BROADENED INCLUSIVENESS FOR URBAN RENEWAL

A SPATIAL DESIGN CONTRIBUTING TO ECOLOGICAL JUSTICE FOR CARNISSE ROTTERDAM

EMY STEENBERGEN

BROADENED INCLUSIVENESS FOR URBAN RENEWAL

A spatial design contributing to ecological justice for Carnisse Rotterdam

Student
Emy Steenbergen
4688341

Faculty and department
Delft University of Technology
Faculty of Architecture and the Built environment
Urbanism
AR3U115 Graduation Lab Urbanism
Design of the Urban Fabrics

Date
January 10, 2024

Tutors
1st mentor: Ir. Leo van den Burg
2nd mentor: Dr. ir. Nico Tillie

TU Delft Delft University of Technology

Urbanism

ABSTRACT

The complex relationship between humans and the natural world is still visible in 2023s urban planning: a city is a place for humans, and nature gives space to all non-human species. The anthropocentric perspective within the urban environment puts humans above non-human nature. This is also the case within urban renewal in the Netherlands, which aims to improve human liveability. This aim is reflected within the ongoing urban renewal in Carnisse, Rotterdam, the Netherlands, under the leading plan of NPRZ as well. However, considering non-human species might have positive effects for both human and non-human species. This thesis addresses the research question: *"How can values of ecological justice contribute to a spatial design that improves urban renewal in Carnisse, Rotterdam?"* to investigate the impact of non-human species liveability on urban renewal concepts and spatial plans in Carnisse. The study conducts a systematic liveability analysis of several target species representing circa 80% of the species currently present in the neighbourhood. Based on the analysis, a toolbox is developed, which is the foundation of integrating human and non-human demands within urban renewal. With a combination of consideration of the existing structure, context consideration, the implementation of zoning, biocentrism and nature-inclusive thinking, the translation towards a spatial plan based on ecological justice values for the neighbourhood Carnisse is created. Comparing the current NPRZ urban renewal plan and the ecological justice values-based plan reveals that if ecological justice is included, the concept of urban renewal should be revised and that there is a case for a more integrated approach to the physical and social domain within urban renewal. Besides, the focus on ecological justice values might reduce the in-depth focus on human liveability compared to the approach to urban renewal. Nevertheless, the spatial outcomes of the focus on non-human liveability will (indirectly) positively affect human liveability by improving health, lowering crime rates, improving interaction between humans and non-human species, and increasing climate adaptation of the area. Therefore, implementing ecological justice values will improve urban renewal concepts and spatial plans from an Arcadian perspective by improving the non-human species' liveability and from a resource standpoint, by improving human liveability.

Keywords: ecological justice, urban renewal, Carnisse Rotterdam, the Netherlands, biotope mapping, biocentrism, liveability, co-existance

PREFACE

In urban planning, nature and green spaces in the city are becoming increasingly important. This greenery positively affects human well-being, reduces vandalism and aggression, contributes to climate adaptation, and so on. Throughout my studies, I always found greenery, due to these benefits and my own personal interests, an interesting topic to work with, making it a recurring element in my projects. However, previous designs were always created from a human perspective, focusing mainly on what greenery contributed to the human living environment. The designs were conscious and unconsciously about aesthetically pleasing greenery, which, upon reflection, positively affects humans but not always the other flora and fauna present.

When the opportunity arose in my graduation year to create my own project, it was an easy decision to once again focus on integrating nature into the urban environment. This decision resulted in research that did not only consider human liveability but also all other species present in an area to design. I designed with nature in a way that is new to me. By doing this, I expanded the concept of inclusivity, which is no longer solely attributed to inclusivity within the human species, aiming to achieve *broadened inclusiveness*.

In front of you lies the result of my year-long graduation project. This report may provide you with a new insight into the approach of urban design, emphasizing the consideration of all urban residents, encompassing not only humans but also animals and plants.

I would like to thank my first mentor, ir. Leo van den Burg, for providing new insights during my project, motivating feedback, and critical questions during our meetings to help progress in my project. Besides, I would like to thank my second mentor, dr. ir. Nico Tillie for his help during the year, mainly regarding the ecological aspect of this project, assisted me in better understanding the approach to and way to design with (urban) nature.

I hope you enjoy reading this report!

Emy Steenbergen

The maxim 'live and let live' suggests a class-free society in the entire ecosphere, a democracy in which we can speak about justice, not only with regard to human beings, but also for animals, plants and landscapes.
Naess, 1989:173

As cited in Low & Gleeson, 1998, p. 133

GLOSSARY

Terms in the graduation report are briefly defined in this glossary.

Anthropocentrism
"Philosophical viewpoint arguing that human beings are the central or most significant entities in the world." - Britannica (n.d.)

Arcadian position
The position which approaches nature as something beautiful that has inherent legitimacy. From this standpoint, nature is valuable in and of itself, without the need to be useful to humans (Deliège & Van Damme, 2019, p. 41).

Biocentrism
"The ethical perspective holding that all life deserves equal moral consideration or has equal moral standing." - Britannica (n.d.)

Biodiversity
"The number and degree of variety of life forms within a specific ecosystem or the entire planet. This variety involves diversity in genes, diversity in species, and diversity in ecosystems." - Vink et al. (2017, p. 35)

Biotope
"A combination of biotic and abiotic conditions. It constitutes a coherent landscape type that distinguishes itself from other landscape types. Within a biotope, various habitats or living areas are present." - Vink et al. (2017, p. 33)

Biotope mapping
A tool or nature conservation strategies that contributes to the improvement and quality of biotopes (Starfinger & Sukopp, 1994; Reumer & Epe, 1999; Werner 1999).

Context consideration
The consideration of the existing conditions of the biotopes present in the planning area (Werner, 1999).

Ecological justice
Doing justice to nature. Within this justice, all living beings should have the opportunity to enjoy and flourish in their own lives (Gleeson and Low, 1998, p. 133).

Ecology
"The study of the relationships between organisms and their environment." - Britannica (n.d.)

Liveability
"The extent to which an environment aligns with the adaptive repertoire of a species. It's important to note that a particular area may offer better liveability for one species compared to another. Nevertheless, an environment does not need to be optimal to be liveable for a specific species." - Veenhoven (2000)

Matter out of place
The presence of two conditions: a collection of structured relationships and a violation of that structure (Douglas, 1996, p. 44).

Nature
There is no general definition of nature. During this graduation project, nature is approached as the physical world and everything in this which is non-human (Ducarme & Couvet, 2020).

Nature-based thinking
"Drawing up inspiration by nature as an outset for the development of more sustainable and inclusive cities, balancing anthropocentric and ecocentric values and acknowledging the importance of the social and governance dimensions in a more balanced socio-ecological perspective." - Randrup et al., 2020

Nationaal Programma Rotterdam Zuid (NPRZ)
"A collaborative initiative involving the municipality of Rotterdam, the national government, the police, the Public Prosecution Service, housing corporations, healthcare institutions, educational institutions, and businesses, with the shared objective of enhancing the liveability of Rotterdam South." - Municipality of Rotterdam (n.d.a)

Red list
"An overview of species that have disappeared from the Netherlands or are at risk of disappearing. This is determined based on rarity and/or negative trends." - Ministry of Agriculture, Nature and Food Quality (n.d.b)

Resourcistic position
The position which approaches nature as a resource for humans. From this standpoint, nature is only valuable when useful for humankind (Deliège & Van Damme, 2019, p. 41).

Urban heat island effect
"A common environmental problem occurring in metropolitan areas in which the air temperature is significantly higher than in suburban areas." - Xie et al. (2015)

Urban renewal
"A comprehensive scheme to redress a complex of urban problems." - Britannica (n.d.)

Well-being
"The state of being happy, healthy, or successful." - Britannica (n.d.)

TABLE OF CONTENTS

Figure 1. The polder surrounding the city of Rotterdam. (Natuurmonumenten, n.d.)

01

INTRODUCTION

PROBLEM FIELD

BIODIVERSITY LOSS

Several researchers argue that we are at the start of the sixth mass extinction. The current mass extinction differs from previous ones since it is caused by human activity (Wienhues, 2017; Naggs, 2017; Chapin III et al., 2000). This decline in biodiversity is also visible within the Netherlands, where there is a significantly larger decline compared to Europe and the rest of the world. The populations of native plant and animal species in the Netherlands have, on average, reached 15% of their original size in 1700 A.D. (CBS et al., 2016).

This biodiversity loss is a problem. Besides the Arcadian position of Van Koppen (1997) that non-human species should be treated as something that exists in its own right, there are also consequences for both human and non-human species from a resource point of view. Biodiversity loss has implications such as increased climate change, less resilience towards climate change, and less quality and quantity of ecosystem services (Pedersen Zari, 2018).

As shown in Figure 2, area and quality loss cause biodiversity loss in the Netherlands. Area loss is primarily related to agriculture and urban areas. Figure 3 shows the causes and consequences of the land use change resulting in area loss. First of all, urbanisation demands more space within urban structures. Green and undeveloped pieces of land are often cheaper to develop than redevelopment (Haaland & Konijnendijk van den Bosch, 2015). Besides space needed within the city, urbanisation goes together with higher demands for building materials and food, resulting in area loss. The land use change leads to fragmentation and loss of habitat, resulting in extinctions (Pedersen Zari, 2015).

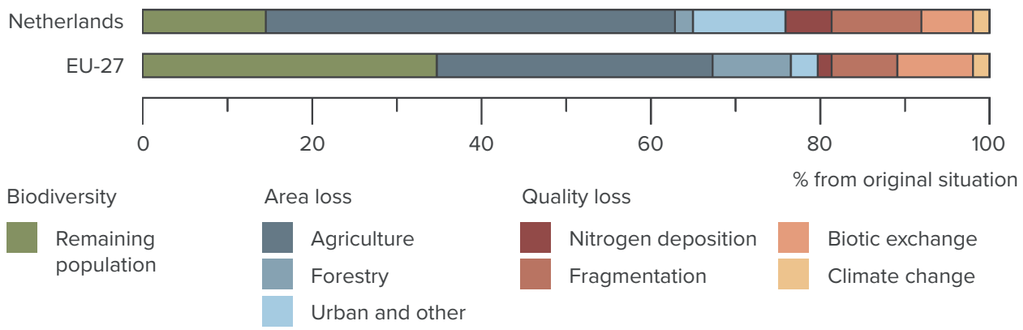


Figure 2. Causes of biodiversity loss in Europe, 2010. (Adapted from Netherlands Environmental Assessment Agency [PBL], n.d.)

Quality loss, on the other hand, is caused by nitrogen deposition, climate change and biotic exchange, as shown in Figures 2 and 3. Greenhouse gas and transportation emissions stimulating climate change and nitrogen deposition result in changing and disappearing habitats, causing extinctions on land, in urban areas, and in aquatic systems. Additionally, biotic exchange caused by the movement of people leads to new invasive species disturbing ecosystems and enhancing the urban heat island effect. This results in habitat change, leading to increased competitiveness. Native species are less able to adapt to the changing habitat and are overgrown by invasive species. Both area and quality loss lead to biodiversity loss. The biodiversity loss results in ecosystems becoming unbalanced or disappearing again leading to increased biodiversity loss (Pedersen Zari, 2015).

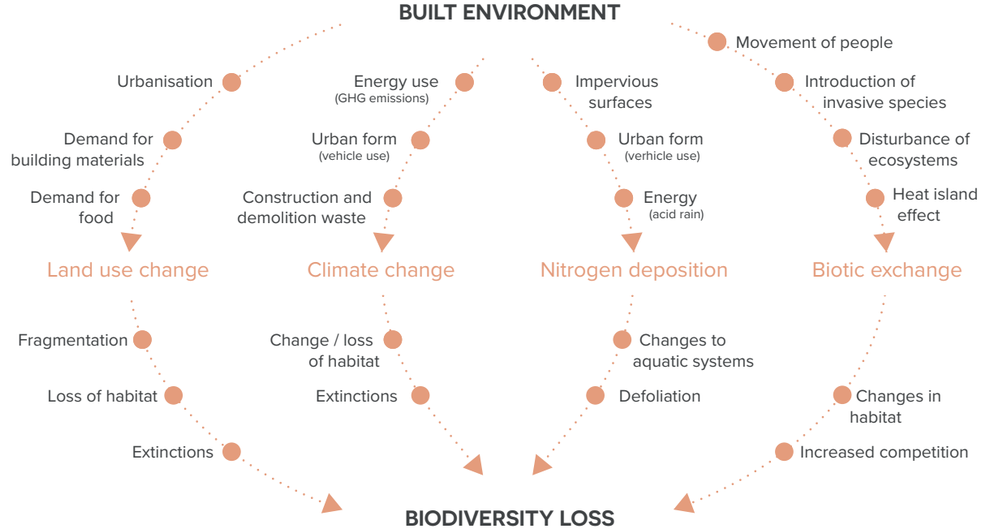


Figure 3. Built environment drivers of biodiversity loss. (Adapted from Pedersen Zari, 2015)

WORLD VIEW

Over time, it became clear what the positive effects of flora are on humans, resulting in plants and trees already being more integrated within urban designs (Beatly, 2011). However, these are often mowed in neat pieces of greenery, also shown in Figure 4, which do not provide the flora's full potential. In terms of fauna, the integration is less. Nature-inclusive buildings get more awareness, but, at the same time, wild animals should not come too close to the human environment, such as cities, since this is a "Matter out of place"(Douglas, 1966). Figures 5 and 6 show examples of this.

The complicated relationship with nature is rooted within history, impacting today's tradition of nature-focused thinking. Before the Industrial Revolution, the human species perceived nature as a threatening and wild place where people should not go and were therefore afraid of this nature. The city needed protection for these wild animals and wilderness. This protection was created by using fortifications, among other things, as shown in Figure 7. The industrial revolution made it possible to develop electricity and other technologies. As a result, nature was no longer a scary and wild place. Human beings became stronger than nature and used nature to their own purpose. People no longer needed protection against nature, but rather nature from people (Deliège & Van Damme, 2019, p.42-43).

In 2023, there still seems to be a division between the city and nature. Even when the importance of flora has become more visible, green spaces are still the first bits to disappear as soon as space is needed for humans (Haaland & Konijnendijk van den Bosch, 2015). The city is perceived as a place for humans, nature as a place for all other plants and animals, and agriculture as a place where humans and nature can harmoniously meet (Van Koppen, 1997). This way of thinking leads to ignorance towards non-human species within urban environments and maintains that humans and nature cannot go hand in hand. Therefore, this could be approached as the base of the ecological injustice within the city.

Figure 7. Medieval settlement town of Carcassonne: a place for the human species. (Adapted from Musement, n.d.)

Figure 4. Public green in Amelandseplein, Rotterdam.

Figure 5. Example of nature-inclusive building: built-in nest box, for the common swift. (Adapted from Vivera pro, n.d.)

Figure 6. Bird scrap for keeping birds out under roof tiles. (Adapted from Traas building care, n.d.)

ECOLOGICAL JUSTICE

To comprehend ecological injustices within the built environment, an explanation of ecological justice is provided first. The definition of ecological justice is doing justice to nature. Within this justice, all living beings should have the opportunity to enjoy and flourish in their own lives (Gleeson and Low, 1998, p. 133). In this, nature can be perceived as both, pristine and significantly altered by humans, such as in urban environments (Stevis, 2000). Ecological justice complements environmental justice, which focuses on justice among humans concerning the environment. At the core of environmental justice lies the distribution of environmental quality between humans. This ensures all humans live in a safe, healthy and pleasant environment. Environmental and ecological justice connect with a recognition of the value of the environment. However, what is a good environment for humans may not align with a good environment for non-humans. In ecological justice, the environment carries a deeper meaning, emphasizing the moral relationship between humans and the natural world. Within this kind of justice, both human and non-human species are entitled to moral consideration (Gleeson and Low, 1998, p. 133). This shifts the definition of value, in which value is no longer always related to humans as the primary source of value (Gleeson & Low, 1998, p. 137). Gleeson and Low (1998, p. ii) describe ecological justice as follows:

> *"Ecological justice is about fair distribution of good and bad environments among all inhabitants of the planet. To speak of ecological justice means to recognise the value that an environment has for all creatures. An environment is comprised not only of people, but also nonhuman nature in all its abundance and diversity: animals and plants, landscapes and ecologies. An environment is not divisible like property but is fundamentally shared. Bad environments are dead, disintegrated, damaging to health. Good environments are alive, healthy and integrated."*

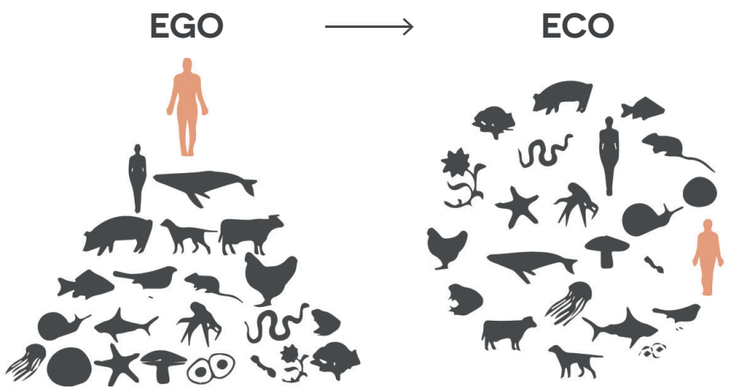


Figure 8. Egocentric to ecocentric. (Adapted from Braakman, 2019)

The relationship

The complex relationship between human and non-human species rooted in history needs improvement to create ecological justice. To create a relationship between all species, in which they fundamentally share the environment, all species, including humans, should be approached as a part of the bigger system. Humans are already part of this bigger system since they kill other species for a living, but other species, such as bacteria, live due to humans (Wienhues, 2017). However, from the anthropocentric perspective, they are above the rest of the system, as shown in Figure 8. Besides, to create this relationship, it has to be recognized that both human and non-human species are vulnerable to the actions of humans (Wienhues, 2017). Since ecological justice gives all species the right to flourish, there occurs the "right to need satisfaction". If nature has rights, then nature has needs (Gleeson and Low, 1998, p. 67). This further develops the relationship between human and non-human species. As this relationship evolves, there will be a further change within this relationship between nature, society and the human self. Humans will learn more about nature and its vulnerability, which can result in mutual dependency. This mutual dependency works in three ways, as shown in Figure 9: Human individuals depend on other humans, human society depends on non-human nature, and non-human nature depends on human individuals and society (Gleeson and Low, 1998, p. 142)

However, within this relationship, nature cannot represent itself. Adding ecological rights within the traditional rights of politics, economics, and society does not actually result in more nature. However, by adding ecological rights, nature is recognised. This provides the people advocating for nature as much voice as the ones who do not (Stevis, 2000).

Ecological injustice

With the current tradition of dividing the city and nature, there is still the case of ecological injustice since the liveability of non-human species is often not considered in urban environments (Van Koppen, 1997). Besides, ecological spaces within and outside the urban environment are taken over by the human species. This results in qualitative and quantitative loss of these ecological areas, leading to biodiversity loss. In this context, biodiversity loss itself can not be seen as an injustice. However, it indicates ecological injustices within the urban environment (Wienhues, 2020, p.21). The moral relationship between humans and the natural world is missing, resulting in ecological injustices. To mend this connection, the implementation of ecological rights is a potential avenue, but the designer and user of the urban environment can also influence this bond.

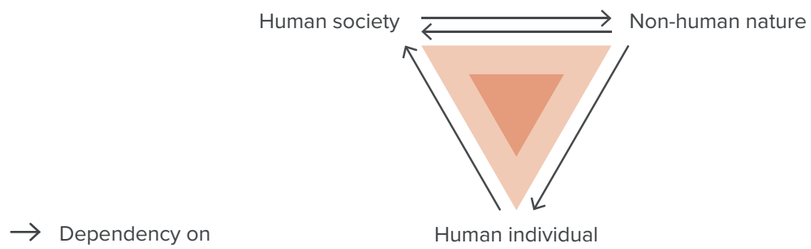


Figure 9. Relationships. (By author, based on Low and Gleeson, 1998)

URBAN RENEWAL IN THE NETHERLANDS

Ecological injustice is also visible within concepts and designs in the urban renewal of neighbourhoods in the Netherlands, often approached from an anthropocentric perspective. Examples are shown in Figures 11, 12, and 13. Urban renewal in the Netherlands aims to improve the liveability of its human citizens (Stouten, 2016). Veenhoven (1993, p. 6) describes liveability as *"the extent to which facilities and requirements match the needs and capabilities of members"*, consisting of the physical environment, housing stock, amenities, social cohesion, and safety and nuisance (Nieboer, 2005; Mandemakers et al., 2021). The liveability of non-human living beings within the built environment does often not matter, due to the original tradition of separating human and non-human nature (Van Koppen, 1997). However, by implementing an ecological justice perspective and embracing biodiversity, living conditions for both - human and non-human species - will be improved through, for example, better air quality, climate adaptation, water retention, eco-services, health, and well-being (Wageningen University & Research [WUR], 2018).

