nl
Bad retrieved from: Pinterest.com, original source unknown.

Fig. 119
construction:
river bank, retrieved from: www.multituin.nl/natuurvriendelijke-oevers-in-landgoed-ockenburgh/
cyclingstreet, retrieved from: www.fietsberaad.nl
boardwalk, source unknown
vegetation:
reed, retrieved from: www.fietswandelweb.nl
Yellow water lily retrieved from: www.ecopedia.be
White willow retrieved from: Groenelong.weblog.nl
species:
Owl, retrieved from: www.natuurpunt.be
Grey heron: author unknown, *In De Weide: informatie weidevogels* retrieved from: http://www.opavontuuropameland.nl/wp-content/

uploads/2017/06/7-Weide-stap-3-informatie-weidevogels.pdf
Rudd, retrieved from: www.ravon.nl

Fig. 125
Daycare farm from: www.flevopost.nl/artikel/1025061/dorpsboerderij-dronten-viert-feest
Allotmentgardens from: www.ijssellandschap.nl/wonen_werken/volkstuinen/
Eco housing from: www.groenebouwmaterialen.nl/referenties/cpo-projecten-en-eco-wijken/aardehuizen-olst/
Camping from: www.familiecampings.eu/belgie/luxemburg/camping-tonny
Naural burial from: nbp-de-utrecht.nl/33-quotes/167-natuurlijk-kiezen-voor-natuur

Fig 126
Grey heron from: author unknown, *In De Weide: informatie weidevogels* retrieved from: http://www.opavontuuropameland.nl/wp-content/
uploads/2017/06/7-Weide-stap-3-informatie-weidevogels.pdf
Grove snail from: Grove snail from: www.lt.wikipedia.org/wiki/Cepaea_nemorali
White wagthail: Pinterest.com, original source unknown
Common buzzard by: Moorlag, H. from: www.ivn.nl/afdeling/hoogeveen/nieuws/natuur-op-zaterdag
Hedgehog from: www.mijntuin.org/articles/egel
European oystercatcher from: Vries, de, G. from: www.rootsmagazine.nl/vogels/zie-je-een-scholekster-op-het-dak-laat-het-weten/
Putter by: Pauwels, L. from: www. oost-online.nl/tropisch-ogende-putter-is-doodgewone-distelvink/
Bad: Pinterest.com, original source unknown.
Barn swallow from: www.blijevogelswesterpark.nl
Common linnet: www.birdphoto.nl/vogels/Kneu
Rabbit from: www.shutterstock.com

Fig. 129
construction:
Houses, retrieved from: www.stedenbouwarchitectuur.nl
Farming animals, source unknown
Trail, retrieved from: www.wandlknooppunten.be
species:
Barnswallow, retrieved from: www.blijevogelswesterpark.nl
Mole, retrieved from: www.beestjeskwijt.nl
Bee: www.arcgis.com/apps/MapJournal/index.html?appid=7fae896330654190bec6e55c8e49be52

Fig. 132
construction:
Daycare farm, retrieved from: www.flevopost.nl/artikel/1025061/dorpsboerderij-dronten-viert-feest
Houses, retrieved from: www.stedenbouwarchitectuur.nl
Sportfield retrieved from: www.idverde.nl
Species:
Owl, retrieved from: www.natuurpunt.be
Hedgehog: https://www.mijntuin.org/articles/egel
Fox from: pinterest,com original source unknown.

APPENDIX

I. THE ROLE OF EXISTING INSTITUTIONS AND PARTNERSHIPS

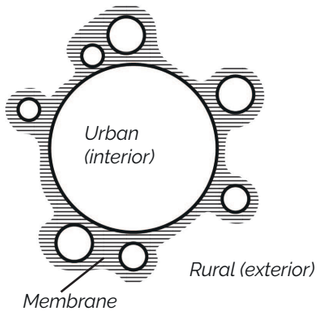
This section provides an overview of existing institutions and partnerships that concern cross-municipal cooperation and regional spatial development in the region of South-Holland that might have similiar interests to the Membrane Management Group and can be involved in the development process of the membrane in some kind of way.