Climate change affects both human and non-human species, as shown in Figure 10. Therefore, especially in Dutch-deprived neighbourhoods, these benefits of implementing ecological justice values and embracing biodiversity matter. Lower human liveability is associated with lower-income groups not having money to invest in climate-related problems (Kind et al., 2020). This manifests itself not only as a problem for humans but also for other species in this area. As mentioned, current urban renewal focuses on the human perspective of improvement and therefore does not consider the viability of non-human species. However, current urban renewal also seems to be a short-term and ineffective solution for human liveability. The social connections created to improve liveability often linger poorly, and neglected climate problems further worsen liveability (Netherlands Environmental Assessment Agency [PBL], 2020). Deprived interests and living conditions of non-human species and climate change create only a short-term solution for these neighbourhoods.

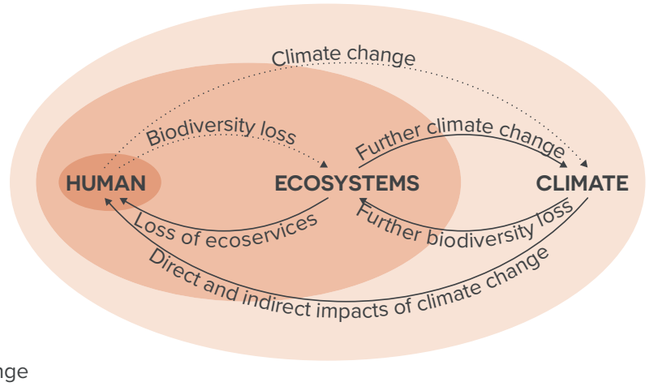


Figure 10. Relationship between humans, ecosystems and climate. (Adapted from Pedersen Zari, 2015)

Figure 11. Street lighting for human safety purposes is blinding to nocturnal animals such as the common pipistrelle. (Modernista, n.d.)

Figure 12. Street design for human connectivity, does not consider the connectivity of other species, such as the common pipistrelle or common blue.

Figure 13. High quays without vegetation for human safety and a neat streetscape lead to drowning hazards for hedgehogs, frogs and young swans, among others.

CONTEXTUALISATION

By linking the problem statement and the built environment, a context in which the interventions can take place to satisfy ecological justice principles is necessary. The interventions will take place on the neighbourhood and street level since human individuals, flora and fauna interact on this scale, and interventions during urban renewal are visible on this scale. The project should be located within the urban context, with poor human liveability and high climate risks. Poor human liveability gives rise to urban renewal at this location (Stouten, 2016). High climate risks, including the risk of heat stress and flooding, show areas in which the living environment of humans, flora and fauna are affected by these climate risks (Atlas Leefomgeving, 2021).

Figure 14 shows a national map which combines climate risks and poor liveability. Rotterdam and the Hague have larger clusters with poor liveability and climate risks. Rotterdam is chosen to zoom in on further. In Figure 15 vulnerable neighbourhoods for climate risks in Rotterdam are examined. The map shows vulnerable neighbourhoods to climate risks, based on climate risk, the vulnerability of its human inhabitants and liveability (Atlas Leefomgeving, 2021). In addition, the planning area of the Nationaal Programma Rotterdam Zuid (NPRZ) is layered over the vulnerable neighbourhoods, pointing out focus districts and other districts. Looking into an area vulnerable to climate risks and including ongoing urban renewal ensures a comparison between the current urban renewal and the proposal. When looking within this planning area, Carnisse stands out since it is both a vulnerable neighbourhood and fits within NPRZ's focus neighbourhood programme. Due to these two reasons, Carnisse is the location for this project.

Figure 14. Climate risks and poor liveability in the Netherlands. (By author contains data from National Institute for Public Health and the Environment [RIVM] , 2021a; RIVM, 2021b)

Figure 15. Climate risks and urban renewal districts in Rotterdam. (By author contains data from RIVM, 2021c; Nationaal Programma Rotterdam Zuid [NPRZ], 2023)

CARNISSE ROTTERDAM

Carnisse is localised on the south bank of Rotterdam, the Netherlands. The Dorpsweg, Van Swietenlaan, Pleinweg and Zuiderpark enclose the area. East of the neighbourhood, there is the Zuidplein shopping centre, including a public transport hub with a bus and metro station. Due to the growing importance of the Port of Rotterdam, Rotterdam-Zuid developed rapidly at the end of the nineteenth century (Lörzing et al., 2008). Carnisse was developed to provide housing for the dock workers on the south side of the Maas River (De Nijl Architecten, 2022). The district was mainly built between 1938 and 1950, according to the expansion plan of Witteveen in 1938, based on the expansion plan of Granpré Molière in 1921, Figure 16. The architect Jo van den Broek executed the plans (De Nijl Architecten, 2022). In 2021, the area gives home to almost 12,000 human inhabitants, spread over circa 6,500 dwellings (Kadastrale Kaart, n.d.). The neighbourhood consists predominantly of pre-war closed, four-storey high, row construction porches and upper flats. Only on the south side of the old city part of Carnisse has had urban renewal in the 1970s (De Nijl Architecten, 2022).

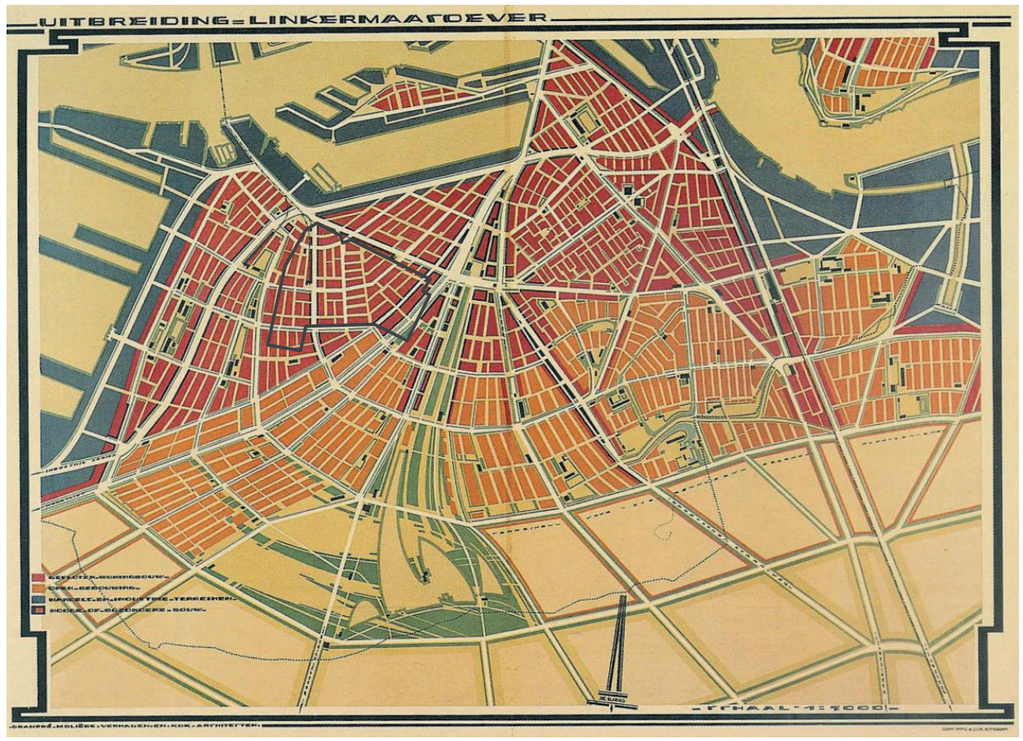


Figure 16. Expansion plan of Granpré Molière in 1921. (By Meijendel et al., 2008)

Figure 17. Carnisse. (By author collected data using Kadaster, 2023)

THE ENVIRONMENT

Carnisse is a pre-war urban neighbourhood characterized by intense use, focussing on human housing and infrastructure connectivity. Also, in terms of land use, it becomes clear that pavement (used for human transport and parking) and buildings take up most of the space in Carnisse, as shown in Figure 18. The public space includes predominantly paved and sealed surfaces, providing pathways for pedestrians and cars, as shown in Figures 19 and 21 on the next page. Due to the human infrastructure-oriented design, relatively little public space is available for other land use types. Non-paved areas are present at Lepelaarsingel, Amelandseplein, tree pits, and some façade gardens. Lepelaarsingel and Amelandseplein provide space for short-mown grasslands with various well-maintained trees, shrubs, and hedges, as shown in Figures 19 and 20.

The buildings in Carnisse consist of half-open blocks shielded by fences or hedges on the not-built sides. These houses lack front gardens, but private back yards include a mix of pavement, grass, plants, and trees. In the Netherlands, approximately 39% of back yards are non-paved, a statistic also applied to Carnisse during this project (Kullberg, 2016). Zuiderpark, located south of Carnisse, provides a green space contradicting the predominantly paved neighbourhood of Carnisse. The Zuiderpark arose in 1952 and includes allotment gardens and sports fields (Municipality of Rotterdam, n.d.b). However, the connection to Carnisse is limited to Lepelaarsingel and Urkersingel, linking Zuiderpark to Amelandseplein, Figure 19.

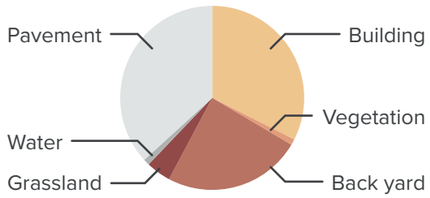


Figure 18. Current land use in Carnisse.

ECOLOGICAL INJUSTICE

Carnisse arose to meet housing needs, resulting in a predominantly paved public space focussing on human housing and movement. While these conditions may not be optimal for many non-human species, some, such as pigeons, swallows, and bats, adapt to and inhabit the stoney environment. Various plant species also find a place in the stony landscape. However, the human-centred design still lacks consideration of a suitable living environment for most non-human species. Lepelaarsingel and Amelandseplein offer grasslands that have the potential to accommodate both human and non-human species. However, the monotonous grasslands lack diversity in landscape, affecting the liveability of many species while promoting human safety through well-organized parks.

Figure 19. Carnisse. (By author collected data using Kadaster, 2023)

Private back yard spaces exhibit more variation in landscapes compared to public spaces, combining pavement and rougher green structures where trees and plants have more space. Depending on the conditions, these areas are more suitable for both, humans and various non-human species. However, fences create barriers, making private outdoor spaces less accessible for ground-dwelling animals, such as the hedgehog.

Zuiderpark provides space for humans and various non-human species by offering fewer paved areas and more green structures. However, even in this area, monotonous mowed grasslands optimized for human use exist. Thus, from a distance, it appears that there is ecological injustice within the current design of Carnisse. Especially within the public space of Carnisse due to compromising the liveability of non-human species.

Examining the human liveability of Carnisse reveals below-average conditions, particularly for lower-income residents, rendering them vulnerable to climate change (Kind et al., 2020). Climate risks, such as flooding and heat stress, are prevalent in Carnisse, affecting both humans and non-human species (Atlas Leefomgeving, 2021; Kind et al., 2020; PBL, 2015). This makes Carnisse a location to demonstrate the impact of ecological justice principles on urban renewal, aiming to improve the neighbourhood for both human and non-human species.

Figure 22. Carnisse on the larger scale. (By author collected data using Kadaster, 2023)

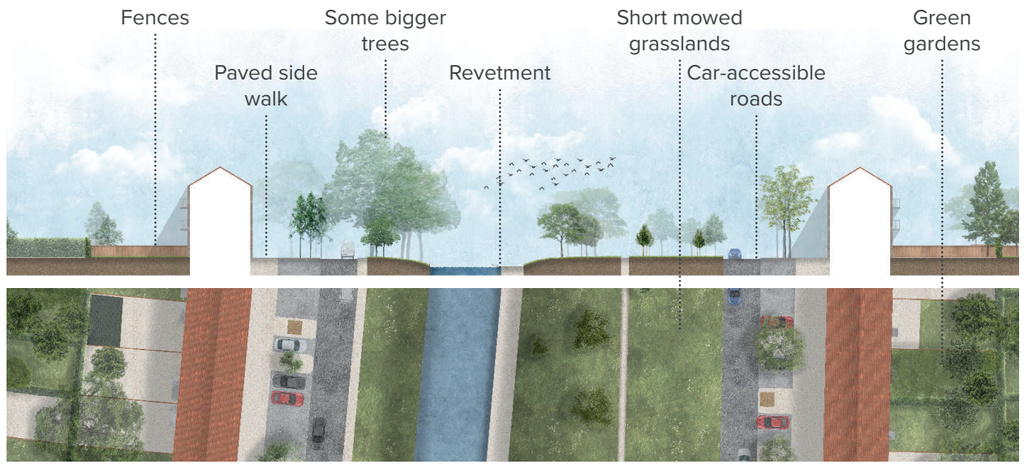


Figure 20. Section A-A": Current state of Lepelaarsingel.

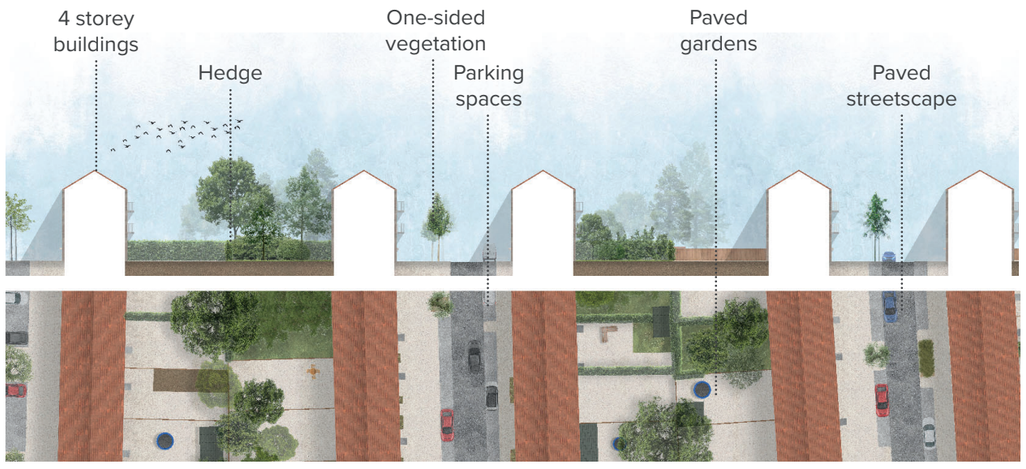


Figure 21. Section B-B": Current state of Klaverstraat.

1. Open soil around the tree


2. Semi-open fences


3. Closed fences


4. Flora between the street tiles


5. Green spur Lepelaarsingel


6. Revetment


9. Façade garden


10. Amelandseplein park

Figure 23. Impression of the neighbourhood. (By author collected data using Kadaster, 2023)


7. Common streetscape


8. 4-storey high building blocks


11. Green spur Urkersingel


12. Surrounding road Goereesestraat

PROBLEM STATEMENT

The complex relationship between humans and the natural world is still visible in 2023's urban planning: a city is a place for humans, and nature gives space to all non-human species (Van Koppen, 1997). The anthropocentric perspective within the urban environment puts humans above non-human nature, which leads to ecological injustice within these environments. One of the consequences and indicators of ecological injustice is biodiversity loss (Wienhues, 2020, p.21). Species extinction is a problem from an Arcadic and resourcistic position and has consequences on all scales (Van Koppen, 1997; Pedersen Zari, 2018).

Urban renewal in the Netherlands is also approached from an anthropocentric perspective by focusing on human liveability only, resulting in ecological injustice. Besides, social connections created to improve human liveability often worsen over time and result in poor liveability eventually, which seems a short-term solution (PBL, 2020). Within Carnisse, a neighbourhood with poor liveability and high climate risks in Rotterdam, the Netherlands, there is currently also the case of urban renewal that focuses on only human liveability (Atlas Leefomgeving, 2021).

The lack of ecological justice values affects biodiversity among others, whilst this could have positive consequences for both human and non-human species within Carnisse (WUR, 2018). However, this requires creating an improved relationship between human and non-human nature, which results in a co-existence between human and non-human nature, which is currently missing. The missing central place of ecological justice within urban renewal concepts and spatial elaborations might prevents a long-term solution for urban renewal.

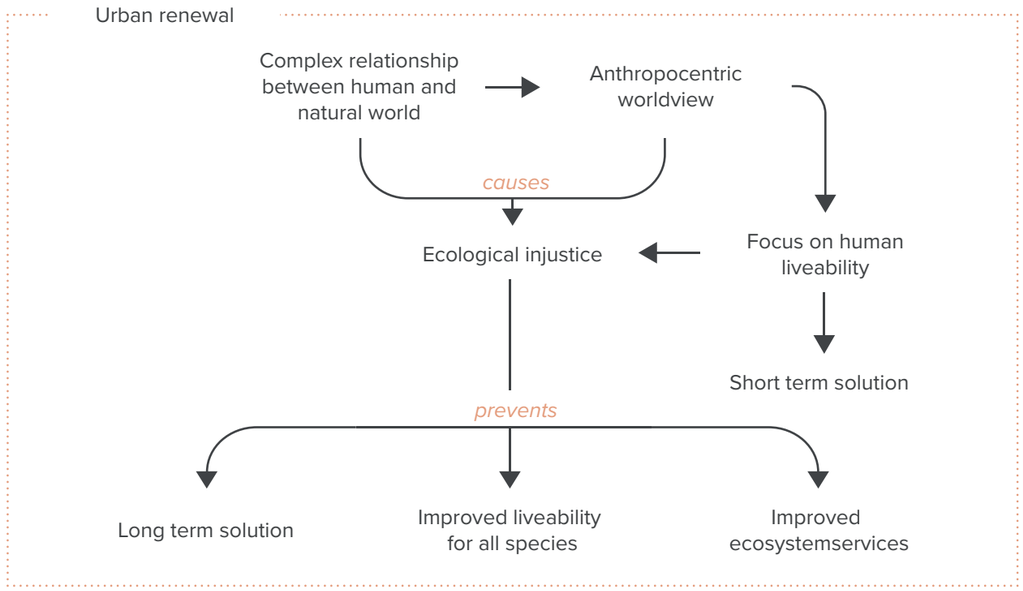


Figure 24. Problem statement.

RESEARCH AIM

Based on the problem statement, the research aim is defined. The research aim is to determine whether incorporating the principles of ecological justice into a spatial plan contributes to improved urban renewal in the context of Carnisse, Rotterdam. The objective is to establish a long-term solution for a liveable environment for both human and non-human species in the urban environment, emphasizing a moral relationship that considers all species.

To address this research aim, the human species must acknowledge their role in contributing to ecological injustices within the built environment, and a paradigm shift is necessary. Firstly, humans should be approached as part of the "bigger system", moving away from the anthropocentric worldview prevalent in current urban planning and redevelopment in the Netherlands. This involves acknowledging that the current situation is primarily designed for the human species and, as a result, may not, to a lesser extent, or only unconsciously consider other non-human species. Moreover, it should be acknowledged that the value of the environment extends beyond humans, encompassing all living beings that are integral to the environment. Finally, it should be recognized that the right to life is not exclusive to humans; all living beings, human and non-human, possess the right to lead a fulfilling and flourishing life. This implies that non-human species also need a liveable environment, and humans must recognize the consequences of their actions on both other humans and other species.

A spatial design at the neighbourhood and street scale demonstrates a possible implementation of ecological justice values within the spatial environment. Comparing the proposed spatial urban renewal plan to the current urban renewal plans of Carnisse makes it possible to compare how the implementation of ecological justice values affects urban renewal concepts and spatial plans.

Figure 25. The cover of Justice, Society and Nature. (Low and Gleeson, 1998)

02

THEORY AND METHODOLOGY

THEORETICAL FRAMEWORK

To incorporate the values of ecological justice into the spatial outcome of urban renewal, a foundational compression of theories is necessary. First of all, the theories of urban renewal and liveability are clarified to indicate the perspective from which these theories are approached. Subsequently, the ecological justice theory emerges, emphasising the principles that underpin this theory. To translate theoretical comprehension into practical application, the theories of biocentrism, nature-based thinking, and contextual considerations are delineated, forming a structured framework to support this transition.

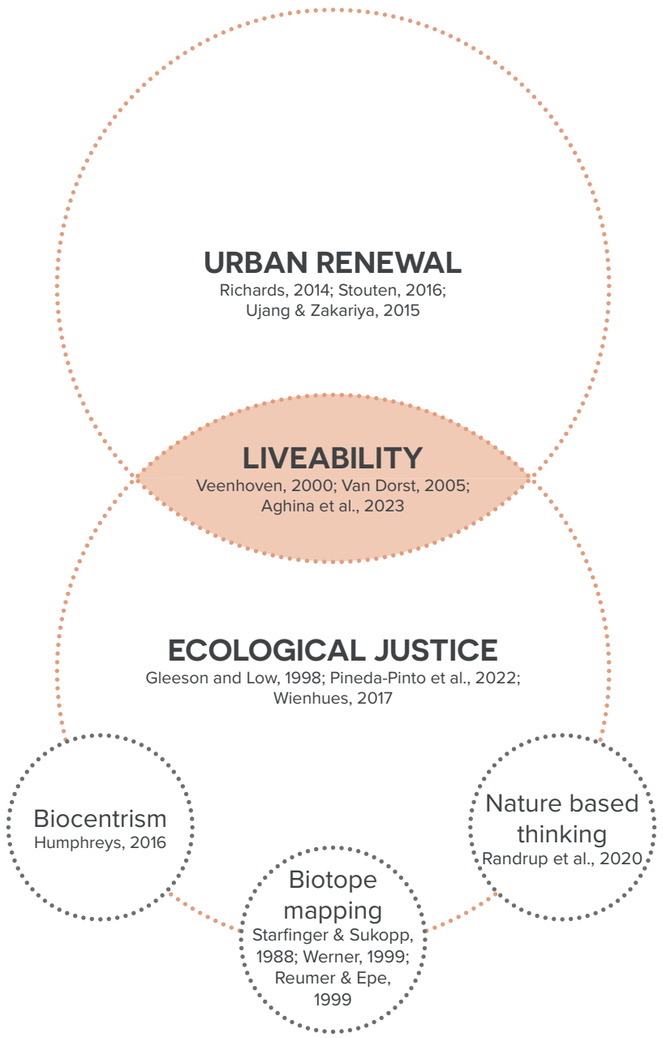


Figure 26. Theoretical framework.

URBAN RENEWAL

The definition of urban renewal as interpreted follows the definition described by Richards (2014): *"Urban renewal refers to a set of plans and activities to upgrade neighborhoods and suburbs that are in state of distress or decay. Urban renewal programs address the physical aspects of urban decay. Urban problems such as deteriorating housing, poor physical infrastructure (including water and sanitation services), and poor community services such as sports and recreational amenities are addressed through such programs."*

In other words, urban renewal is the process of remaking places to create a socially better life for humans (Ujang & Zakariya, 2015). In doing so, urban renewal strives to establish lasting spatial solutions that connect design issues with social, economic, and political contexts. These solutions encompass changes in urban structure that could be interventions at regional, city and neighbourhood scales. Driven by changing conditions and social needs, these solutions are created through integrated visions and interventions necessary to address these challenges. In this process, the quality of human life, including liveability, is often a central focus (Stouten, 2016). Chapter 3 delves further into the evolution of urban renewal over time.

LIVEABILITY

The interpretation of liveability in this thesis follows the general definition articulated by Veenhoven (2000): *"Liveability is the extent to which an environment aligns with the adaptive repertoire of a species. It's important to note that a particular area may offer better liveability for one species compared to another. Nevertheless, an environment does not need to be optimal to be liveable for a specific species."*

Liveability is the link between the living environment and the life form, making an area more liveable for one entity than another. This applies not only to different species but also to individuals within the same species. A liveable environment doesn't have to be ideal, but it involves the compatibility of the environment, making it more or less liveable (Veenhoven, 2000). Liveability, when applied to humans, is measured differently than for flora and fauna. According to Van Dorst's definition (2005), human liveability encompasses the physical environment, housing stock, amenities, social cohesion, and safety (Mandemakers et al., 2021). For non-human species, liveability depends on residence, food, variation, safety, and connection (Aghina et al., 2023). The main difference between the two approaches to liveability lies in the approach to social aspects. For humans, the social domain is addressed through separate elements like safety and social cohesion. Conversely, for non-human species these elements are one-to-one related to the physical environment, making individual improvements in the social field impractical (Van Dorst, 2005).

ECOLOGICAL JUSTICE

The definition of ecological justice as interpreted follows the definition described by Gleeson and Low (1998, p. ii): *"Ecological justice is about fair distribution of good and bad environments among all inhabitants of the planet. To speak of ecological justice means to recognise the value that an environment has for all creatures. An environment is comprised not only of people, but also nonhuman nature in all its abundance and diversity: animals and plants, landscapes and ecologies. An environment is not divisible like property but is fundamentally shared. Bad environments are dead, disintegrated, damaging to health. Good environments are alive, healthy and integrated."* Chapter 1 Introduction elaborates on the ideology of ecological justice. This chapter delves into theoretical foundation.

The theoretical foundation of ecological justice has four dimensions: distribution, recognition, participation and capabilities, centralizing the symbiotic relationship between humans and nature (Pineda-Pinto et al., 2022).

Distribution focuses on equity between human and non-human interests and consideration of the distribution of environmental bads and goods. There is an acknowledgement that the impact on nature should be treated with the same consideration as human interests (Pineda-Pinto et al., 2022). This dimension is especially relevant in the context of the finite planet since ecological space is becoming more scarce and therefore threatening the well-being of various species (Wienhues, 2017).

Recognition involves acknowledging diverse and vulnerable social and ecological groups and individuals. It entails identifying relationships, values, and interconnections within ecological processes (Pineda-Pinto et al., 2022).

Participation refers to an inclusive and empowering collaboration in decision-making and planning processes by acknowledging all species and promoting knowledge exchange and education (Pineda-Pinto et al., 2022).

Capabilities refer to the necessity of abilities for all living beings to live a healthy, fulfilling and flourishing life. Within urban development is the aim to sustain the well-being of both human and non-human species (Pineda-Pinto, et al., 2022).

The combination of these four dimensions is shown in Figure 27. This is a theoretical framework that aligns with the inclusion of all species.

Not the full end-state

It could be argued if ecological justice can be the full-endstate within urban development since all individual living being's needs can never be satisfied simultaneously (Wienhues, 2017). All species, not only human species, possess the capacity to destroy their local environment, resulting in ecological injustice. However, in the case of non-human species destroying a local environment, it eventually results in a decline of species in the sufficient amount needed to restore the ecological balance in the long run. In the case of the human species, the relationship with the ecosystem has changed. Therefore, this resiliency within the environment is not always possible anymore. As global species, human activities have the potential to destroy the whole ecosystem, not just local ones. Besides, humans have developed the ability to outmanoeuvre the retroactive impact of local environments, allowing them to survive significant environmental changes and bypass species destruction to some extent (Gleeson & Low, 1998, p. 155). Due to the irreversible activities human species have taken towards the environment, ecological justice becomes more crucial in promoting justice and restoring the relationship with non-human nature. Therefore, while ecological justice may not be the ultimate end-state, it remains a vital aim to strive for within the urban context (Wienhues, 2017).

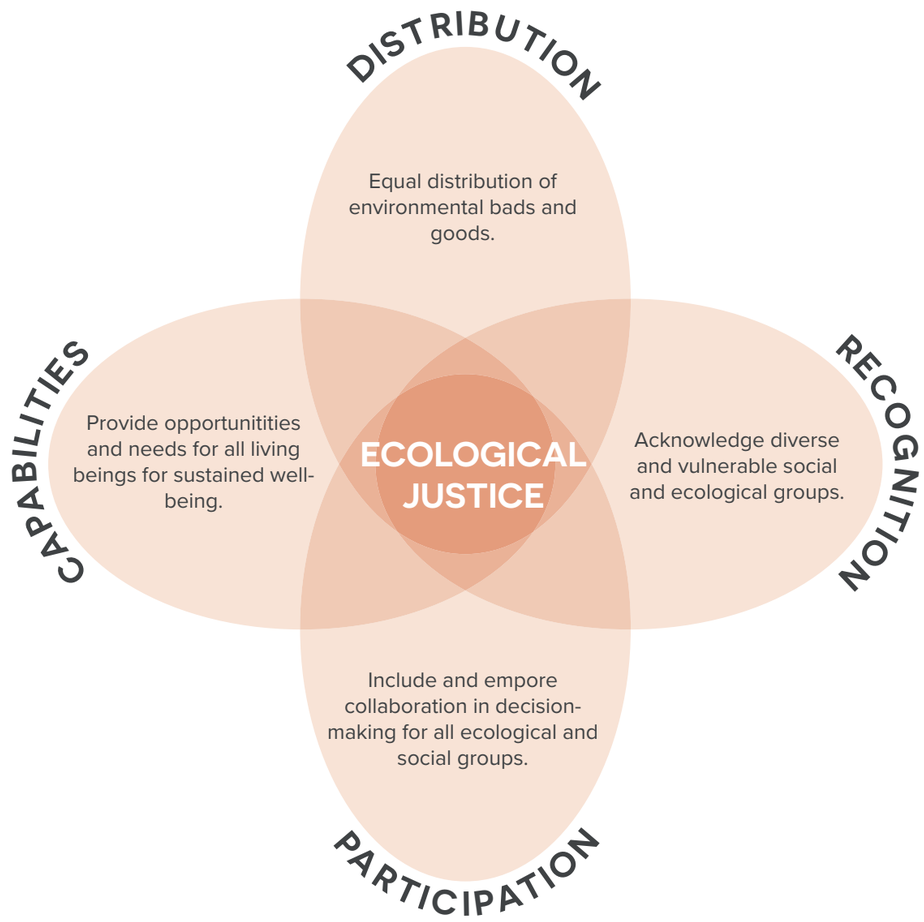


Figure 27. Ecological justice. (By author, based on Pineda-Pinto et al., 2022)

BIOTOPE MAPPING

The interpretation of biotope mapping in this thesis follows a combination of the descriptions provided by Starfinger & Sukopp (1994), Reumer & Epe (1999), and Werner (1999): *"Biotope mapping is a tool for nature conservation strategies that contributes to the improvement and quality of biotopes. The ultimate objective is to get essential ecological information to elevate the ecological and aesthetic value of urban green spaces. Biotope mapping achieves this by offering a realistic and comprehensive depiction of urban nature."*

An urban environment is a patchwork of different biotopes, each with its own biotic characteristics. The individual biotopes, including their ecological characteristics, location, and distribution, should be recognized to integrate nature conservation strategies (Starfinger & Sukopp, 1994; Werner, 1999). Recognition is crucial to achieve the goal of enhancing the ecological and aesthetic value of a city (Reumer & Epe, 1999). In biotope mapping, there is a distinction between selective mapping, which focuses only on biotopes deemed "worthy" of protection, and comprehensive mapping, which considers all biotopes (Sukopp & Weiler, 1988). This thesis will focus on comprehensive mapping. By observing the existing biotopes, urban design considers the existing qualities and ecological values to better align with the current features of this existing biotope in harmony with the community of plants and animals associated with it (Starfinger & Sukopp, 1994; Werner, 1999).

Context consideration

During this thesis, "context consideration" based on the biotope-mapping theories replaces the pillar of "distribution" in the ecological justice framework. Context consideration aims for the adaptation of biotope mapping, and therefore increased alignment with the existing conditions of the biotopes present in the planning area (Werner, 1999). In the current situation, these biotopes already serve as a habitat for various species that inhabit this area, and the goal is not to suppress these present species (Starfinger & Sukopp, 1994). This adjustment is shown in Figure 28.

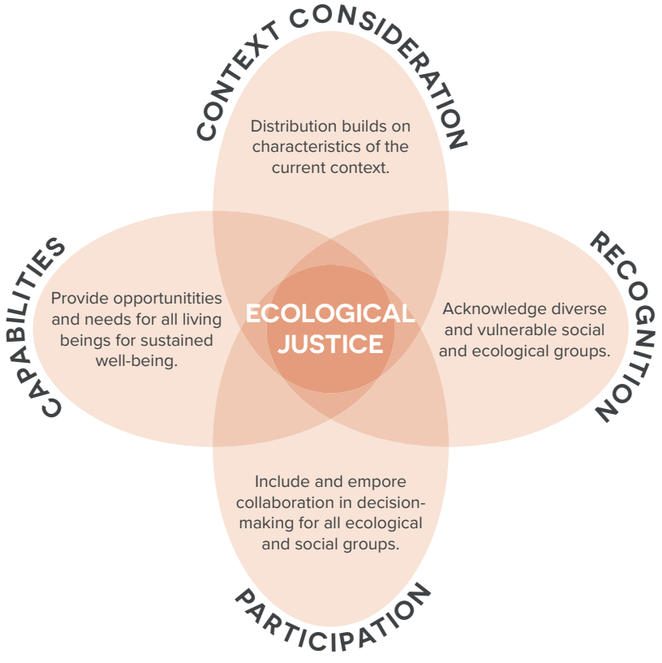


Figure 28. Modified ecological justice framework. (By author, based on Pineda-Pinto et al., 2022; Werner, 1999)

BIOCENTRISM

The definition of biocentrism as interpreted follows the definition described by Humphreys (2016): *"Biocentrism is a stance in environmental ethics which extends the scope of morality much wider than traditional ethics to include all living creatures. On the basis that all living creatures are capable of being beneficiaries and as such all have morally relevant interests, the biocentrist claims that all have moral standing."*

In other words, biocentrism extends moral recognition to both human and non-human species. As a consequence, the responsibility of humans not only applies to themselves but also to other non-human species. This is due to the human species that not only affects itself but also affects other involved species. The biocentric approach can also mean that actions do not always need to relate to the human species and may lead to sacrificing human interests to benefit non-human species. This contradicts the traditional anthropocentric approach, which only acknowledges the moral status of humans. Within the current approach, non-human species receive only indirect moral recognition when their interests conflict with those of humans. However, this human-centred approach leads to environmental problems that affect not only the human world but also the non-human world. When non-human entities are considered beings with intrinsic value and moral considerations, addressing climate issues becomes of greater importance than in the current anthropocentric perspective (Humphreys, 2016).

NATURE BASED THINKING

The interpretation of nature-based thinking in this thesis follows the general definition articulated by Randrup et al. (2020): *"Drawing up inspiration by nature as an outset for the development of more sustainable and inclusive cities, balancing anthropocentric and ecocentric values and acknowledging the importance of the social and governance dimensions in a more balanced socio-ecological perspective."*

Nature-based thinking elaborates on nature-based solutions, focusing on solutions inspired and supported by nature. Unlike nature-based solutions, nature-based thinking goes beyond the anthropocentric and solution-oriented approach to transform sustainable cities through a broadened nature-based and social-ecological approach. Nature-based thinking does not only provide space for the expected benefits. It is also about unexpected beneficial outcomes to envision a longer-term perspective by recognizing the value of nature beyond solutions and services and emphasizing inclusivity through culturally diverse and community-centred ways through the interconnectedness of humans and nature (Randrup et al., 2020).

Nature-based thinking focuses on three dimensions. The ecological dimension allocates more space for nature beyond human services and solutions. The community dimension focuses on creating a new urban aesthetic that allows for new experiences with nature, potentially increasing diversity within nature. The economic dimension addresses the political and governmental perspective to enhance the link between the formal governments and the local communities to provide this way of thinking (Randrup et al., 2020).

CONCEPTUAL FRAMEWORK

Figure 29 shows the conceptual framework. The pre-urban renewal Carnisse is located in the middle of the framework. The framework shows how the current approach of NPRZ and the proposed approach based on ecological justice values affect the neighbourhood in world view, governance & space, approach and purpose.

On the left side is the current lens based on the NPRZ approach shown. The urban renewal based on the NPRZ pillars focuses on refurbishing, elevating, differentiating and connecting. This approach results in an anthropocentric worldview, inclusivity for all humans, area-based and a short-term efficiency solution. In this, the anthropocentric worldview and short-term efficiency for the human species go together, and the area-based approach and human inclusive governance & space go together. In between, there is a dichotomy resulting in sectorized urban renewal.

Replacing the values of the NPRZ with the principles of ecological justice, it becomes clear that most values correspond. However, ecological justice expands the values of NPRZ by not just focusing on the human species but adapting these values to all living beings.

Due to ecological justice principles, the aim is to include all species and create a relationship between all these living beings. However, the process takes time to develop this relationship. Therefore, the final state will not immediately work out but will develop over time during urban renewal processes. The four main pillars of ecological justice focus are recognition, capabilities, context consideration and representation. This approach results in a biocentric worldview, inclusivity for all living beings, considering the existing context and biotopes and a long-term solution for all living species for urban renewal. These four elements need to overlap within the spatial design to create integral urban renewal.

Both, the NPRZ and ecological justice approach will be analysed. However, the main focus will be urban renewal focussed on ecological justice values to create a spatial design for the neighbourhood of Carnisse. The outcomes of both, current and proposed urban renewal, will be compared to see how each approach affects human and non-human species' liveability.

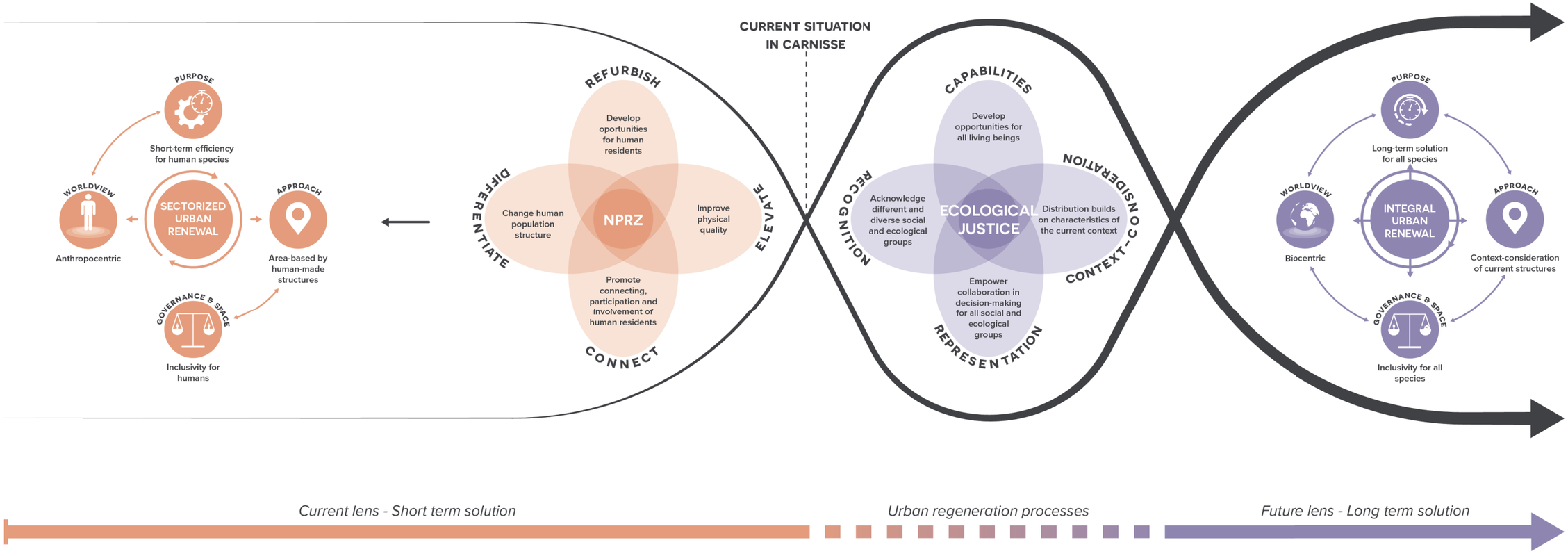


Figure 29. Conceptual framework.

RESEARCH QUESTIONS

How can values of ecological justice contribute to a spatial design that improves urban renewal in Carnisse, Rotterdam?

1 SUB QUESTION 1

What are the current urban renewal concepts in the Netherlands and Rotterdam, and how does this manifest within the ongoing urban renewal of Carnisse?

Aim: Understand the concepts of the previous and current urban renewal in general and how this modus operandi manifests itself in the spatial design of Carnisse, Rotterdam.

2 SUB QUESTION 2

How does ecological injustice express itself among the present species in Carnisse in the field of liveability?

Aim: Understand the needs of present species and how this results in injustice between these species in the field of liveability.

3 SUB QUESTION 3

How to implement ecological justice values within the spatial context of Carnisse?

Aim: Test how the needs of the present species with support from the underlying theories can translate into a design supporting ecological justice values in the spatial context of Carnisse.

4 SUB QUESTION 4

How can ecological justice values influence urban renewal concepts and spatial plans in Carnisse?

Aim: Compare the proposed situation with the current urban renewal to find out how the principles of ecological justice and its supporting theories affect liveability and the urban renewal concepts and spatial plans.