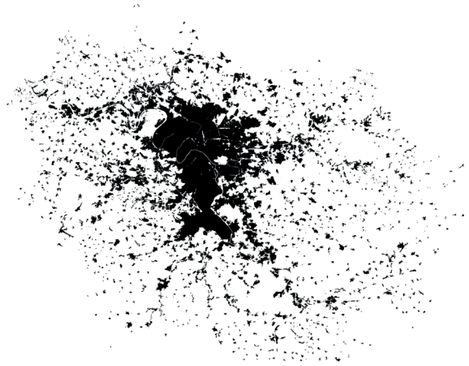
MRDH and netwerk Zuidelijke Randstad do not discuss spatial quality as primary objective but put economic development first. Therefore, these parties should operate in close collaboration with the MMG in order to align their regional economic interests with the concerns for spatial quality in the membrane that are main point of attention of the MMG.

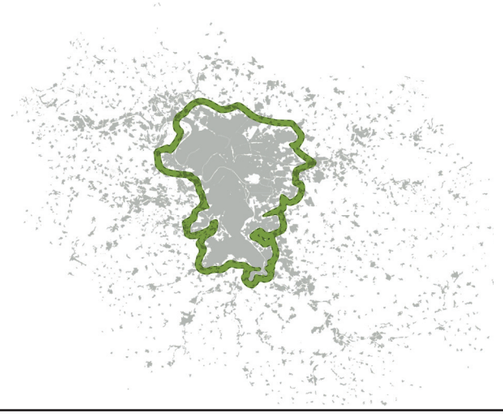
Name	Type of institution/ partnership	Objectives and tasks	Interest to the membrane	Proposed role or contribution to development of the membrane.
vereniging delta metropool	Independed, non-political and research association for metropolitan development.	Improving and strengthening the position of the Dutch Delta metropolis. primary tasks: 1. **Initiating and coordinating research**. 2. **Advising business and authoritiets.** 3. Facilitating **communication** and information exchange among stakeholders. Source: Deltametropool.nl	Interest into membrane proposal from knowledge perspective. How does it relate to existing knowledge base on metropolitan design and planning?	Start up **research trajectory** parallel to membrane development. Monitoring of spatial developments, progress and implications with respect to spatial quality. Regular publication and communiation of findings with Membrane Management Group (MMG) and local authorities.
MRDH METROPOOLREGIO ROTTERDAM DEN HAAG	Economic partnerhsip between 23 municipalities in the metropolitan region. They decide on strategic economic objectives at regional scale.	1. **Strengthening economic position** of the region through economic investments. 2. **Improving accessibility and infrastructural connectivity** between living and working environments in the region. Source: Mrdh.nl	Interest from economic perspective. The potential of the membrane as strategic location for high quality mixed working-living environment. With the aim of improving the settlement climate for businesses and creating high quality living evironment for workers in the region.	**Cooperate with Membrane Management group** on regional economic and infrastructural investment projects from an integrated economic, social and ecological perspective. Discuss what extra spatial investments might be needed in order to ensure spatial quality in the membrane nearby these economic and infrastructural developments.
netwerk ZUIDELIJKE RANDSTAD	Public-Public partnership between province of South-Holland and regional and local governments.	Strengthening international **economic competiteveness** of the region. 1. Renewing of economy 2.Creating a high quality metropolitan landscape 3. Promoting sustainability and external safety in the region.	Interest from economic perspective. The metropolitan region of Rotterdam-The Hague could use the membrane as a branding tool for the region, in order to attract new business and workers to the region.	Discuss with MMG in what way the membrane can be used as a **branding tool** to attract new business and workers to the region. This branding can also help kickstarting the spatial transformations in the membrane.

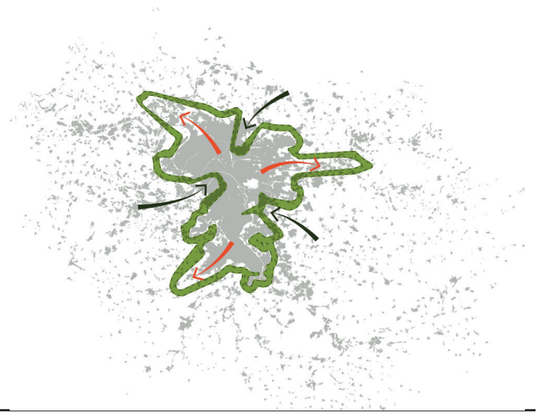
II. TRANSFERABILITY STUDY AT LARGER SCALE

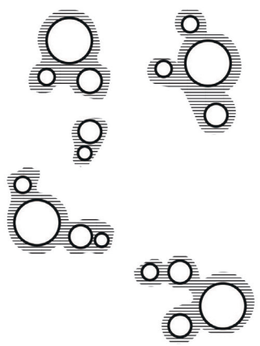
CONCEPTUAL URBAN FORM	EXAMPLES	MEMBRANE CHARACTERISTICS	PROPOSED DEVELOPMENT STRATEGY
Concentric urban region	Paris, France	**Single membrane** *1.. Greater distance to membrane from urban core* *2. Low total surface area of membrane in relation to urban area.*	*Improve **accessibility of the membrane** and increase total membrane surface in relation to interior of the area (urban). By **increasing curvilinearity** of the urban border.*
Polycentric urban region	Randstad, Netherlands	**Membrane network** *1. Great total membrane surface area in relation to urban area.* *2. Small distance from urban core to membrane*	*Improve **inter-connectivity between membranes** at regional scale by creation of a macro membrane that also functions as a buffer for **protection of the interior** (rural) environment.*

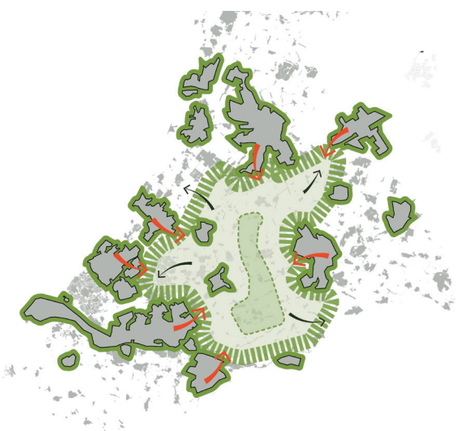












III. DESIGN PROCESS MAP

INTERCONNECTING GREEN SPACES

IV-A. PHOTOS SITE VISIT

HOEK VAN HOLLAND-DE HAAK

IV-B. PHOTOS SITE VISIT

NIEUWEKERK AAN DEN IJSSEL - PARKZOOM

IV-C. PHOTOS SITE VISIT

RIDDERKERK - CORNELISLAND

V. THEORY PAPER

Reconsidering the territories in-between

Understanding how an integrated placemaking approach can strengthen the ecological quality and sense of place of the territories in-between.

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Theories of Urbanism (AR3U023)

25 November 2020

Abstract
Territories in-between (TiB) have gained increased attention the past decades. These territories are identified as territories somewhere in-between the urban and rural. Because of their unique spatial characteristics, they tend to be of great potential for the provisioning of ecosystem services. However, neglect of attention given to the TiB in spatial planning and decision-making does not only limit the ecological quality of these landscapes, but also causes these territories to be identified as placeless. Findings conclude that the open spaces of the TiB offer a window of opportunity for the improvement of spatial quality in the TiB from both a social and ecological perspective. Green space interventions for the open spaces of the TiB can improve the ecological quality and strengthen the sense of place through the provisioning of ecosystem services. In order to achieve this, a nature-based placemaking approach for the open spaces of the TiB is proposed to integrate not only the needs of local residents and stakeholders in the design process, but also the needs of the natural environment.

Key words: Territories In-Between, Ecosystem-Services, Sense of place, Ecological design, Placemaking, The Netherlands.

1. Introduction

As a result of ongoing urban growth and densification in the Netherlands, pressure is mounting on urban fringes in-between cities and rural land (Nabielek, Kronberger-Nabielek & Hamers, 2014). As a result of this trend the distinction between the urban and rural landscape diffuses (Frijters et al., 2004; Zonneveld, 2007). These landscapes between the urban and rural are identified as territories in-between (Wandl et al., 2014).
In order to understand the spatial challenges of these landscapes more systematically Wandl's definition of the TiB is used as a starting point for this research paper (Wandl et al., 2014)
The concept of TiB is used as an umbrella term to describe dispersed urban settlements which cannot merely be defined as simply urban or rural.
Wandl shows that an abundance of unbuilt grey and green spaces is to be found in the territories in-between (Wandl et al., 2014). It is argued that there is a great potential for these open spaces for ecological development and the provisioning of ecosystem services.
However, as a result of the neglect of spatial planning strategies for the TiB its potential for the provisioning of ecosystem services is often not recognized (Frijters et al., 2004; Wandl et al., 2014). Moreover, the open spaces in the TiB are often identified as monofunctional and underused. This reduces the ecological quality of these open spaces and negatively affects the sense of place in these territories (Wandl, Rooij, Rocco, 2012). Sense of place describes both the intrinsic character of a place as well as our perception of the place, based on personal experiences (Shamai, 1991).