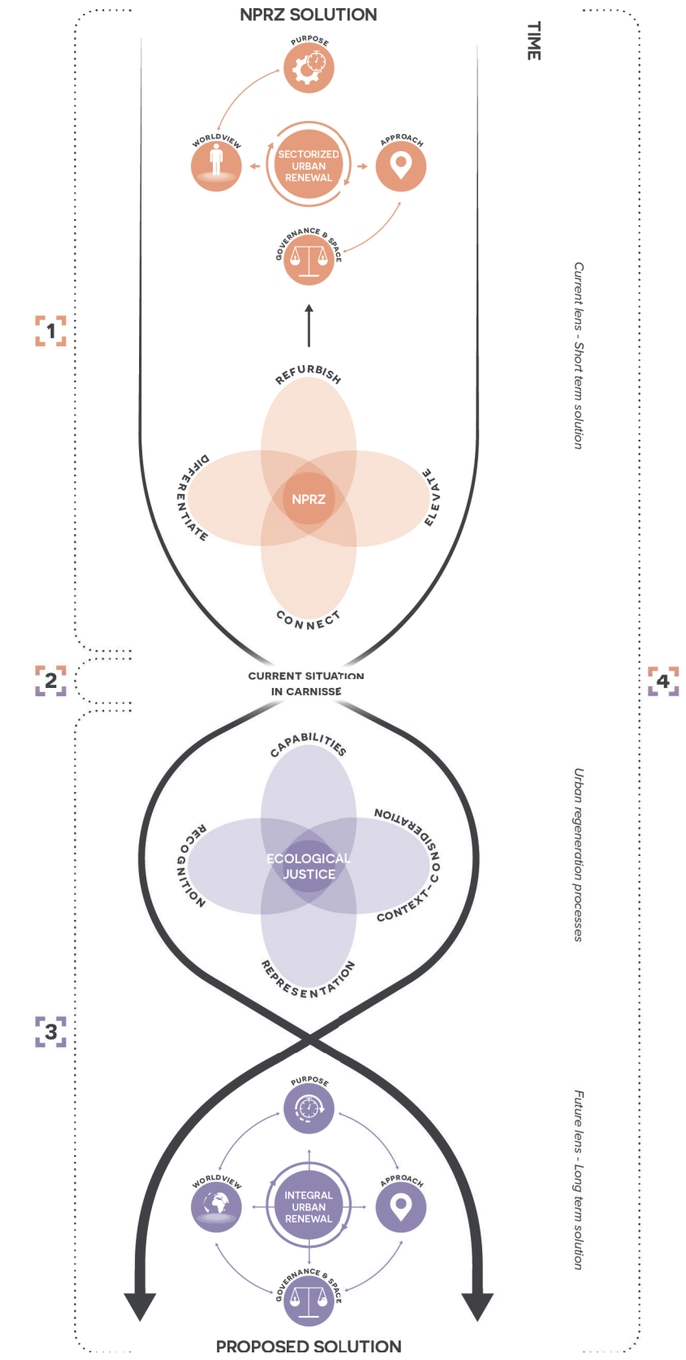
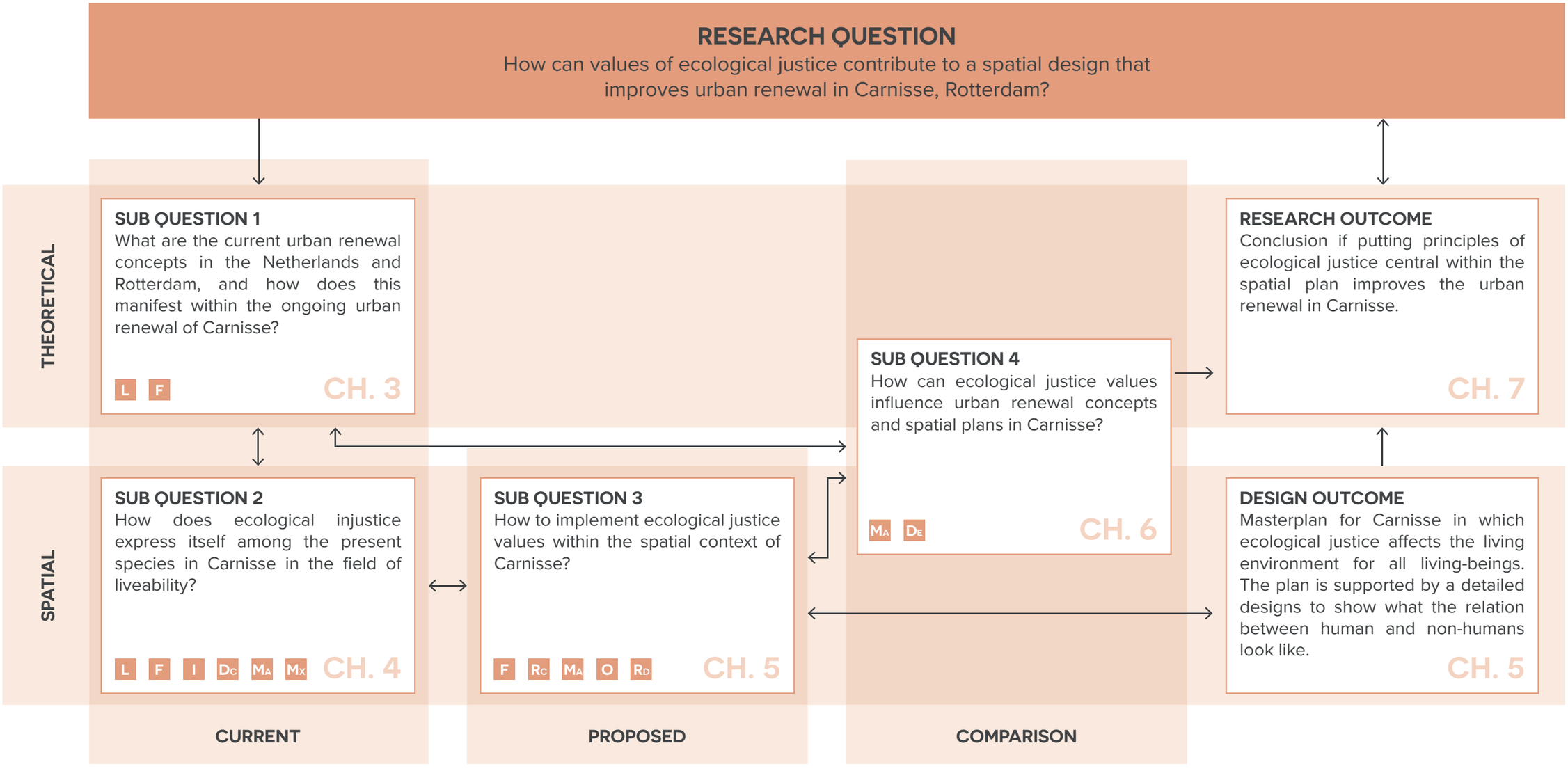


Figure 30. Conceptual framework in relation to research questions.

ANALYTICAL FRAMEWORK



- Dc Data collection
- DE Design evaluation
- F Field trip
- I Interview
- L Literature research
- MA Mapping
- Mx Maximization
- O Optimization
- Rc Reference case
- RD Research by design

Figure 31. Analytical framework.

The analytical framework in Figure 31 shows the relation between the (sub) research questions and the applied method for the specific sub-question. The number in the corners show the chapter (ch.) in which the sub-question will be answered. The subquestions are divided into two fields: theoretical and spatial. In addition, the questions apply to the current and proposed situation, in which the proposal relates to ecological justice and evaluation. Through using various methods, the questions have different answers and will help to go to the next question. Therefore, relations between the analytical framework should be sustained, to get to the final answer of the research question.

METHODOLOGY

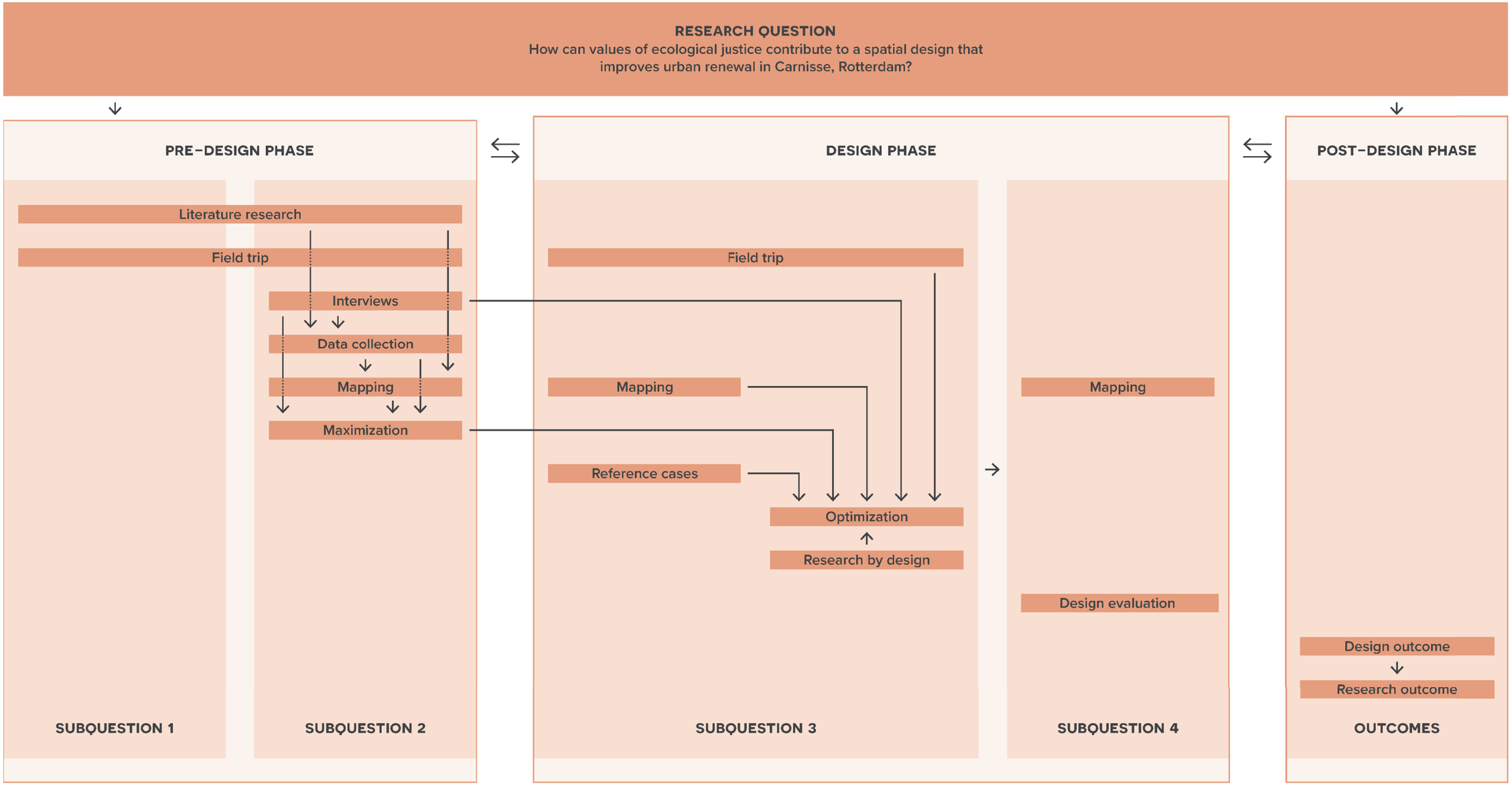


Figure 32. Methodological framework.

Figure 32 shows the applied methods in relation to the research question and the subquestions. The overall method is research by design, resulting in methods divided over the pre-design phase, the design phase, and the post-design phase (Roggema, 2017). The design phase in this could be seen as the most important phase since this will provide the provide the spatial answers for the research, and is interwoven with the pre-design phase. Similar methods apply to various resource questions and phases. Needed actions, aims and limitations for each method is described on the next page.

METHODS

L LITERATURE RESEARCH

Action
Read and review (scientific) literature.

Aim
Understand the theory behind urban renewal processes, liveability, ecological justice and its values, and related themes to create ecological justice.

Limitations
Literature about ecological justice is relatively new and not well documented with its applications within the built environment. Additionally, it is required to be critical of the used literature.

F FIELD TRIP

Action
Visit the site.

Aim
Observe existing structures and processes within the neighbourhood to provide a link between the digital world and reality. Additionally, gain information that is not documented in the literature or other media.

Limitations
The field trip might be subjective. Besides, the field trip is snapshot which could provide a distorted picture of reality. Therefore, it is important to have field trips more often.

MA MAPPING

Action
Map the existing and future structures, typologies, trends and liveability.

Aim
Make research, data and observations visual to understand the context through different scales.

Limitations
Maps can provide a distorted view of reality due to incomplete or generalized information. Working through different scales can mediate.

MX MAXIMIZATION

Action
Design the most optimized situation for a singular species within the urban structure.

Aim
Through maximalization, optimized conditions for human, fauna and flora liveability are designed seperately. The needs of other categories are temporarily not considered to move from tunnel vision.

Limitation
The combining process after maximization is biased. Minimise this as much as possible.

I INTERVIEW

Action
Interview experts in the field of ecology.

Aim
Gain more knowledge about ecology and how the environment can be optimized for flora and fauna.

Limit
The ecologists can have tunnel vision due to the work field and the limitations they work with in their everyday lives.

DC DATA COLLECTION

Action
Gain and process data related to present species.

Aim
Understand in terms of flora and fauna what species are present in Carnisse and where they live. Besides, understanding human liveability. The data provides numbers related to non-spatial information, such as safety and social cohesion.

Limitations
In terms of fauna, it is hard to have exact data about present species due to their moving behaviour, and data is dependent on volunteers counting.

RC REFERENCE CASES

Action
Study reference cases related to the project.

Aim
Gain inspiration for solutions through examining projects with similar challenges.

Limitations
Reference cases can be optimized for the a context. Therefore, it might not be transmittable to the context of Carnisse. Social context and climate conditions should be considered.

O OPTIMIZATION

Action
Combine the different maximized situations to create a design suitable for all different species.

Aim
Create a design that considers the needs and wishes of the different present species.

Limitation
The optimization process is biased. Minimise differences is preferences as much as possible.

RD RESEARCH BY DESIGN

Action

Translate theories into spatial interventions within the context.

Aim

Understand how theories can translate into interventions and what synergies this creates within the context.

Limitations

The design is context specific. As a result, in some cases it will not be possible to implement a specific theory.

DE DESIGN EVALUATION

Action

Reflect and compare the design results and compare them to the original urban renewal.

Aim

Identify differences between current and proposed urban renewal to see how each process affects liveability.

Limitations

Since the ongoing and proposed urban renewal are not developed (yet), it is not possible to see how this works out. However, when comparing the outcomes, it should be considered that the ongoing urban renewal only focusses on human liveability, and the proposal focusses on all-species liveability.

Figure 33. Demolition of homes due to upcoming renewal of Tweebos neighbourhood in Rotterdam. (Grootenhuijs, 2022)

03

CURRENT URBAN RENEWAL

URBAN RENEWAL OVER TIME

Urban renewal is a significant challenge for cities in the Netherlands and Europe. It involves creating a comprehensive vision and strategy for urban development that considers various aspects and stakeholders This approach aims to address (social) needs and improve economic, social, and physical aspects, with a primary focus on enhancing quality of life (Stouten, 2016). Urban renewal encompasses a range of factors such as housing, transportation, education, and environmental considerations, and within the Dutch context, policies are in place to guide this process from a governmental perspective. It typically occurs when an existing neighborhood no longer aligns with future plans (Wassenberg, 2010; Mak & Stouten, 2014).

The historical progression of urban renewal in the Netherlands is summarized to understand its evolution. This analysis seeks to clarify the underlying principles of modern urban renewal in the Netherlands and how these apply to Carnisse and Rotterdam-Zuid. The special focus is on the potential emergence of ecological (in)justice within these urban renewal efforts.

Urban renewal in the Netherlands began after World War II, focusing on improving housing quality. War-damaged buildings and slums were replaced with new constructions, primarily through area clearance, without regard for existing structures. The national government played a dominant role in this process, adhering to a top-down approach, as it aimed to sustain the welfare state (Wassenberg, 2010; Mak & Stouten, 2014).

By the late 1960s, resistance against this approach began to grow. Therefore, in the 1970s, the area-based approach gained prominence in urban renewal. The emphasis shifted to preserving existing urban fabric and focusing on social infrastructure and affordable housing. The principle of “Building for the neighbourhood” emerged, employing bottom-up initiatives and encouraging participation, though still primarily influenced by top-down processes, as urban renewal relied on state budgets and policies to address social issues through spatial design (Wassenberg, 2010; Mak & Stouten, 2014). This period was the start of decentralized control, particularly in Rotterdam, where market-oriented approaches gained influence. Investments were increasingly based on economic value, often leading to gentrification and attracting private investors (Mak & Stouten, 2014; Stouten, 2016).

In the 1980s, urban renewal in the Netherlands shifted the focus from physical improvements to social renewal. This transition emphasized social and socio-economic programs to integrate marginalized communities and encourage interaction among diverse groups. This approach involved a combination of social, economic, and construction policies alongside the increasing influence of market-oriented strategies (Mak & Stouten, 2014; Wassenberg, 2010).

By the 1990s, it became evident that addressing urban issues required a more comprehensive approach to ensure the overall vitality of cities. Policymaking became more integrated, emphasizing spatial-economic development and social cohesion to create diverse neighbourhoods. Both government and non-governmental actors played essential roles, with the government responsible for budget and policy. Specific “focus neighbourhoods” were designated in the Netherlands to concentrate efforts, primarily in early post-war areas. However, the market-driven approach often led to gentrification, boosting economic value but potentially displacing residents (Wassenberg, 2010).

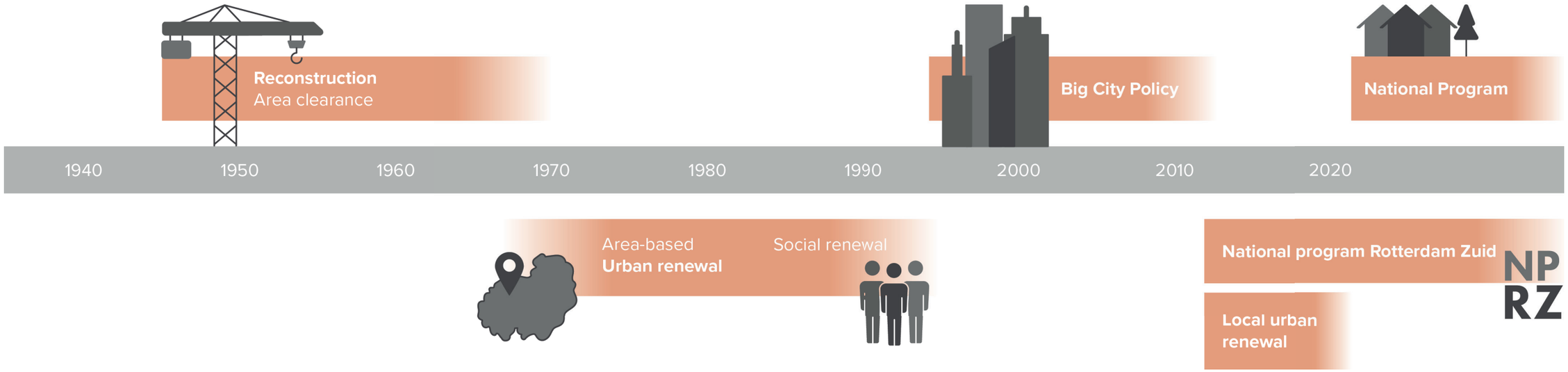


Figure 34. Timeline of urban renewal in the Netherlands.

In 1994, the “Big Cities Policy” aimed to address social inequalities, liveability, and safety, particularly in early post-war neighbourhoods. This policy placed a stronger emphasis on the social aspect of urban renewal. In Rotterdam, multiple neighbourhoods included this initiative to use area-based strategies to promote gentrification through collaboration with the private sector. The urban renewal efforts were led by both national and local policies (Mak & Stouten, 2014).

In 2002, new challenges prompted a shift in focus from physical to social issues, leading to the creation of the “Restructuring Program” that identified 56 “Power Districts”, including 5 in Rotterdam. The government attempted to tackle social and economic problems through spatial and physical interventions, which resulted in the one-sided housing supply, the demolition of social housing, and new construction aimed at gentrification (Mak & Stouten, 2014; Stouten, 2016). Over time, a “social reconquest” was deemed necessary, emphasizing physical improvements, social cohesion, and liveability, which led to the designation of “Power Districts” in 2007. Some areas faced liveability challenges, while others improved the living environment. The goal was to stimulate gentrification and urban renewal became closely tied to enhancing liveability and safety, although certain socio-economic issues continued to present challenges. By 2007, “Power Districts” broadened their focus to encompass aspects related to living, working, learning, and growing (Mak & Stouten, 2014; Werkwijzer, n.d.).

In 2012, the economic crisis resulted in the end of the “Power district” policy. Most municipalities shifted towards locally-driven neighbourhood renewal, except for Rotterdam-Zuid, where collaboration continued among the municipality or Rotterdam, housing corporations, healthcare institutions, and ministries under the Nationaal Programma Rotterdam Zuid (Werkwijzer, n.d.).

In 2018, there was a renewed focus on vulnerable neighbourhoods, with municipalities adopting an area-based approach and the central government providing more support (Werkwijzer, n.d.).

In 2022, the National Program for Liveability and Safety was developed, which provides extra support from the national government towards 20 areas, of which Rotterdam-Zuid is one under the NPRZ (Ministry of the Interior and Kingdom Relations, 2022). Smaller initiatives have been predominantly led by local governments or housing associations, with resident involvement often limited to a few individuals motivated by financial considerations.

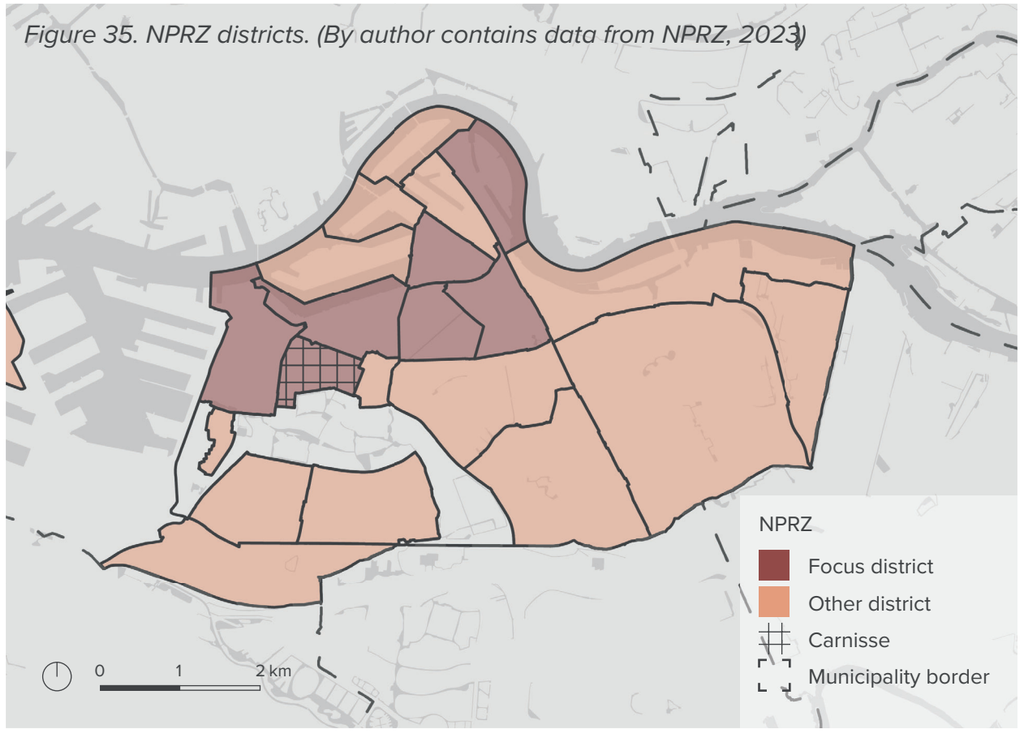
Within contemporary urban renewal, the role of ecology gets more attention. However, for this aspect, there is no specific answer yet for who should be responsible for this: the government, the market or the human residents. The most potential is within housing corporations. However, there are not much present within Carnisse. Within the focus points of the municipality of Rotterdam, there is a focus on biodiversity, mainly by creating and strengthening existing green structures. Other key points nevertheless advocate for the predominant presence of nature and recreational spaces outside the city centre (Wassenberg, 2010; Mak & Stouten, 2014; Municipality of Rotterdam, 2021).