The aim of this review paper is to understand the spatial planning process of the territories in-between and explore how the ecological quality and the sense of place can be improved by means of a placemaking approach for the design and planning of those open spaces in the TiB.
In order to answer this question four sub-questions will be answered in this paper: 1. How are the TiB considered in the context of Dutch spatial planning? 2. What are the spatial characteristics of the open spaces in the TiB in relationship to the supply of ecosystem services? 3. What is placemaking and how can it improve the sense of place of the TiB? 4. How can ecological planning approaches be integrated in the placemaking process?
A literature study is performed to gain an understanding of the TiB within the Dutch spatial planning context. Further, the paper discusses in more detail the potential of open spaces in the TiB for the provisioning of ecosystem services. Then, the design approach of placemaking is reviewed upon as a strategy to enhance sense of place in the TiB. The last chapter proposes an integrated placemaking strategy that incorporates both ecological goals and societal demands for the TiB. It also briefly discusses the role of the urban designer in this.

2. Planning context of the Territories in-between

Defining the TiB

In academic literature many other concepts have been introduced to describe dispersed urban settlements such as peri-urban, urban sprawl, suburban etc. However, according to Wandl (2014) these concepts do not sufficiently reflect the complexity and diversity of dispersed urbanization patterns. Moreover, he argues that TiB have a distinct character and functioning that cannot be described by a simple urban to rural gradient, based on the dichotomy of urban and rural that most of these concepts rely on. Therefore, he introduced the concept of Territory in-between as an umbrella term to describe the significant spatial and functional characteristics of these landscapes. The TiB can be characterized by three spatial features which distinct the TiB from rural and urban areas: the intermingling of built and unbuilt spaces, the mix of functions and the significant presence of infrastructures in the landscape (Wandl et al., 2014).

The urban – rural divide in Dutch spatial planning

In academic literature there is a general consensus that dispersed urban settlements are being neglected in spatial planning and policy making. This is even described as one of the key characteristics of the TiB (Frijters, et al., 2004). This is critical when we consider the fact that an increasing amount of the Dutch landscape cannot be described by either urban or rural (Wandl et al., 2014). Several socio-economic trends and planning policies are fundamental in the emergence of territories in-between in the Netherlands. First, there is the renowned spatial planning tradition of the Netherlands starting from the 1960's, when the first National Policy Document on Spatial Planning was issued *(Eerste Nota Ruimtelijke Ordening)* by the national government (Zonneveld, 2005). These national reports outline the spatial planning strategies that need to be implemented by provinces and local governments. The main goal of all the national spatial planning policies so far has been to control suburbanization and preserve the rural landscape (Healey, 2006; Zonneveld, 2005). This idea was explained through the use of concepts like *compacte stad, gebundelde deconcentratie* and *stadsgewest* which were used to give direction to urban growth (Frijters, et al, 2004; Zonneveld, 2005). However, in the last National Spatial Strategy it is argued that national spatial planning policies so far have failed to succeed their main goal of preserving the rural landscape (Bontje, 2003; Zonneveld, 2007). Moreover, they speak of *verommeling* and spatial degradation of the landscape (Van Ool, 2006, Veenklaas et al., 2006). The prevalent lack of significant landscape features, and the presence of footloose industries and businesses are reasons why many people identify these landscapes as in-authentic and placeless (Arefi, 1999; Wandl 2014). The current densification process taking place in most Dutch cities pushes large scale land uses, such as industrial facilities and sport facilities, towards the urban outskirts. These land uses are often re-located along infrastructural routes or at the urban fringe of the city. Moreover, it is expected that the strong emphasis on economic development of the national government in combination with globalization and digitalization trends will put further pressure on the urban fringe of the city (Nabielek, Kronberger-Nabielek & Hamers, 2014; Zonneveld, 2005). Consequently, the TiB will only become a more fundamental part of Dutch landscape (Van Ool, 2006).

Until 2006 when the last National Spatial Strategy *(Nota Ruimte)* was issued by the Ministry of Spatial Planning (MVROM) the national government took the lead in Dutch spatial planning (VROM, 2005). In 2010, however the ministry of VROM was abolished as part of decentralization liberalization measures (Balz & Zonneveld 2018). Since then, urban development and sustaining spatial quality of the Dutch landscape is no longer a primary task of the national government. The national government concentrated its attention to spatial economic and infrastructural developments (Zonneveld, 2005). Hence, sustaining the spatial quality within the TiB seems to be an issue of conflict between regional and local planning.

As a response to this spatial trend of diffusion between the urban and rural landscape, a research about these emerging in-between landscapes was initiated by the national government in 2003, named '*Tussenland*' (2004). The writers of this research are less pessimistic about the emergence of the TiB and emphasize the strengths of these landscapes for sustainable urban development, such as bottom-up initiatives and mix-use developments (Frijters et al., 2004). Additionally, Wandl (2012) also stresses the potential of these territories for the supply ecosystem services as a result of the relatively high amount of unbuilt and underused open spaces. However, because of the neglect of TiB in spatial planning and decision-making this ecological potential has not yet been used optimally (Freijters et al., 2004; Wandl, 2014).

The next paragraph will discuss the potentials of open spaces in the TiB in further detail.

Open spaces in the TiB

One of the key characteristics of the TIB that is discussed is the significant presence of open spaces. Wandl identified eight types of typical open spaces in TiB, see figure 1. They can be either green, hybrid or grey (Wandl, Rooij, Rocco, 2012). Some of them have a clear purpose, such as leisure and sport facilities, while others do not seem to have such a clear purpose for use. An important concept used to describe these spaces which lack a clear purpose is S.L.O.A.P *spaces left over after planning* (Zuo, Daniel, & Soebarto, 2016; van Ool, 2006) Open spaces around, along or underneath transport infrastructures and derelict sites can be identified as such. Just like, small green patches between two sport fields or open spaces in-between industrial facilities. Therefore, the concept of leftover space should always be considered at a particular scale. Figure 2 is an example of a typical leftover spaces in the TiB. According

	Green open spaces	Hybrid open space	Grey open spaces
Predominantly related to links	Green areas being informally used as parks (1)	Areas in-between infrastructures (4)	
Predominantly related to nodes		Leisure and sports facilities (5)	Spaces around nodes of logistic facilities (7) Parking spaces (8)
Relation to nodes or links not distinguishable	Bodies of water (2) Small extensively used agricultural batches (3)	Derelict areas (6)	

Figure 1: Typologies of open spaces in the TiB (Wandl, Rooij & Rocco, 2012)

to Akkerman and Cornfield (2010) , leftover spaces offer a great potential for small informal activities which cannot be supported by formal open spaces such as clean-cut lawns and marked out urban wilderness. “Conversely, however, [..] an embellished leftover space could be not only a welcome agent of change in a regimented urban environment, but also a small place of spiritual refuge” (Akkerman & Cornfield, 2010). As a result of the significant presence of infrastructural facilities in the TiB and the mix of land uses that characterizes the TiB, these kinds of open spaces are inherent to the spatial character and functioning of the TiB. Moreover, Wandl states that these open spaces also have great ecological potential to offer through the supply of ecosystem services (Wandl, 2014; Wandl, Rooij & Rocco, 2012). The concept of ecosystem services will be explained in the next chapter.

Figure 2: typical left over space in TiB (NRC, 2020) Retrieved from: https://www.nrc.nl

3. TiB from the perspective of ecosystem services

Ecosystem services explained

Ecosystem services are the benefits provided to humans by the natural environment. The Millenium Ecosystem Assessment report distinguished four sub categories of ecosystem services (Carpenter et al, 2009). These are supporting, provisioning, regulating and cultural ecosystem services, see figure 3. Supporting ecosystem services are considered fundamental for the provisioning of services to the other three categories (Carpenter et al, 2009). In urban design practice most attention is given to cultural ecosystem services. This paper emphasizes both supporting ecosystem services, such as biodiversity as well as cultural ecosystem services like well-being and sense of place. The next paragraph will discuss the potential for the supply of ecosystem services in the open spaces of the TiB.