URBAN RENEWAL IN CARNISSE

Most urban renewal bypassed Carnisse, as mentioned in Chapter 1 - Carnisse Rotterdam (De Nijl Architecten, 2022). Historically, Carnisse was an unassuming area with relatively good conditions. However, in recent years, it has faced increasing challenges, putting the quality of life for its human residents under pressure (NPRZ, 2013). This decline in liveability was also evident in parts of Rotterdam-Zuid. Consequently, in 2011, the Nationaal Programma Rotterdam Zuid was established (NPRZ, 2023). The NPRZ diverged from the local urban renewal of that time, which relied on local initiatives (Werkwijzer, n.d.). NPRZ differentiated itself by fostering collaboration between the municipality of Rotterdam, the national government, law enforcement, housing corporations, healthcare and educational institutions, and businesses. The overarching aim was to address socio-economic issues and improve the liveability in Rotterdam-Zuid. Although conceived at a national level, NPRZ operated with a targeted focus, offering neighbourhood-specific perspectives, also for the Carnisse district (NPRZ, 2023).

Within the NPRZ strategy, urban renewal is approached as a comprehensive task that includes physical and social interventions (NPRZ, 2023). The existing structure and qualities of the neighbourhood are considered to provide more opportunities, improve the quality of life for Carnisse residents, and empower them in society. This involves an intensive participatory process to engage the human residents of Carnisse as much as possible. In this context, Rotterdam-Zuid's approach appears to blend various methods previously employed in urban renewal in the Netherlands (NPRZ, 2013; NPRZ, 2023).

Figure 35. NPRZ districts. (By author contains data from NPRZ, 2023)



NPRZ focuses on five pillars: housing, employment, education, an in-order home base, and safety, each tailored to the human residents of the area. Education is used as the starting point for a better future, with employment seen as the subsequent step to combat poverty and enhance liveability. Education and work combined create more opportunities and meaningful daycare for the human residents of Carnisse. A well-ordered home base is considered crucial to facilitate these opportunities. The housing pillar emphasizes the physical quality and quantity of homes and living environments within the Carnisse neighbourhood. A diverse housing stock with sufficient technical quality is essential to accommodate various human target groups and promote progression within the district. The safety pillar contributes to a secure and crime-controlled environment, enhancing liveability (NPRZ, 2023).

The various pillars and the project's approach overlap, forming the core of NPRZ, categorized into four elements: refurbish, elevate, differentiate, and connect, as shown in Figure 36. Each of these aspects contributes to the final physical implementation of the plan, with some being more visible in spatial design than others. Notably, "connect" plays a significant role in the process, as the participation and engagement of people in the design contribute to urban renewal (In.Fact.Research & Circusvis, 2022; NPRZ, 2023).

In Carnisse, there are short-term, ongoing, and medium-term projects (De Nijl Architecten, 2022). This research focuses on the medium-term design, which also encompasses both short-term and ongoing projects, including all smaller initiatives in the neighbourhood. While the financial feasibility remains unclear, it represents the current train of thought for urban renewal according to NPRZ. The neighbourhood's urban renewal currently consists of various smaller projects, lacking a final master plan. However, the framework in Figure 37 on the next pages, shows the aimed medium-term projects, accompanied by brief explanations of major interventions for which future perspectives are available.

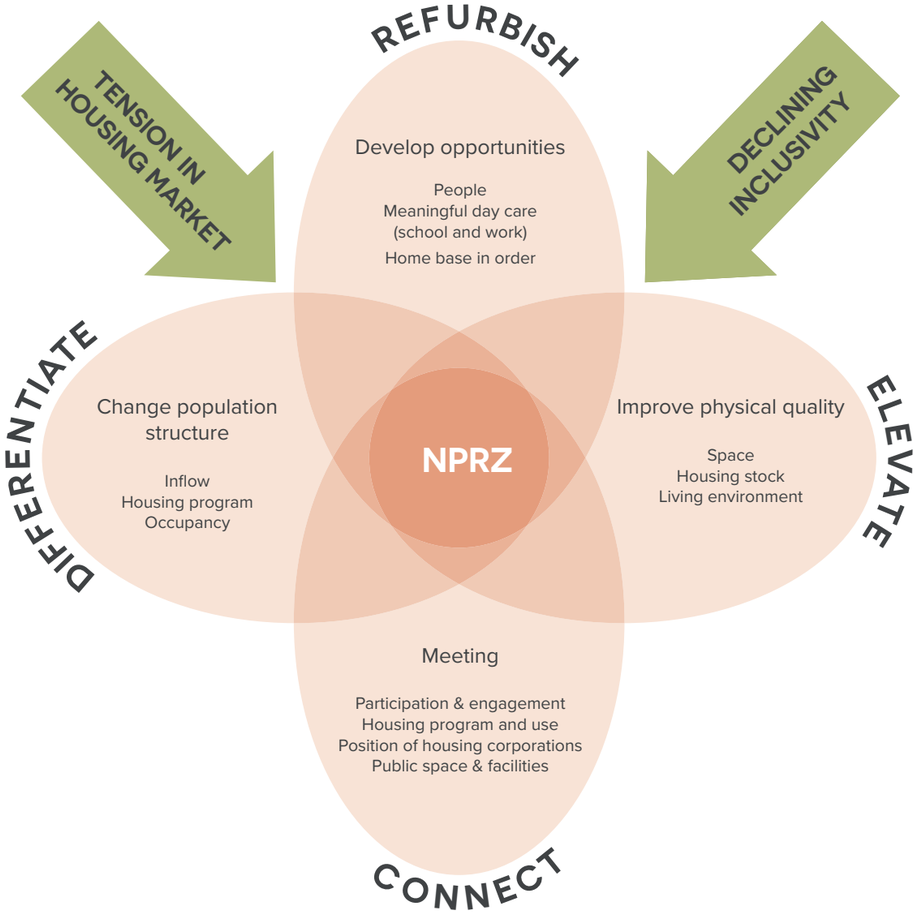


Figure 36. Narrative NPRZ. (Adapted from In.Fact.Research & Circusvis, 2022)

Figure 37. Overview of medium-term NPRZ projects. (Adapted from De Nijl Architecten, 2022)

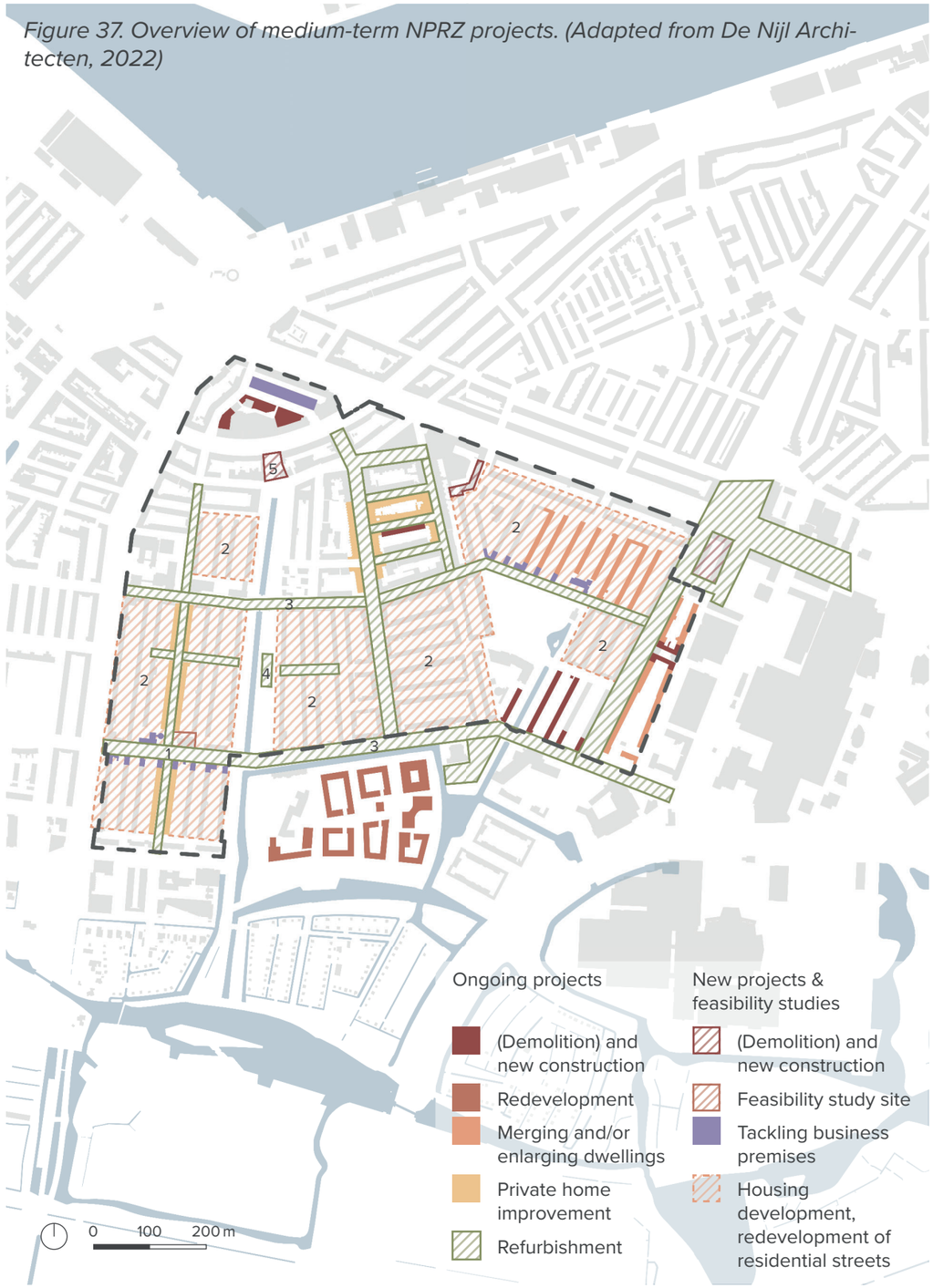
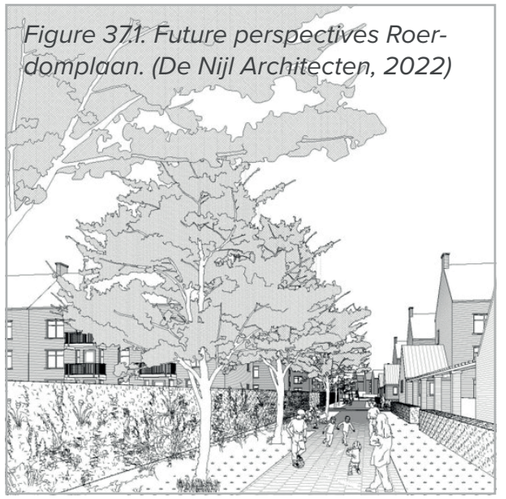
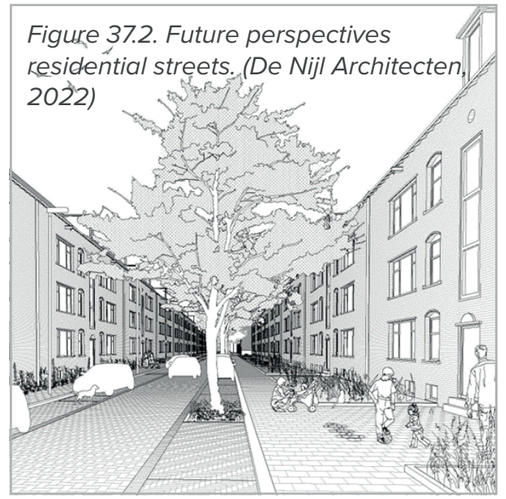


Figure 37.1. Future perspectives Roerdomplaan. (De Nijl Architecten, 2022)



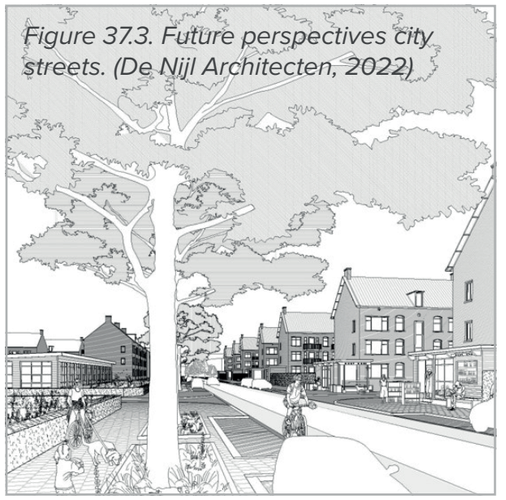
De Nijl Architecten (2022, p. 14):
"In the Vogelbuurt neighbourhood, the road gives way to a cycle and footpath with wide green edges and tree planting. These leafy avenues link up with the Lepelaarsingel."

Figure 37.2. Future perspectives residential streets. (De Nijl Architecten, 2022)



De Nijl Architecten (2022, p. 12):
"Residential streets carry an attractive, safe, green living environment. Climate-adaptive. The one-way traffic with longitudinal parking, provides more space for playing (play pavements) and greenery (trees, tree pits, planting, façade gardens)."

Figure 37.3. Future perspectives city streets. (De Nijl Architecten, 2022)



De Nijl Architecten (2022, p. 6):
The design of both city streets is improved. Narrow roads provide more space for cyclists and pedestrians. Where possible, the city streets are greener: tree structure, tree beds, façade gardens. The street walls are improved. Shop and business premises and end façades are refurbished. Appropriate functions and good entrepreneurship are encouraged, including visible, easily accessible social facilities.

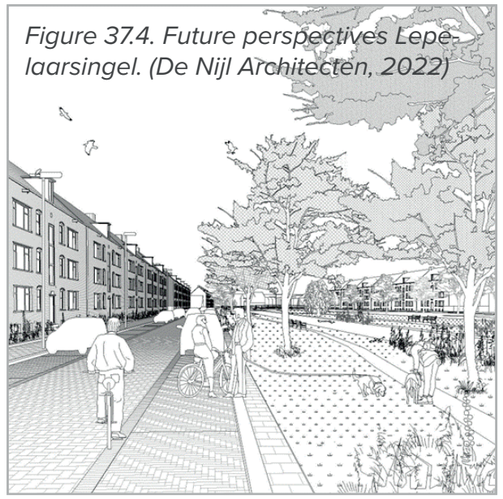


Figure 37.4. Future perspectives Lepelaarsingel. (De Nijl Architecten, 2022)

De Nijl Architecten (2022, p. 8):
"Lepelaarsingel, green carrier of the Vogelwijk: lush green gateway to the Zuiderpark. The spatial design is improved by reducing paving, enriching the assortment and creating more space for play and meeting. The relationship with Carnisse Eiland and the Zuiderpark will also be strengthened, for example by a small bridge."

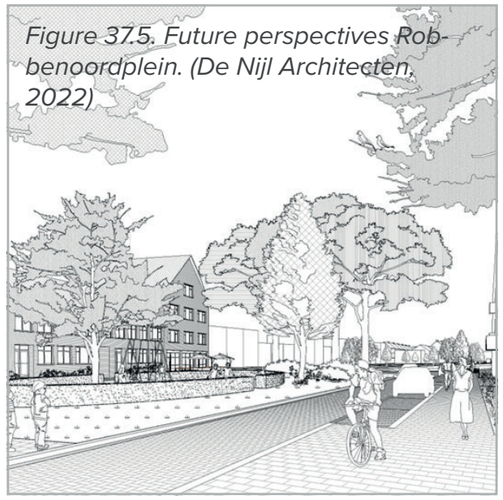


Figure 37.5. Future perspectives Robbenoordplein. (De Nijl Architecten, 2022)

De Nijl Architecten (2022, p. 18):
"Robbenoordplein links the Wolphaertsbocht, Katendrechtse Lagedijk and Lepelaarsingel. There are opportunities for a better spatial structure and better public space. The mixed character of Wolphaertsbocht and Katendrechtse Lagedijk, fanning out in some places to the streets behind, is the starting point."

CONCLUSION

As the history of urban renewal in the Netherlands shows, the approach to urban renewal has changed over time. New methods have been applied and tested to create an optimized solution. So far, each approach has pros and cons, contributing to the ongoing evolution of the process and spatial design. A significant shift occurred over the years. Initially, the focus was on area-clearance urban renewal. Later, social and area-based urban renewal gained prominence, with residents in the respective areas having more impact on urban renewal. In contemporary times, there is an assumption that urban renewal entails striking a balance between physical and social interventions, aiming to derive an area-based solution that results in an integrated outcome. Failure to do so and focusing solely on one aspect leads to negative consequences for the human residents of the planned area. Throughout the timeline of urban renewal, the overarching aim is to improve the liveability of human citizens. While ecology is gradually gaining importance, especially in terms of recreation sites, its precise integration into urban space remains unclear.

In the urban renewal of Carnisse, led by the NPRZ, there is also an emphasis on an integral and area-based approach, incorporating both physical and social interventions. The process involves significant participation from human residents to incorporate their wishes and needs into the plan. This ongoing process, with uncertain feasibility, may not have all outcomes clear. However, involving residents gives them considerable influence on the outcomes and enhances the neighbourhood's liveability. The process and renewal plans described by NPRZ and De Nijl Architects, like general urban renewal in the Netherlands, are centred around people. This is also visible in the urban renewal processes and plans for Carnisse, wherein the participatory process is specifically customized to cater to human needs.

The urban renewal for Carnisse aims to improve the liveability of human citizens. In public spaces, the space for cars is reduced, making a place for social interaction and recreation for human residents. This is pursued by creating a greener environment through additional greenery like façade gardens, tree pits, and plants. Moreover, this green environment serves the purpose of promoting climate adaptation for the neighbourhood. The greenery is attractive and has a function for the humans. The role of the greenery for non-human species is not considered. Nevertheless, the interventions might have positive incidental effects for other non-human species in Carnisse, even though they are not participating in the planning.

Figure 38. Common blue.
(Johnson, 2015)

Figure 39. Common pipistrelle.
(Vishal Mahale Widlife, n.d.)

Figure 40. European hedgehog.
(Terwiel, 2015)

Figure 41. House sparrow
(Rhododendrites, 2022)

Figure 42. Human
(Barnes, 2020)

Figure 43. Vagrant Darter.
(Andy C. Wildlife, n.d.)

04

LIVEABILITY

ECOLOGICAL (IN)JUSTICE?

This chapter analyzes the current liveability and state of ecological justice in Carnisse. First, the present species participating in the process are recognized. Next, the needs or capabilities of these different species are analyzed to create optimal liveability for each species. By doing this, the positive elements for the specific species of the current situation are the base to establish an ideal scenario for liveability for this species. This optimized situation is based on indicators provided by the Urban Ecology Department of the Municipality of Rotterdam. The aim is to minimize changes to private property, such as homes and estates, during the maximization process. Changes within private properties are only acceptable when necessary to achieve the optimal liveability of a particular species. Also, within the process, preserving existing waterways is crucial for preventing flooding, even when water is not directly relevant to a specific species. The analysis of capabilities leads to two outcomes: the current distribution of environmental goods and bads and the current interconnections and interactions among diverse species in the present context.

Figure 44. Biotopes of in Carnisse. (Collected data using Ministry of the Interior and Kingdom Relations)

PRESENT SPECIES

Various species are present in Dutch cities (Vink et al., 2017). The exact presence of species and their numbers can be determined using data, but this is often just a snapshot. The presence of non-human species, like humans, can change over time. Moreover, selective sampling from the Dutch species register indicates that 3,900 multicellular species depend on urban areas for population survival (Lahr et al., 2014). Investigating all these city-dependent species within the time limit is unfeasible. Therefore, this study focuses on several target species. These species are alreay pr have specific habitat requirements other present species can also benefit from. When an optimal habitat is designed for the target species, it is assumed that 80% of the other present species will also have an optimal habitat (D.O. van der Gaag, personal communication, May 15, 2023). The target species within this study exclusively comprise fauna. Nevertheless, other species, such as flora, are considered as well since they have a crucial role in preserving the habitat for these fauna.