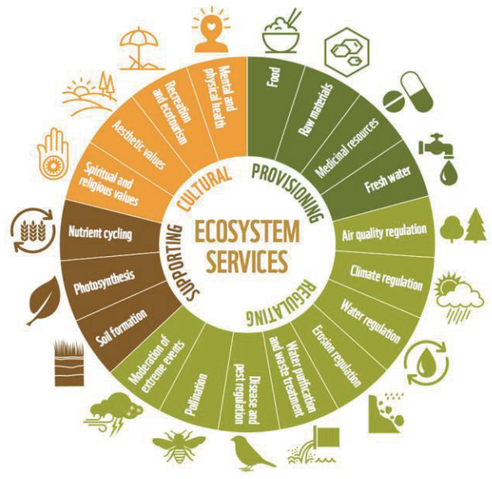

Figure 3: ecosystem services diagram (WWF Living Planet Report, 2016) retrieved from: https://www.belmire.com/post/what-are-ecosystem-services

The provisioning of ecosystem services in the TiB

As stated previously the grey and green open spaces in the TiB offer a grey potential for the supply of ecosystem services. However, as a result of the limited attention given to these spaces in spatial planning this potential is often underestimated (Wandl, 2014).

This is critical because the ongoing process of densification and urban growth increases the pressure on urban green spaces, especially those which are seemingly underused. This loss of green spaces challenges the provisioning of ecosystem services. For this reason, it is increasingly important to improve the ecological quality of existing green spaces (Haaland, van den Bosch, 2015). Considering the TiB Wandl stresses in particular the segregating and unintegrated character of open spaces in the TiB which is especially problematic from both social and ecological perspective. Consequently, urban designers should aim at physically reconnecting these areas to their surroundings (Wandl, Rooij & Rocco, 2012). Transport infrastructures in particular, provide the opportunity to create ecological corridors for wildlife movement at the regional scale (Wandl, Rooij & Rocco, 2012; Forman, 2014). In order to achieve this, the ecological quality of the open spaces in the TiB needs to be improved. In literature there are many ecological design principles on how to improve green space quality (Forman, 2014). These principles depend on the kind of ecosystem services that are targeted (Elmqvist, 2015) Some key ecological design principles for creating good ecological spaces are: connecting habitat patches, to allow species movement through the urban environment. Provide multiple layers of vegetation and design for a diversity of species and plant forms (Parris, 2016 as cited in Bush, Hernandez-Santin & Hes, 2020). These kinds of design principles improve the supply of supporting ecosystem services such as biodiversity. Green spaces however, can also provide cultural ecosystem services such as the improvement of sense of place and sense of belonging that people feel to a certain place. “Sense of place emerges through our interactions with the biophysical environment” (Masterson et al, 2017). This need for improving sense of place is of specific relevance for the TiB as it can improve the perception that people have of these spaces.

However, for the supply of cultural ecosystem services, we do not only need to understand the local identity and needs of nature, but also the identity and needs of people in the place. Therefore, an integrated design approach is required to meet the needs of nature and people simultaneously (Bush, Hernandez-Santin & Hes, 2020; Cilliers et al., 2015).

The next chapter discusses placemaking as an approach to strengthen the sense of place in the TiB and discusses how nature can be integrated in the placemaking process.

4. Placemaking

“Placemaking is the process by which people transform the locations they inhabit into the places where they live” (Cilliers et al. 2015) The aim of placemaking is to improve the quality of spaces by a collaborative design process. (PPS, 2013). Places that people care about and want to be in have a strong sense of place. Most people feel at home in these places. They can also be referred to as Quality Spaces. Engaging local residents and other stakeholders in the design process is an important aspect of placemaking and distinguishes it from other kind of development strategies (Wyckoff, 2014). According to Azadi, public involvement in the planning and management of green spaces results into greater sense of belonging and ownership. Moreover, people are more likely to positively contribute to the management of the place (Azadi et al., 2011; Ellery & Ellery, 2019). Therefore, collaborative placemaking provides an important tool for dealing with the placelessness and lack of identity that people experience in the territories in-between. There are several types of place-