The selection of target species is based on the biotopes and species present within Carnisse. Carnisse, as a whole, represents a pre-war urban neighbourhood biotope. This biotope's characteristics are an intensive neighbourhood, limited public green, no front yards and a presence of back yards (D.O. van der Gaag, personal communication, May 15, 2023). This biotope subdivides into smaller biotopes. The buildings, streets and paved back yards represent a rock biotope. The green back yards represent a brushwood biotope. The park represent grassland biotopes. The sandpits represent deserts. The denser bushes and trees represent forest biotopes, and the waterways are aquatic biotopes.

Figure 45 shows the target species correspond with these existing biotopes. The selection is based on the recommendation of the urban ecologists of the municipality of Rotterdam (D.O. van der Gaag, personal communication, May 15, 2023; M.A. de Beaumont, personal communication, October 14, 2023).

	COMMON BLUE	COMMON PIPISTRELLE	EUROPEAN HEDGEHOG	HOUSE SPARROW	HUMAN	VAGRANT DARTER
Rock		■		■	■	
Grassland	■	■	■	■	■	■
Brushwood	■		■	■	■	■
Forest		■	■		■	
Water		■			■	■
Desert				■		
Infrastructure					■	
Free-riding species	• Various butterflies • Various insects • Various mice	• Various bat species • Small birds • Moths	• Various mice • Weasel • Polecat • Stone marten • Amphibians	• Various bird species • Various insects		• Various dragon-fly species • Amphibians • Small ground-dwelling mammals • Fishes • Various (water) insects • Water birds

Figure 45. Selected target species with biotopes and free-riding species. (Based on (D.O. van der Gaag, personal communication, May 15, 2023; M.A. de Beaumont, personal communication, October 14, 2023)

ALIGNED LIVEABILITY

The introduction to Carnisse briefly explained how the current liveability for both human and non-human species takes place. However, the chapter looked superficially at the characteristics of Carnisse, and generalized the needs of human and non-human species. This chapter delves deeper into the liveability of the various present species in Carnisse.

As described in the Theory chapter, the definition of liveability of human and non-human species differs. Figure 46 aligns the liveability of human and non-human species to create equal comparisons within liveability analysis. However, the liveability of the human species includes a social (safety and social cohesion) and a physical (housing stock, amenities and physical environment) environment. For non-human species, the social and physical environment are one-to-one related (Van Dorst, 2005). Therefore, the definitions of each aspect should align to ensure a more just comparison and are the social aspect included for both human and non-human species within the physical environment during this analysis. The choice to align the different aspects of liveability also results in different interpretations of certain factors compared to human and non-human liveability. The aspects used are briefly explained in terms of what they encompass:

Environment This aspect relates to the environment, biotopes, and their variation.

Residence This aspect includes the necessary resting and mating places.

Amenities This aspect covers food resources and other species-specific amenities.

Connectivity This aspect concerns the physical connections necessary within an area, such as the infrastructures required for movements.

Safety This aspect involves needed safety measures and requirements to meet these safety focusing on the physical aspect.

These different elements will each be analysed for the different target species.

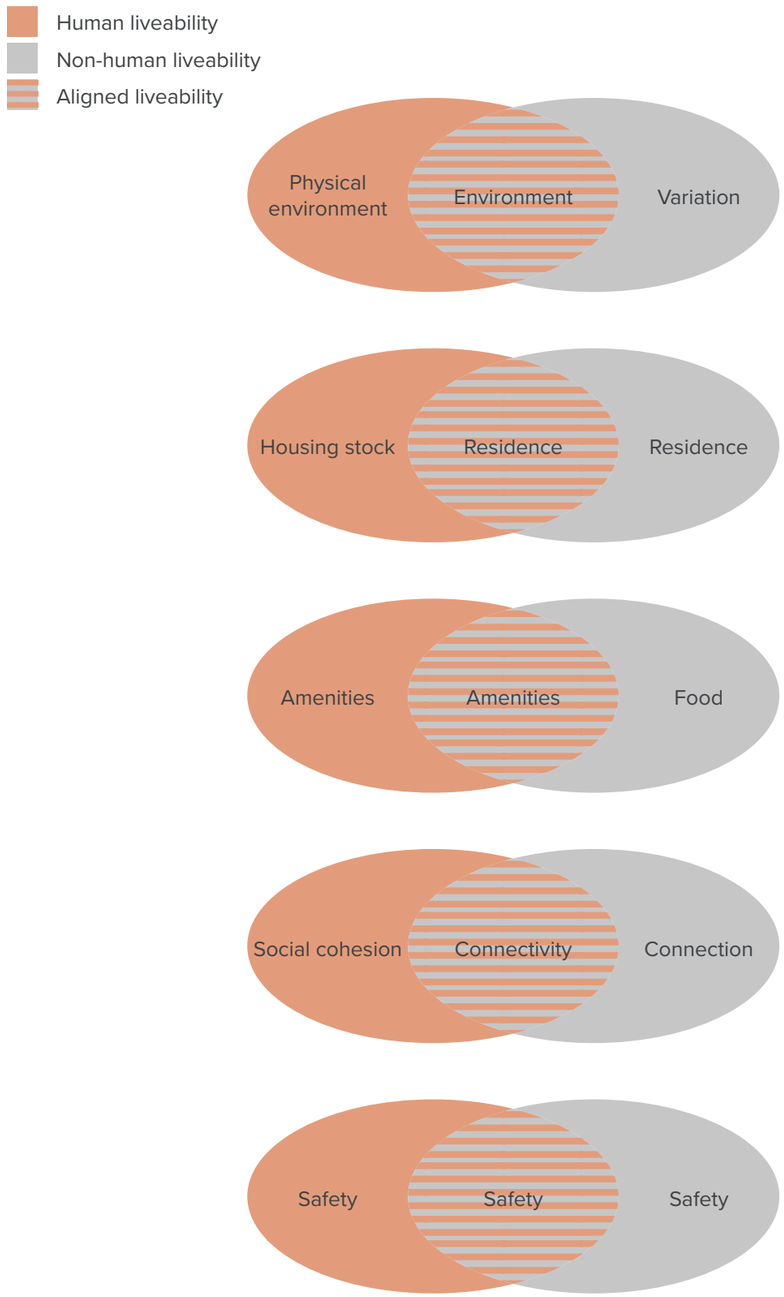


Figure 46. Aligment of human and non-humans liveability.

COMMON BLUE - POLYOMATTUS ICARUS

The common blue (Polyommatus icarus) is a native stand butterfly found in 35% of the atlas blocks in the Netherlands. It is one of the most common blues in the Netherlands (De Vlinderstichting, n.d.). The common blue is also present in the rest of Europe, Asia and North Africa (Cuvelier et al., 2007). In the Netherlands, the blue butterfly mainly occurs in herb-rich grasslands and can sustain itself well in urban areas (Bos et al., 2006).

Their life cycle, visible in Figure 47, is about one year. The egg hatches after 5 to 7 days, from which the caterpillar appears. The stage of the caterpillar takes around 270 to 360 days, including the overwintering phase which takes place in the litter layer (Bos et al., 2006; De Vlinderstichting, n.d.). At that time, the common blue is a half-grown caterpillar. After the winter period, the caterpillar will pupate to blossom into a butterfly in 9 to 15 days. The adult common blue flies around for 13 to 26 days and will mature new eggs in 6 to 8 days (Bos et al., 2006). The common blue flies in two and sometimes three generations per year, depending on the temperatures, and takes place from mid-May to the end of August (Cuvelier et al., 2007). The males are territorial during this flight period and defend their territory from fixed points. In doing so, they chase flying insects. When they are not busy defending, they hold patrol flights to find females (De Vlinderstichting, n.d.).

The common blue is currently not endangered in the Netherlands, nor is it on the red list. Its numbers are stable, and the common blue is observed as a pioneer that can survive even in smaller areas (Bos et al., 2006).

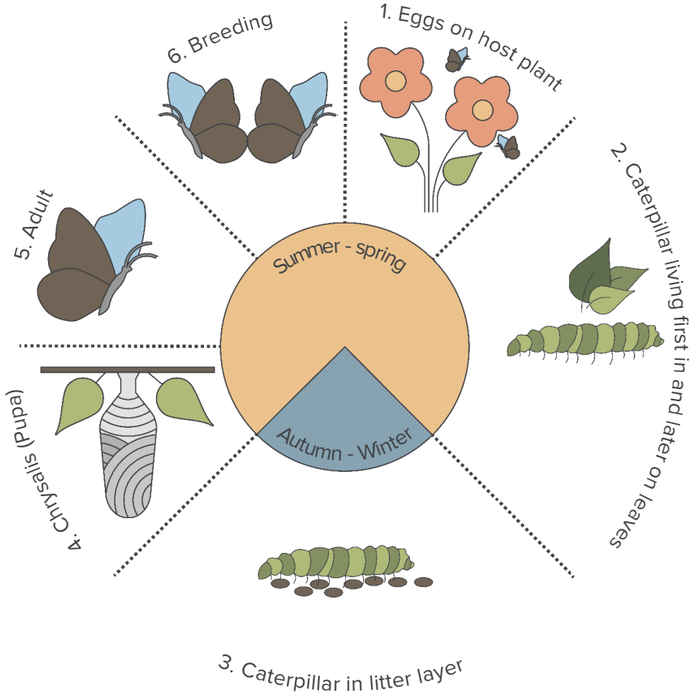


Figure 47. Life cycle of the common blue.

ENVIRONMENT

The common blue resides in environments where herb-rich vegetation is present. The presence is in both agricultural and urban environments as long as there is a combination of short and open vegetation and more rough vegetation. The highest densities of the common blue are in dry grasslands. However, the species benefits from alternating herb-rich grasslands such as parks, roadsides, dykes and pioneer vegetation. The habitat of the common blue consists of several aggregated biotopes. The habitat divides into two predominant biotopes, grasslands and brushwood, contributing to the well-being of the common blue. The biotopes are visible in Figure 49.

Firstly, the grassland biotope. This biotope is present in the parks and around the canals in Carnisse. These areas currently consist mainly of grasslands where the common blue can stay and forage in various stages.

Secondly, there is the brushwood biotope. This biotope is present in the back yards in Carnisse. This biotope provides herb-rich grasslands where common blue can stay and forage in different stages. In addition, this site also provides a litter layer during the winter period where the semi-mature caterpillars can reside. All back yards are marked as brushwood biotopes. However, not every back yard provides the brushwood biotope, since only 39% of the back yards in the Netherlands are green and the rest is paved (Kullberg, 2016). So on the map, the present habitat of the common blue seems larger than it is in real life.

Figure 48. Biotopes of the common blue. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

RESIDENCE

The common blue depends on several hostplants. In particular, lesser trefoil, common bird's-foot trefoil and Black Medick. Throughout the life cycle of the common blue, these plants play a crucial role as a habitat (De Vlinderstichting, n.d.).

In the first stage, eggs are laid individually on the top of the leaves of these host plants. Early in the season, the lesser trefoil is often preferred, while later the common bird's-foot trefoil is. The plants chosen to leave the eggs on usually grow in short vegetation (De Vlinderstichting, n.d.). Once the caterpillar hatches, it begins its life in the leaves of the host plant. As the caterpillar grows, it moves to the outer leaves of the respective host plant. During winter, the semi-adult caterpillars stay in the litter layer or close to the host plants (Cuvelier et al., 2007). In spring, they pupate against the host plants or on the ground. During the adult stage, when they are a butterfly, common blues often rest in small groups near sheltered grass pollen. These grass pollen also serve as communal resting places in the early morning and late afternoon for the common blue (De Vlinderstichting, n.d.).

Figure 49 visualizes back yards within Carnisse, among others. The back yards often provide variation, herb-rich grasslands, and during winter litter layers due to trees and shrubs. However, not every back yard represents these grasslands, due to paved or completely overgrown yards. The map assumes that host plants are present in the public grasslands even when precise data regarding their locations is absent. The host plants grow on almost all soil types in the case of no maintenance (FLORA van Nederland, n.d.a; FLORA van Nederland, n.d.b; Ecopedia, n.d.b). The areas with larger plants provide litter layers during autumn and winter time. The flat roofs show the potential for greenery on the roofs.

AMENITIES

The caterpillar of the common blue eats the intermediate tissue of the host plants in the early stages. Caterpillars eat the entire leaves of these host plants in later stages (De Vlinderstichting, n.d.). The butterfly mainly forages butterfly flowers but also other herbaceous and nectar plants (Cuvelier et al., 2017).

As shown in Figure 50, especially in Amelandspark and Lepelaarsingel are grasses where foraging is possible. Also, the back yards potentially offer a place where food is present. However, not every back yard provides the necessary foods. So on the map, it seems to be a more nutritious location than it is in real life.

Figure 49. Possible residence of the common blue. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2022; Kadaster, 2023)

Figure 50. Possible foraging areas of the common blue. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020)

CONNECTIVITY

The common blue is a mobile butterfly and uses grasslands and railway and road verges as connecting zones. The butterfly can easily cross physical barriers such as roads. Therefore, a stepping-stone connection is sufficient. However, continuous networks of grasslands and railway and road verges are optimal (D.O. van der Gaag, personal communication, May 15, 2023).

Smaller stepping stones for the common blue are present within Carnisse. However, there is no fully connected green structure. In between larger grass areas, road vergers can function as connection areas. Private back yards can also be better connected. However, it is important that the back yards provide a suitable place to stay and forage before these connections are useful.

Figure 51. Connectivity and missing links of the common blue. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam)

SAFETY

Herb-rich grasslands should remain intact and be well managed for the safety of the common blue to stay and forage in these areas. Phased mowing is necessary to maintain these grasslands, preferably from mid-September onwards (Cuvelier et al., 2007). Mowing and grass clippings removal prevent vegetation from overgrowing or becoming too tall. However, mowing should not happen too often to avoid the disappearance of caterpillars and pupae and the scarcity of nectar supply. Additionally, avoid soil becoming too nutrient-rich and prevent the use of pesticides due to their negative effect on the common blue (Cuvelier et al., 2007; De Vlinderstichting, n.d.). For the safety of the caterpillars during the overwintering period, have a sufficient litter layer present (De Vlinderstichting, n.d.).

Figure 52 shows that larger public green spaces such as Urkersingel, Amelandseplein and Lepelaarsingel are intensively mowed, meaning ten or more times a year or very intensively maintained, disrupting the habitat of the common blue. Smaller stepping stones are mostly intensively managed, leaving less space for the common blue. A large part that may contain grasslands in Carnisse are back yards. These are private areas, making it difficult to manage them. Here, it varies whether these are intensively maintained or not. However, there is more frequent use of pesticides, which negatively affects the common blue.

Figure 52. Mowing management in Carnisse. (Collected data using S. Jansen, personal communication, September 6, 2023).

MAXIMIZATION

Figures 53, 54, and 55 show the maximized map and sections for the common blue. The maximization is an outcome of the analysis and the indicators provided by the Urban Ecology Department of the Municipality of Rotterdam. The outcome is based on existing structures, with private properties transformed only when necessary to reach the needs of the common blue.

The map shows how most of the paved areas transform into grasslands. These grasslands undergo a quality change compared to the current form of grasslands found in Carnisse, as they consist of herb-rich grasslands combined with dense grass pollen and host plants.

The flat roofs are connected and transformed into herb-rich grasslands to enlarge the habitat of the common blue. Additionally, pergolas with roofs accommodating herb-rich grasslands are added to the gardens, connecting the different back yards. Larger trees are preserved, but smaller trees that do not shed leaves are replaced with deciduous trees, providing a suitable habitat for the common blue during its caterpillar stages in the leaf litter and for overwintering.

Figure 38. Common blue. (Johnson, 2015)

Figure 53. Maximization of the common blue. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2022; Kadaster, 2023)

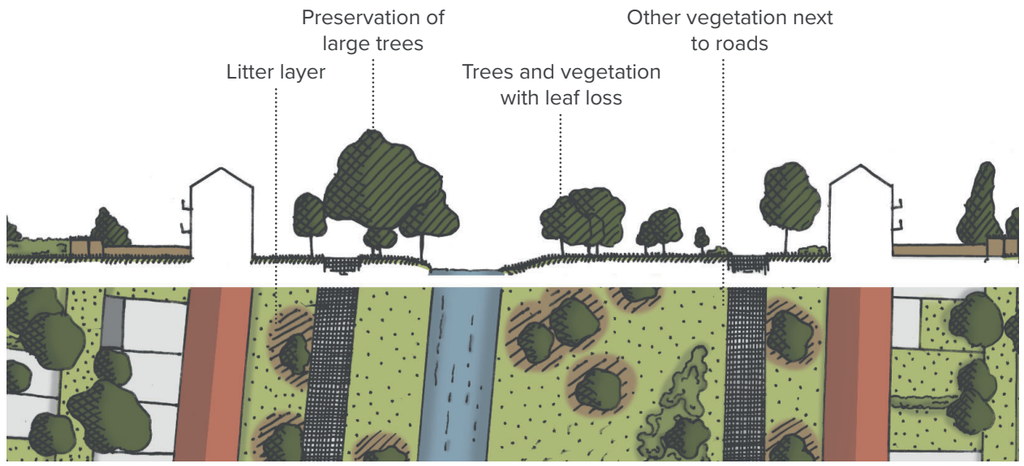


Figure 54. Section A-A": Maximization of the Lepelaarsingel for the common blue.

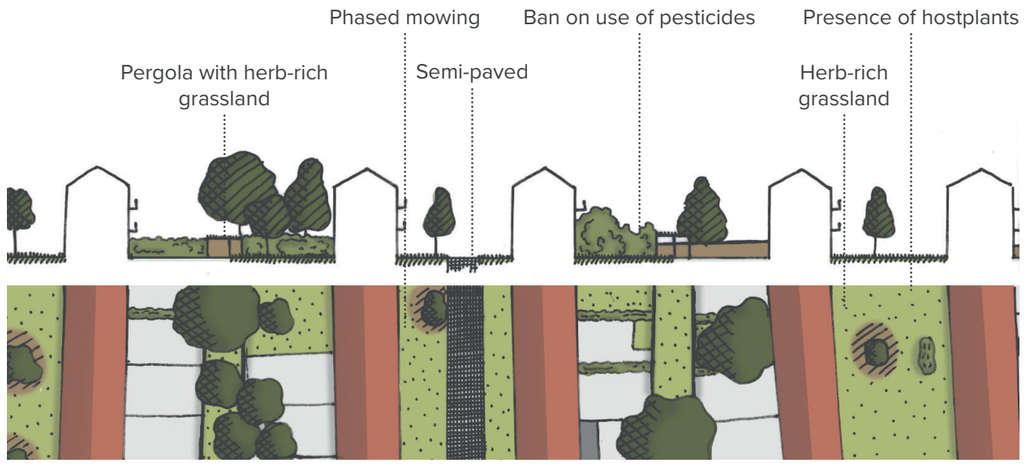


Figure 55. Section B-B": Maximization of the Klaverstraat for the common blue.

COMMON PIPISTRELLE – PIPISTRELLUS PIPISTRELLUS

The common pipistrelle (Pipistrellus pipistrellus) is a native bat that occurs in 95% of the atlas blocks in the Netherlands. The species also inhabits regions across Western, Southern, and Central Europe and parts of Asia (NDFF Verspreidingsatlas, 2023c; Natuurpunt, n.d.). This bat species is the most widespread in the Netherlands and lives in urban and rural areas in human-made buildings. The average lifespan of the common pipistrelle is 2.2 years, but they can live up to 16 years (BIJ12, 2017; Ecopedia, n.d.a).

Common pipistrelles are social animals, forming colonies composed of genetically related groups of females. During winter, they gather in large groups, while males remain solitary or in smaller groups. Their network includes various local populations. Each population has one or more maternity colonies, a few non-reproductive females, and male members. The size of these colonies depends on the availability of food resources (BIJ12, 2017).

The common pipistrelle is currently not an endangered species. However, it does appear on the Red list (Ministry of Agriculture, Nature and Food Quality, n.d.a).

ENVIRONMENT

In the Netherlands, the common pipistrelle primarily resides in urban areas, especially within buildings. The species prefer areas with greenery nearby, such as gardens, forest edges, forests, and orchards (BIJ12, 2017). The habitat of the common pipistrelle encompasses various biotopes, each with characteristics that contribute to the well-being of this species.

Firstly, there is the rock biotope. Within this habitat, the common pipistrelle can seek shelter in cracks, crevices, and cavity walls. Rock biotopes are represented in urban and suburban areas with built-up stone and paved environments. The size of this biotope is crucial because the common pipistrelle bat requires multiple roosting places (BIJ12, 2017).

Secondly, there is the grassland biotope. In these open green areas, the common pipistrelle finds its primary food source (BIJ12, 2017).

Thirdly, there is the forest biotope. This habitat also fungates as a foraging area, by the small open areas between the trees (BIJ12, 2017).

Lastly, there is the water biotope. This biotope also contributes to the food source for the common pipistrelle. Vegetation must surround the water to provide insects to forage (BIJ12, 2017).

As shown in Figure 56, the rock biotope is predominantly present in Carnisse. However, not the entire rock biotope areas are available as nesting places for the common pipistrelle. Additionally, grasslands and water bodies are present in larger public green spaces such as Amelandseplein, Urkersingel, and Lepelaarsingel. However, the water is surrounded by grasslands, which results in no taller vegetation along the water's edge. The forest biotope is only found to a limited extent, primarily near Amelandseplein.

Figure 56. Biotopes of the common pipistrelle. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

RESIDENCE

The residence of the common pipistrelle is usually in buildings. They can be found in cavity walls, behind façade cladding, roof cornices, and window shutters, under roof tiles, and in cracks and crevices in walls. Additionally, old tree hollows are sometimes for roosting sites. Often, buildings in or near green areas such as parks, forests, and sheltered water bodies are chosen to reside, and these places are used year-round. However, each season requires different roosting requirements. There are specific roosts for the pairing, maternity, winter and summer season (BIJ12, 2017).

Maternity roosts are utilized from early May to mid-July. Females gather here in groups of 20 to 120 individuals to rear their offspring. Pairing roosts are used for pairing from mid-August to early October. Males use them year-round. Within the male's territory, he has one or more roosts. 1 to 10 common pipistrelles use a roost. Winter roosts serve as sleeping places between November and March. Usually, these are above ground in buildings, but sometimes the roots are at cellar entrances. These locations must be frost-free. Overwintering typically occurs in larger groups and sometimes in smaller clusters. Summer roosts encompass all roosting places not used as winter, maternity, or pairing roosts. Here, males and females stay in small groups or as solitary individuals. The common pipistrelle prefers buildings where various spaces can be utilized (BIJ12, 2017).

Figure 57 shows the buildings in Carnisse with probably exposed cavity walls, based on the building year and energy label. In these buildings, the common pipistrelle may reside. Additionally, it becomes apparent that various structures exist where old and/or trees with natural cavities can be found.

Figure 57. Possible roosts of the common pipistrelle. (Collected data using Municipality of Rotterdam, 2020; Kadaster, 2023; Netherlands Enterprise Agency [RVO], 2023)

AMENITIES

During the evening and at night, the common pipistrelle forages within a 5-kilometer radius of its residence. The choice of foraging areas depends on the availability of insects and weather conditions. The diet of the common pipistrelle includes mosquitoes, midges, caddisflies, mayflies, lacewings, moths, and occasionally butterflies. They capture their prey in mid-flight and find them in various environments, including gardens, parks, estates, along roads, tree lines, hedgerows, riparian planting, forest edges, cemeteries, sheltered ponds, and waterways. While hunting, they do not fly through the vegetation but instead maintain a distance of 1 to 8 meters from it, depending on vegetation height and shelter. During their hunting flights, they typically fly at 2 to 5 meters in height but can occasionally reach altitudes of more than 50 meters. The common pipistrelle distinguishes three different types of foraging areas, which are close to semi-open landscapes. The first type is open spaces roughly the size of 1 to 3 mature trees within dense vegetation. The second type includes heavily wind-sheltered locations along linear, tall vegetation or near water. The final type of foraging area consists of open areas without trees, particularly above water elements.

As shown in Figure 58, the main foraging areas are around bigger public green spaces within Carnisse. Here is a combination of open green landscapes and water. However, hardly any riparian vegetation is present here to provide cover for the common pipistrelle.

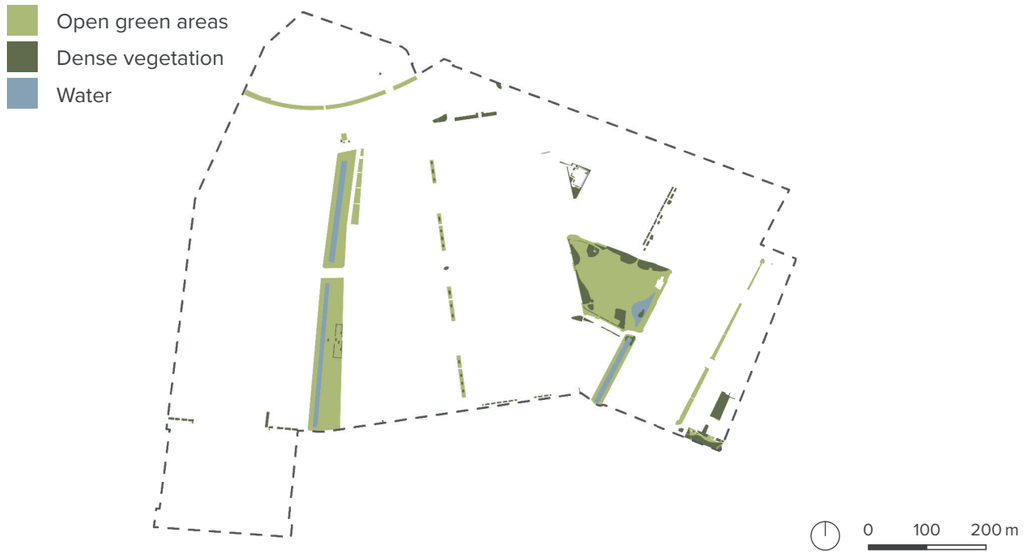


Figure 58. Possible foraging areas of the common pipistrelle. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

CONNECTIVITY

During sunset, common pipistrelle fly out to forage. The species use sheltered routes to reach foraging areas (BIJ12, 2017).

Movement of the common pipistrelle is aerial and takes place mainly between residences and foraging areas. Line-shaped elements located in the landscape, preferably out of wind and light, are used for movement. These line-shaped structures include rows of trees, water courses with upright vegetation, façades and green yard fences. There are requirements on these flight routes in terms of the gaps or interruptions, which should not exceed 15 metres, light sources and the position of the flight route concerning the landscape. Sometimes, the flight route cannot be related to the linear structure, in which case a diffuse distribution takes place over the residential area (BIJ12, 2017; D.O. van der Gaag, personal communication, May 15 2023).

Figure 59 shows the flight routes between the potential habitats, in buildings and older trees, and the foraging areas. The trees and linear building structures on these flight routes are visualized. The missing links show places with an interruption of more than 15 metres between linear elements. This is particularly the case in western Carnisse. This causes deteriorated connectivity for the common pipistrelle present in Carnisse.

Figure 59. Connectivity of the common pipistrelle. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023; Netherlands Enterprise Agency, 2023)

SAFETY

The natural enemies of the common pipistrelle are primarily cats that prey on colonies or catch weakened individuals. Additionally, some bird species also pose natural threats to the bat (BIJ12, 2017).

A more significant danger to the safety of the common pipistrelle is the climate within its residence. These spaces must not become overheated during the summer but should not cool down too quickly during the winter. Furthermore, these areas must be free from drafts. Due to the increasing insulation and renovations in buildings, gaps and crevices are being sealed, preventing the common pipistrelle from residing in cavity walls that meet these requirements. Additionally, pipistrelle bats can become trapped during this insulation process (BIJ12, 2017; D.O. van der Gaag, personal communication, May 15, 2023).

In addition, street lighting ensures that the common pipistrelle is visible to predators. When lighting is present, common pipistrelles fly out later resulting in less time to forage (Zoogdiervereniging, 2011).

As shown in Figure 60, a part of the buildings in Carnisse have energy labels A, B or C. From this, it is concluded that these buildings are already inaccessible for the common pipistrelle as a residence. In addition, it becomes clear that street lighting is present in Carnisse, which provides reduced habitat for the common pipistrelle.

Figure 60. Possible dangers of the common pipistrelle. (Collected data using Municipality of Rotterdam, 2020; Netherlands Enterprise Agency, 2023)

MAXIMIZATION

Figures 61, 62, and 63 show the maximized map and sections for the common pipistrelle. The maximization is an outcome of the analysis and the indicators provided by the Urban Ecology Department of the Municipality of Rotterdam. The outcome is based on existing structures, with private properties transformed only when necessary to reach the needs of the common pipistrelle.

Figure 39. Common pipistrelle. (Vishal Mahale Widlife, n.d.)

The Figures show that within the public space, almost all paved structures are replaced by grasslands and upright vegetation. These grasslands undergo a quality change compared to the current form of grasslands found in Carnisse, as they consist of herb-rich grasslands combined with linear upright vegetation. Within the current street structures, trees are preserved and trees forming natural cavities are added in linear tree structures to provide flight routes for the common pipistrelle. The current revetments are transformed into natural banks with shore vegetation to provide a place to forage for the common pipistrelle.

In terms of private properties, all buildings with cavity walls expose those walls to create a place to reside for the common pipistrelle. Additionally, climbing plants and dark façades are created to optimize the flight routes of the common pipistrelle.

Figure 61. Maximization of the common pipistrelle. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

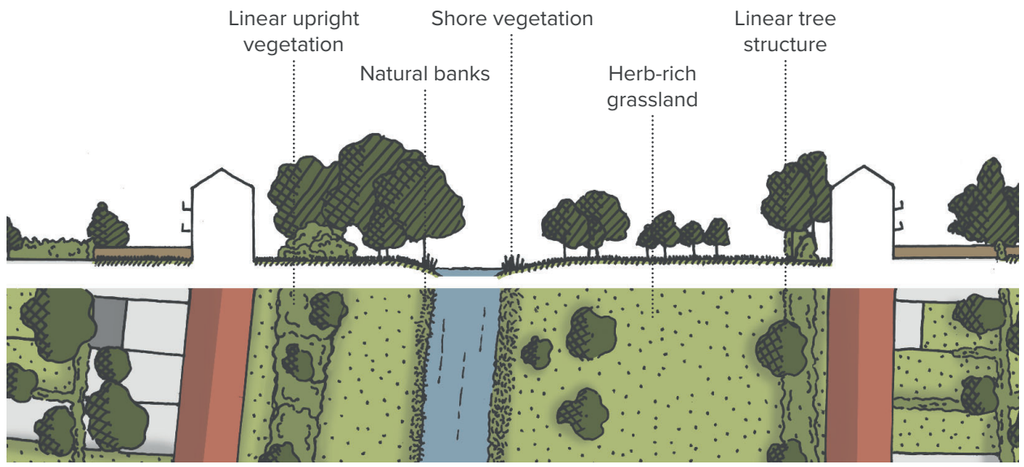


Figure 62. Section A-A": Maximization of the Lepelaarsingel for the common pipistrelle.

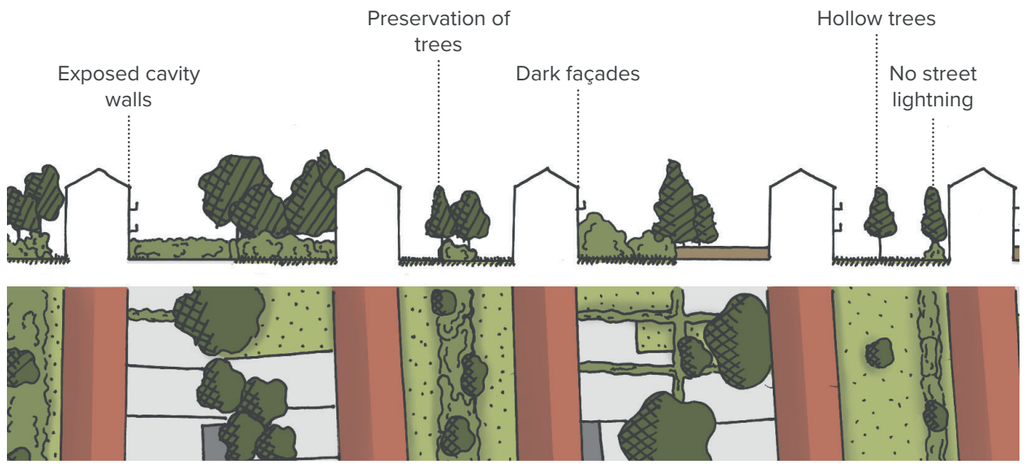


Figure 63. Section B-B": Maximization of the Klaverstraat for the common pipistrelle.

EUROPEAN HEDGEHOG - ERINACEUS EUROPAEUS

The European hedgehog (Erinaceus europaeus) is a native mammal that occurs in 96% of atlas blocks in the Netherlands and is also present elsewhere in Western Europe (NDFF Verspreidingsatlas, 2023b; Zoogdiervereniging, n.d.). The European hedgehog has adapted to the human environment and is present in almost all landscapes, including urban environments, as long as greenery and hiding places are available. Therefore, the European hedgehog and humans meet each other regularly. On average, the European hedgehog has a life expectancy of five years, but they can live up to ten years (Zoogdiervereniging, n.d.; Mulder, 1996).

The European hedgehog is a nocturnal animal (Natuurmonumenten, n.d.). The species sleep during the daytime and forage when not sleeping or resting (Mulder, 1996). During the night, they cover several kilometres on their own. They do not form a pair. The habitat is 20-40 hectares for males and 10-20 hectares for females. They do not treat this as a territory. Therefore, they will not defend it against other conspecifics. From November/ December to April-May, European hedgehogs hibernate, from which they may occasionally wake up (Zoogdiervereniging, n.d.)

European hedgehogs have been declining since 1994. By 2022, the population was about 40 per cent of the original in 1994. There is a significant decline between 1994 and 2008. Meanwhile, the European hedgehog is on the red list as currently not threatened. Although the decline appears to have stabilised at low levels, there has still been little development in the recovery of the population of the European hedgehog (Ministry of Agriculture, Nature and Food Quality, n.d.c; Zoogdiervereniging, 2023).

ENVIRONMENT

European hedgehogs are present in nearly every landscape in the Netherlands, including urban areas providing an adequate amount of greenery and places for shelter. In urban environments, European hedgehogs are common in parks and gardens (Zoogdiervereniging, n.d.; Mulder, 1996). The habitat of European hedgehogs encompasses a combination of various biotopes, with their presence often concentrated on the boundaries or edge zones of these biotopes (D.O. van der Gaag, personal communication, May 15, 2023). These biotopes, each possessing distinct characteristics, are crucial for the well-being of European hedgehogs, as illustrated in Figure 64.

The first biotope is the brushwood biotope, typically found in densely vegetated gardens and public areas with shrubs and greenery. This particular biotope offers the European hedgehog a place to live, safety, a source of food, and crucial connections within their habitat (D.O. van der Gaag, personal communication, May 15, 2023).

Second is the grassland biotope. In this biotope, the European hedgehog finds its food sources. This grassland biotope is present around the canals and the park. However, this biotope must be closely linked to the brushwood biotope to ensure adequate habitat for the European hedgehog (D.O. van der Gaag, personal communication, May 15, 2023).

Lastly, the forest biotope. In this biotope, European hedgehogs have their habitat, food, and security. This forest biotope is present at Amelandseplein, where denser vegetation and trees intersect (D.O. van der Gaag, personal communication, May 15, 2023).

Figure 64 shows that mostly the brushwood biotope is present in Carnisse. However, not every back yard provides the densely vegetated vegetation necessary for the European hedgehog. The grassland biotope is mainly present at Lepelaarsingel, Urkersingel and Amelandseplein. The forest biotope is only present in Amelandseplein. Currently, there are not many edging zones between the different biotopes.

Figure 64. Biotopes of the European hedgehog. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; CBS, 2017)

RESIDENCE

The European hedgehog has two types of residence places, one for summer and one for winter. During the summer, European hedgehogs often look for roosts on bare ground under dense bushes, in compost hopes, under tree roots or in rabbit holes. Sometimes, heaps of leaves are used as sleeping places. In the case of young European hedgehogs, these nests are hidden, such as in compost heaps, between branches or in debris piles (Zoogdiervereniging, n.d.).

For the winter period, when European hedgehogs hibernate, they usually make nests in the ground, against fences, in sheds, outbuildings or in branch and compost piles. The size of these winter nests can vary up to a diameter of half a metre (Zoogdiervereniging, n.d.).

As shown in Figure 65, residences of the European hedgehog are primarily concentrated in back yards. However, this representation may be misleading, as not every back yard is suitable for European hedgehog habitation, depending on the type of landscaping in the back yard and the presence of fences, which will make the back yards unaccessible. In the public domain, the main habitats for European hedgehogs are within Amelandseplein.

Figure 65. Possible residence of the European hedgehog. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

AMENITIES

When not sleeping or resting, the European hedgehog is almost always foraging (Mulder, 1996). The European hedgehog feeds on small invertebrates such as snails, worms and beetles. Due to their sense of smell, they can easily detect these prey. Moreover, they hunt small vertebrates such as young mice, amphibians and small birds. They also like to take small food scraps from humans. During autumn, the European hedgehog adds a plant element to its diet and also looks for berries, fruits and mushrooms. They find their food in brushwood and grasslands (D.O. van der Gaag, personal communication, May 15, 2023; Zoogdiervereniging, n.d.; Natuurmonumenten, n.d.).

Figure 66 illustrates the foraging areas of the European hedgehog. Firstly, the grasslands where foraging occurs, primarily in the larger green areas within Carnisse, such as Amelandseplein and around Urkerksingel and Lepelaarsingel. Additionally, back yards are visualized. These have the potential to include foraging areas for the European hedgehog. However, not every back yard provides the necessary food, and not all back yards are accessible due to fences. So on the map, it seems to be a more nutritious location than it is in real life.

Figure 66. Possible foraging area of the European hedgehog. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

CONNECTIVITY

The European hedgehog spreads mainly over land and on the ground but can also swim. They travel considerable distances, so connections between foraging areas and resting places are necessary. European hedgehogs prefer seeking cover in low and dense vegetation during their relocation. This vegetation includes bushes and hedges in gardens and rough grassland or shrubby borders. Continuous green environments ensure that European hedgehogs move smoothly within their habitat. Nevertheless, studies have demonstrated that European hedgehogs also utilize sidewalks for their travel, as these pathways provide quicker and more convenient routes for their movement. For this reason, shelters close to these roads are also interesting to watch (Zoogdiervereniging, n.d.; D.O. van der Gaag, personal communication, May 15, 2023; Mulder, 1996).

Figure 67 shows the back yards are surrounded by buildings and fences, leading to obstacles in European hedgehog connectivity routes. Moreover, the public grasslands are not connected and are separate from the various residential blocks. This requires European hedgehogs to travel without shelter before reaching the next residence or foraging area, which is a danger to the European hedgehog.

Figure 67. Connectivity of the European hedgehog. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

SAFETY

European hedgehogs have to protect themselves from human activities. They are often victims in traffic, both from car accidents and collisions with robotic lawnmowers. In addition, they are at risk of burns from vegetation burns and poisoning from pesticides that accumulate in their food sources (Zoogdiervereniging, n.d.). European hedgehogs also need to guard against predators and adverse weather conditions, and they find shelter in low and dense vegetation (D.O. van der Gaag, personal communication, May 15, 2023). Finally, banks can prevent European hedgehogs from bank revetments, which can lead to the drowning of these animals (Zoogdiervereniging, n.d.).

As illustrated in Figure 68, Carnisse features a multitude of car roads, presenting a substantial threat to European hedgehogs. The illustration shows the neighbourhood's segmentation into smaller sections, offering European hedgehogs a degree of protection from motorized vehicles. Furthermore, the presence of elevated riverbanks is evident in Carnisse, heightening the potential risk of European hedgehogs drowning while swimming.

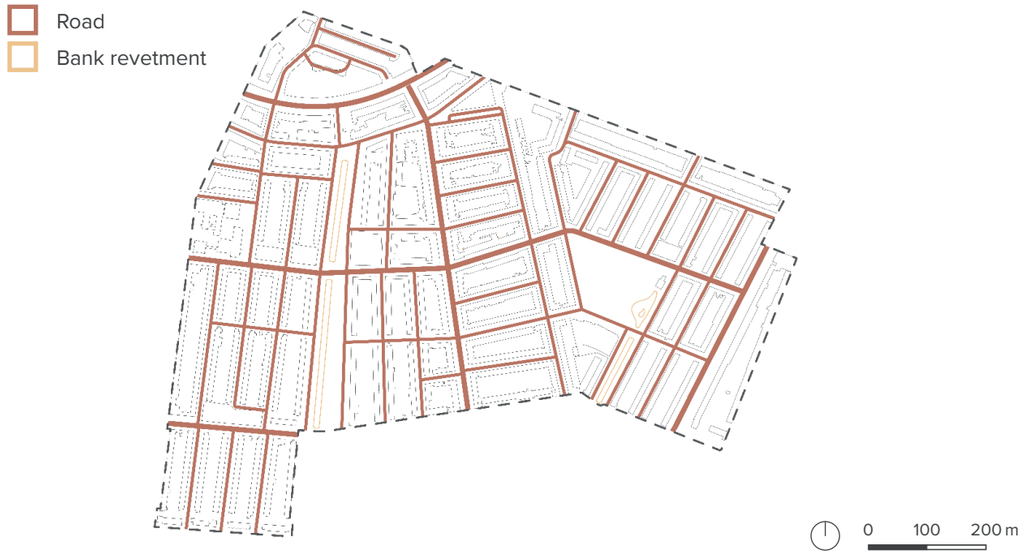


Figure 68. Possible dangers of the European hedgehog. (By author)

MAXIMIZATION

Figures 69, 70, and 71 show the maximized map and sections for the European hedgehog. The maximization is an outcome of the analysis and the indicators provided by the Urban Ecology Department of the Municipality of Rotterdam. The outcome is based on existing structures, with private properties transformed only when necessary to reach the needs of the European hedgehog.

Figure 40. European hedgehog. (Terwiel, 2015)

The Figures show that within the public space almost all paved structures are replaced by grasslands combined with low dense vegetation. These grasslands undergo a quality change compared to the current form of grasslands found in Carnisse, as they consist of herb-rich grasslands. Only paved areas without motorized vehicles are still present within the neighbourhood, to prevent car accidents between the human species and the European hedgehog. The current revetments are transformed into natural banks to prevent drowning hazards for the European hedgehog.