making: strategic, creative and tactical. Strategic placemaking is a targeted process that aims to regenerate with a specific goal, aside from improving the spatial quality. Creative placemaking aims at improving the spatial quality by spatial interventions that use art, culture and creative thinking. Finally, tactical placemaking aims at improving public spaces by creating cheap and usually small scale and quick interventions which, on the long run, can significantly improve the spatial quality. Examples of tactical placemaking are parking lot transformations, temporary gardening activities or park extensions (Wyckoff. 2014). It seems that tactical placemaking is the most promising type, since small scale and quick interventions can be easily implemented in the public environment before permanent measures are taken. This allows the stakeholders to learn and easily adapt to new insights. Considering the fact that open spaces in the TiB are often owned by private parties they are likely more willing to engage in tactical placemaking projects, since there is a smaller financial risk compared to strategic and creative placemaking approaches (Wyckoff, 2014).

Placemaking is about meeting human needs in space. Greenery for example is considered a spatial quality that is essential to placemaking (PPS, 2013; Cilliers et al., 2015). However, placemaking is primarily considered from the human perspective. Even so, nature is excluded as a participant in the placemaking process (Bush, Hernandez-Santin & Hes, 2020). Therefore, the placemaking process can be in conflict with the needs of non-human species. The next chapter will explore several strategies to integrate ecological design and planning with the process of placemaking.

5. Strategies for nature-based placemaking

Integrating green planning approaches and placemaking can help solve problems which are typical to the TiB. Namely, the limited ecological value and the need for improving the sense of place in these territories. As nature is a key element to our experience of sense of place it is crucial to establish the human-nature interaction in the process of placemaking (Masterson et al., 2017)

Linking green planning interventions to placemaking approaches enhances the natural and social environment. Placemaking is primarily focused on providing social functions, whereas green planning approaches are focused on providing environmental benefits. When combined these approaches provide synergies for the social and ecological performance of the place (Cilliers, 2015).

This paragraph explores what strategies can be applied in order to integrate ecological design principles with placemaking process. This integration of ecological design as a fundamental aspect of the placemaking process is described as: nature-based placemaking.

First of all, a strategy that is often used to provide design processes with ecological knowledge of the place conditions is the involvement of expert knowledge (Cilliers & Timmermans, 2014). Experts on ecology can be involved in the collaborative design process between stakeholders. Hence, ecological experts represent the interests and needs of the local ecosystem and provide input for the placemaking process from the ecological perspective. The involvement of experts though may add extra costs to the design process.

Secondly, a framework of ecological design guidelines can be introduced to the placemaking process. Such a framework can inform all people involved in the design process with guidance on improving the ecological quality of the place. The framework for Biodiversity Sensitive Urban Design (BSUD) is an example. This framework can be applied at a wide range of urban development sites (Gerrard, 2018). The disadvantage of such a framework is the general character of it and the lack of site-specific ecological knowledge that it provides, therefore it is usually not sufficient. However, such a framework allows people with little knowledge on ecology to get an understanding of the basic principles of nature inclusive design and its processes. Therefore, it is a very transparent and inclusive approach that is easily understood and accepted by everyone involved in the placemaking process.

Thirdly, an innovative strategy has been introduced by Bush (2020). It introduces a participatory co-design process in which each member involved in the design process acts as a spokesperson for a specific element of biodiversity, such as plants, animals, insects or birds (Bush, Hernandez-Santin & Hes 2020). This way nature is included as a participant in the placemaking process. By answering questions such as: What kind of habitat do I need? what do I eat? and how do I move through space? participants are asked to think about the spatial design interventions necessary to sustain their represented biodiversity element (Bush, Hernandez-Santin & Hes, 2020). This strategy is especially interesting as it actively engages non-expert people, even children, to think about what kind of nature they like to protect and establish. Moreover, it makes people think about public spaces from a different perspective than usual.

By applying these strategies, the notion of sense of place is not only viewed from the human perspective, but also from the perspective of nature.

The role of the urban designer

In the process of tactical placemaking for the open spaces in the TiB the main role of the urban designer is to facilitate in the design process rather than to or design. It is really important that the facilitator seeks to understand the place-based context, both from the social as the ecological perspective and understand that there is no such one-size-fits all approach. Ways in which the designer could facilitate is by visualizing ideas which are initiated by the local community and try to engage local stakeholders with the design process (Alwaer & Cooper, 2019). In nature-based placemaking approaches the facilitator should not only ensure the social inclusivity of the design, but also ensure the ecological inclusivity of the project. The nature-based placemaking strategy requires the urban designer to be creative, connect to multiple stakeholders and operate outside of the usual scope of urban planning and design. Concerning the TiB this is especially relevant because many spaces of interest for improvement of spatial quality are located on private property, such as sport clubs, industrial companies and infrastructural authorities.

Resuming it is concluded that various methods for placemaking are available to incorporate natural environment into the process of placemaking where the urban designer can fulfill a different yet useful role as facilitator. The urban designer can choose and design a nature-based placemaking approach that seems fit for the site-specific conditions.

“Bringing together the principles of ecological urban design with the process of placemaking can make nature and people flourish together.” (Bush, Hernandez-Santin & Hes, 2020)

6. Conclusion

This paper aimed to create a comprehensive understanding of the challenges the TiB have to deal with from a social and ecological perspective. Furthermore, it explored how an integrated placemaking approach can strengthen the ecological quality as well as enhancing the sense of place in the territories in-between.

From the literature review it can be concluded that there is an urgent need for urban designers and policy makers to become aware of the spatial challenges and opportunities of the TiB (Wandl, 2014). It is indicated that the neglect of attention given to the spatial quality of the TiB might be the result of a discrepancy between national and local planning strategies. The very limited attention given to the spatial quality of the TiB negatively affects the feeling of sense of place that people experience in these landscapes (Arefi, 1999; Wandl, 2014).

Moreover, the potential of the TiB for the provisioning of ecosystem services is significantly underestimated (Wandl, 2014). This accounts for both supporting and cultural ecosystem services. The abundance of open spaces in the TiB however, provides a window of opportunity for the improvement of both social and ecological qualities (Wandl, 2012).

Particular attention is given to the relationship between the natural environment and sense of place. Quality green spaces can strengthen our sense of place through the provisioning of ecosystem services (Elmqvist et al., 2015).

Furthermore, the concept of placemaking is discussed as a promising design tool to engage with the local residents and other stakeholders in the redevelopment process of these open spaces. Engaging local residents and stakeholders in the design process can effectively strengthen the sense of place among members of the local community. A tactical placemaking approach is identified as most promising, since it enables short term, small scale and low expected risk of these spatial interventions (Wyckoff, 2014).

Nature is explored as a mode of placemaking to improve the spatial quality and integrate the open spaces of the TiB both in its social and ecological context. The improvement of the natural environment therein, is explored as a means to also improve the sense of place.

Finally, a nature-based placemaking approach for the TiB is proposed to deal with the typical problems of sense of place and ecological quality in an integrated way. In the process of nature-based placemaking the urban designer becomes aware of both the ecological and social needs of the place and operates as a facilitator rather than a designer.

Discussion

The paper discussed the spatial characteristics of the TiB from both social as well as ecological perspectives. This broad approach created an integrated understanding of the problems and potentials that are characteristic for the TiB. This broad approach however, also limited the extend and depth to which the different components were discussed.

The limited amount of literature available on the concept of TiB significantly challenges the validity of the outcomes of the paper. Further research on the spatial characteristics of the TiB is therefore recommended, especially with respect to people's perception of these territories.

This paper primarily focused on the social-ecological potentials of open spaces in the TiB at the local scale. Further research can be done on how the proposed local ecological design interventions can be integrated with the regional ecological structure. This can be especially interesting from a planning perspective in order to understand how the local, regional and perhaps national government should be included in the planning process of the TiB. Additional research can be done to investigate what actors could be interested in nature-based placemaking design approach for the TiB. Further research is also needed to understand what the specific challenges of placemaking in the TiB are in contrast to more traditional design approaches. Especially, considering the engagement of local residents and stakeholders in the process of design.

Considering the following thesis project, it can be particularly interesting to investigate if there are any existing nature-based placemaking projects that can be of inspiration. Finally, further research is necessary to investigate at what locations the proposed nature-based placemaking approach can be further explored and how it can be integrated with a regional design proposal for the redevelopment of the TiB.

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