In terms of private properties, the fences of the back yards are replaced by branch rills, providing the European hedgehog a continuous living environment on ground level.

Figure 69. Maximization of the European hedgehog. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

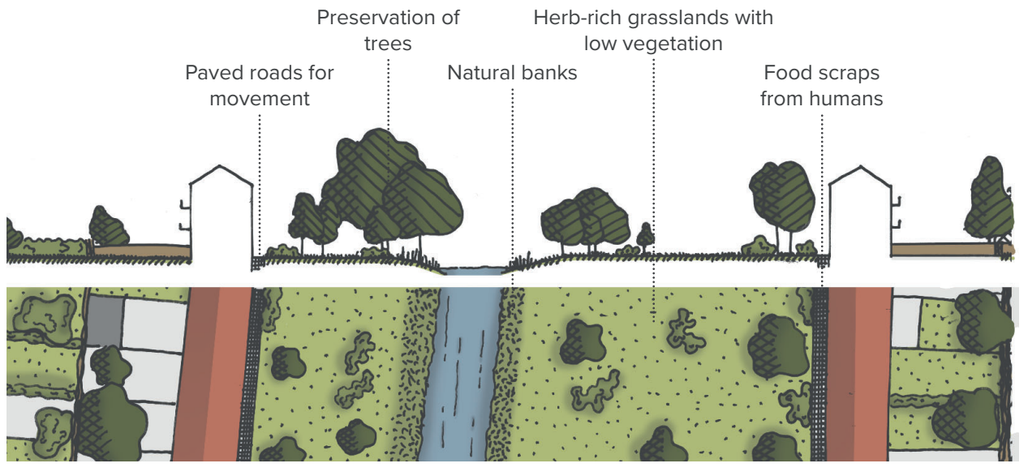


Figure 70. Section A-A": Maximization of the Lepelaarsingel for the European hedgehog.

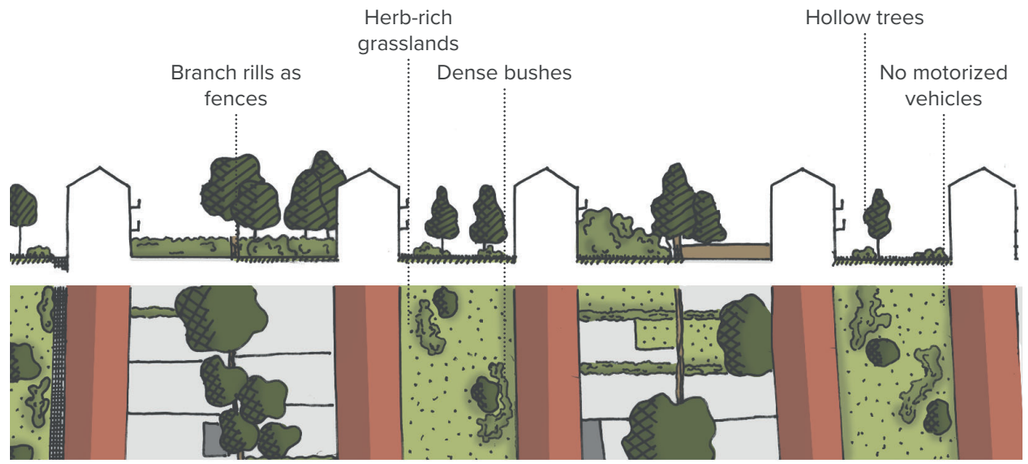


Figure 71. Section B-B": Maximization of the Klaverstraat for the European hedgehog.

HUMAN - HOMO SAPIENS

The human being (Homo sapiens sapiens) is a native mammal in the Netherlands. Since this species uses and impacts its environment for its purposes, this has led to the ultimate configuration of the Netherlands. Humans are the most dominant species on Earth and can be found everywhere except Antarctica, with only a few exceptions (Geologie van de mens, n.d.; van Koppen et al., 1984). Humans primarily reside in urban biotopes, where the highest population densities are (Daalder, 2000). Also, in rural areas, as long as there are residences and amenities (Oregon explorer, n.d.). The average life expectancy of humans is 80 to 83 years, but could exceed 100 years (VZinfo, 2023).

Humans are social, predatory primates, which leads to controversy. Sociality is the need to live in groups where connections and status are. At the same time, as predators, humans live a solitary existence in which they want to hide in their hunting grounds and protect these hunting grounds from their fellow humans and other species. Pairing is not seasonally determined, leading to continuous competition within the human species (de Froe, 1959).

Since 1900, the human population has tripled in size (VZinfo, n.d.). This species is protected in the Netherlands and worldwide by human rights that they have associated with humanity (Government of the Netherlands, n.d.).

ENVIRONMENT

All present biotopes in Carnisse are created by and for humans. Therefore, all the existing biotopes in Carnisse contribute, to varying degrees, to the human living environment, and the combination thereof makes the area a suitable habitat for this species. The various biotopes are visible in Figure 72.

Firstly, the rock biotope. This biotope encompasses the built environment where humans can reside. Additionally, this biotope provides the necessary paved physical connections for movement within the habitat (Mandemakers et al., 2021). These paved connections include sidewalks, bike paths, and roads.

Second is the infrastructure biotope. This biotope includes the larger connecting paved roads necessary for human movement within the habitat. It mainly consists of larger roads accommodating cars for humans to travel greater distances (Mandemakers et al., 2021). Like the rock biotope, this biotope primarily consists of paving to enhance human accessibility.

Third is the grassland and forest biotope. These biotopes include green spaces that contribute to the safety of humans within the area. The grassland biotope features lower vegetation, while the forest biotope includes denser and taller vegetation. This biotope positively affects human health by improving air and soil quality, cooling the environment, and reducing noise pollution. Additionally, green spaces increase water storage, resulting in fewer floods to ensure human safety (Mandemakers et al., 2021).

The brushwood biotope is present in gardens and also provides the positive effects of greenery on human health, thus promoting safety when there is vegetation. This biotope always connects to the rock biotope, where human residences are present. As private properties, individuals are protected from others, resulting in an increased sense of safety within their own (green) environment.

Fourth is the water biotope. This biotope includes water elements which contribute to a cooling effect within the human living environment, promoting human health. Therefore, this biotope also contributes to the safety of humans (Mandemakers et al., 2021).

Lastly, there is the desert biotope. This biotope is less important to the human living environment and is present in sandboxes that are by playgrounds and schools. This biotope provides space for younger humans to stay and play.

Figure 72. Biotopes of the human. (Collected data using Ministry of the Interior and Kingdom Relations)

RESIDENCE

The residence of the human is generally in buildings. However, it is common for them to experience changes in their place of residence throughout their lives. In terms of habitat, the species' suitability is determined by the quality of the building structure. The quality depends on the foundation, energy quality, maintenance, renovations, dwelling type, density with the different places of residence and overcrowding. Dwelling type and density are individual specific, whether this contributes to improved residence (Mandemakers, et al., 2021).

Figure 73 shows the buildings where humans live in Carnisse. The buildings in Carnisse are generally appartment buildings consisting of three stories, accessed by porches and closed stairwells. These were all built just before and just after World War II. The dwelling size of these houses is generally between 50 and 65 m^2, except in Oud-Carnisse. Because of the housing supply, there is a one-sided and vulnerable housing stock. There is little diversity (De Nijl Architecten, 2022).

Most human residences are private, mainly involving many smaller, private landlords. The buildings are relatively expensive for the present human inhabitants, but there is poor technical condition of the buildings. Figure 73 shows the lower energy labels. Lower energy labels, G until D, show buildings with lower quality. Urban renewal has largely bypassed Carnisse, except in the southern part of Oud-Carnisse (De Nijl Architecten, 2022).

AMENITIES

Humans require various amenities in their living environment. For improved liveability, the minimal distance to these facilities and the diversity of the amenities are crucial. Human amenities include basic amenities and all other amenities. Basic amenities include energy, sewage, and water. These are of good quality in the entire Netherlands. Therefore, they do not require further emphasis. Other amenities include education, childcare, hospitality, culture, sports, stores, and healthcare, all contributing to the liveability of the human environment (Mandemakers et al., 2021).

Figure 74 illustrates the present other amenities within Carnisse. Firstly, there are various shops and primary schools within the neighbourhood. In terms of healthcare, there are general practitioners, dentists, pharmacies, care homes, and a residential facility. Also, the social aspects related to the physical space are included within amenities. Carnisse provides parks, community centres, places of worship, eateries, and childcare facilities. The park in Lepelaarsingel mainly consists of a monotonous landscape, leading to reduced interaction between different people. Overall, the various amenities are already close to the residences of the humans within the neighbourhood of Carnisse.

Figure 73. Residence of the human. (Collected data using Kadaster 2023; RVO, 2022)

Figure 74. Existing amenities of human. (Collected data using Kadaster 2023; CBS, 2017)

CONNECTIVITY

Humans primarily move over land occurring by foot, bicycle, and motorized vehicles. These motorized vehicles include cars, motorcycles, and public transportation. The movement takes place between their residences, various amenities, and workplaces. To facilitate this movement, humans prefer paved structures necessary to support vehicle weights. Sidewalks and bike paths provide local connectivity, while motorized vehicles ensure connectivity on a larger scale. For motorized vehicles, connectivity via main roads is also crucial. Additionally, the use of cars is associated with the provision of parking spaces. In the Netherlands, car ownership has increased per household in recent years, but the number of parking spaces has not kept pace (Mandemakers et al., 2021).

Figure 75 illustrates the various physical connections for humans, including sidewalks, bike paths, and larger roads with parking spaces for motorized vehicles. As seen, there are no independent bike paths present. There is notable space for roads for cars, and parking spaces are abundant. The streets accessible for cars connect to the main roads surrounding Carnisse. Currently, cyclists also use these car roads. Furthermore, a bus and tram line connect the area with the surrounding environment.

SAFETY

Humans must primarily protect themselves against influences from the environment that negatively affect their health. Deteriorated air and water quality, soil contamination, and noise contribute negatively to the physical human health. Noise and sleep disturbances, mainly caused by traffic, adversely affect the mental health of humans. Heat stress affects both, physical and mental health and is noticeable on a local scale. Heat stress can lead to sleep disturbances, behavioural changes, reduced work productivity, illnesses and mortality. Another risk to humans are floodings. This does not directly affect health but contribute to damage to residences, posing a danger to humans (Mandemakers et al., 2021).

Green and water elements in the living environment, such as parks and gardens, contribute to improved air and water quality, reducing soil contamination, and decreasing noise pollution, positively affecting the physical health of humans. In addition, green spaces positively affect the mental health of humans by reducing the risk of depression. Regarding heat stress, more water and green spaces lead to a healthier living environment for humans due to the cooling effect and increased water retention of green and water features (Mandemakers et al., 2021). These green spaces mustn't result in unclear situations to ensure human safety. These situations, especially in the dark, can be perceived as unsafe by humans (Mandemakers et al., 2021).

As shown in Figure 76, there are two larger green areas with water elements in Carnisse. These contribute positively to safety. These green areas mainly consist of low grasses, maintaining visibility. Only at Amelandseplein are a few more densely vegetated areas that could negatively influence the sense of safety. The focus on paved surfaces and car traffic within Carnisse leads to deteriorating health for its human residents. Additionally, the paving in residential streets increases the risk of flooding.

Figure 75. Connectivity of the human. (Collected data using Kadaster 2023; Ministry of the Interior and Kingdom Relations, 2022)

Figure 76. Safety of the human. (Collected data using Kadaster 2023; Ministry of the Interior and Kingdom Relations, 2022)

MAXIMIZATION

Figures 77, 78, 79 show the maximized map and sections for the human. The maximization is an outcome of the analysis and the indicators provided by the tarratelescope of Uytenhaak et al. (2008, p. 24). The outcome is based on existing structures, with private properties transformed only when necessary to reach the needs of the human.

The Figures show that the hardened elements remain in order to ensure the physical connections, although it is partially removed to make space for water and greenery. These elements are added to facilitate increased health, recreation and climate adaption. Private gardens are altered as well, to create shared green spaces where people can come together.

Figure 42. Human (Barnes, 2020)

Figure 77. Maximization of the human. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

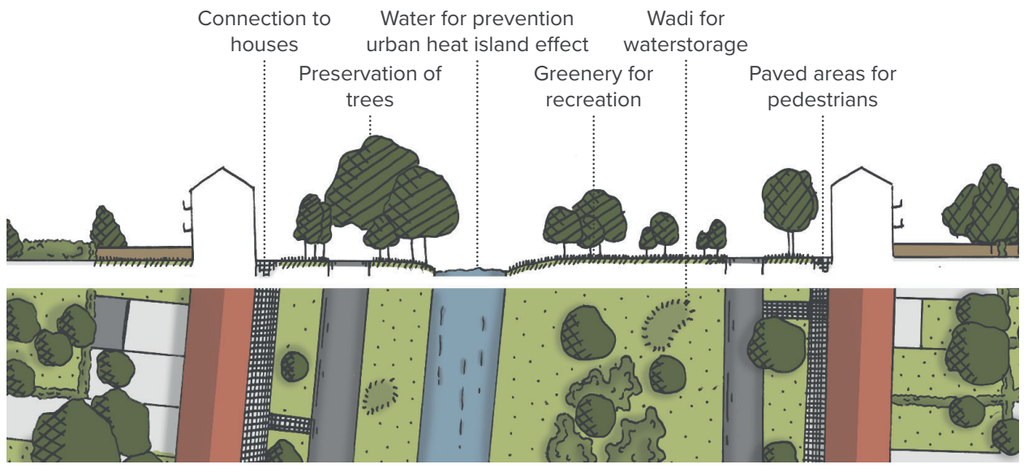


Figure 78. Section A-A": Maximization of the Lepelaarsingel for the human.

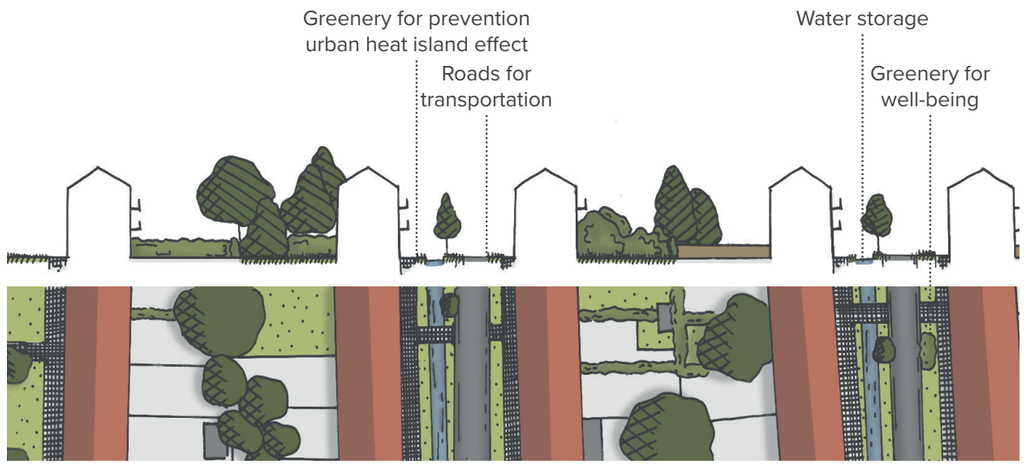


Figure 79. Section B-B": Maximization of the Klaverstraat for the human.

HOUSE SPARROW – PASSER DOMESTICUS

The house sparrow (Passer domesticus) is a native bird that occurs in 95% of atlas blocks in the Netherlands and is also present elsewhere in Europe (Kleunen et al., 2017; Vogelbescherming Nederland, n.d.). In the Netherlands, 70% of the house sparrows live in urban environments. This bird typically has a life expectancy of 3-4 years, but some individuals can live longer. The house sparrow is strongly related to human activities, partly due to their nests in buildings and benefit from human food, both consciously and unconsciously available (BIJ12, 2023).

House sparrows are sedentary birds. They usually stay within a few hundred metres of their nests and even closer during the breeding season. Their movements are short distances, usually within adjacent habitats of their familiar surroundings. Young house sparrows disperse in swarms during late summer in search of new habitats. Initially, they stay close to their birthplace. However, they swarm further over time, often within a 1-kilometre radius of their original nest site. The distance depends on the availability of suitable nesting sites nearby. Adult house sparrows go no further than one kilometre away when looking for a new breeding place (BIJ12, 2023). House sparrows are social animals and live in colonies. They forage, breed and carry out other activities together. Colonies can consist of a few pairs to 40 to 100 pairs of house sparrows. Therefore, facilities that can benefit larger numbers of house sparrows are necessary (BIJ12, 2023).

Since the 1980s, the house sparrow has faced a nationwide decline of about 50% compared to the current number of breeding pairs (BIJ12, 2023). This resulted in listing the house sparrow on the Red List (Schouten, 2017). Although the decline appears to have stabilised at low levels, there has still been little progress. The decrease is due to changes in urban and rural environments (BIJ12, 2023).

ENVIRONMENT

The house sparrow lives in villages and older urban neighbourhoods characterized by unrenovated human-built structures and the presence of green spaces, such as parks and messy gardens (BIJ12, 2023; Vogelbeschermig Nederland, n.d.). These neighbourhoods include various biotopes. The combination of adjacent situated biotopes generated within these neighbourhoods provides the habitat for the house sparrow. The habitat of the house sparrow can be divided into four primary biotopes, each with unique features that are vital for the well-being of the house sparrow, also shown in Figure 80.

Firstly, the brushwood biotope. This biotope is represented in cluttered gardens and public spaces where bushes and greenery are present. This biotope ensures safety, food supply, and sometimes even nesting places for house sparrows. Some green and messy gardens provide protein-rich foods, while others provide grit as a food resource, often close by shelter. In addition, paved gardens allow water to accumulate in which the house sparrow can find drinking water or take a bath.

Secondly, there is the rock biotope. In this biotope, the house sparrow can seek residence in cracks and crevices. This rock biotope is present in urban (sub)urbs with built-up stone and paved environments. Except for residence and nesting, the rock environment causes water to remain on the streets and in gutters after rainfall, which provides space for drinking water and baths.

Thirdly, there is the grassland biotope. In this biotope, the house sparrow can find its primary food source: seeds of grasses and weeds (BIJ12, 2023). This grassland biotope is present around the canals and the park. However, this biotope needs to be closely connected to the brushwood biotope to ensure a sufficient environment for the house sparrow.

Lastly, there is the desert biotope. This biotope is essential for the house sparrow his parasite control and dust-bathing needs (BIJ12, 2023). The desert biotope can be found at playgrounds, vacant lots or unpaved pedestrian paths where dust and sand are present.

Figure 80 shows that mostly the brushwood and rock biotopes are present in Carnisse. In this, the rock biotope can be divided into buildings and pavement on ground level. Especially the buildings are of importance for the house sparrow. The brushwood biotope is present within the back yards, however, not all back yards provide the combination of vegetation and shelter, therefore, the brushwood biotope is less present in real life than it seems on the map. The grassland biotope is mainly present at Lepelaarsingel, Urkersingel and Amelandseplein, and the desert biotope is only very slightly present. The main transition between biotopes is between the rocky and brushwood biotopes.

Figure 80. Biotopes of the house sparrow. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Central Statistical Office [CBS], 2017)

RESIDENCE

The house sparrow has two types of residence: nesting sites, which serve as breeding places, and resting places (BIJ12, 2023). The house sparrows create their nests in human buildings, such as under roof tiles and in the cracks and holes of walls. They may also hide behind downspouts, in sheds or any façade vegetation. If these options are not available, but there is sufficient food and shelter, house sparrows will build their nests in cavities of trees or dense shrubs (BIJ12, 2023). The nest site is resided throughout the year. During the winter period, the nest sites are used occasionally during colder temperatures (Krijn et al., 2021). The resting places are used during winter. The house sparrows gather in evergreen shrubs, dense vegetation with a height of usually 2 to 3 metres, or façade vegetation to rest together. In some cases, these winter quarters are localized behind roof tiles or the inside of human buildings (BIJ12, 2023; Krijn et al., 2021)

Figure 81 shows the buildings in Carnisse with lower energy labels. These have the potential for crevices and seams in the walls, where the house sparrow can breed. However, due to insulation and renovation, it is questionable whether they actually have suitable space for the house sparrow. The suitability is also the question for the room under the roofing tiles, where the house sparrow could nest or rest. Approximately half of the human buildings in Carnisse have roof tiles, but these roofs are often inaccessible due to the use of bird scraps (BIJ12, 2023). As a result, house sparrows have fewer opportunities to stay or nest under the roof tiles. Besides, not all nesting spaces are covered, and most coverings are not directly in front of the openings of the nesting sites. The resting places for the winter in Carnisse are mainly in Amelandseplein and the van Swietenhof and are only present to a limited extent within Carnisse.

AMENITIES

Food must be consistently accessible in the proximity of house sparrows (BIJ12, 2023). Adult house sparrows primarily consume plant-based food, comprising seeds from various grasses and weeds that flower year-round (Cramp & Perrins, 1994). They procure this sustenance from locations with low or sparse vegetation. Moreover, in urban environments, the house sparrow forages food scraps released by humans and pets, such as is the case close to bakeries and terraces. Supplemented to their plant-based diet, house sparrows consume small quantities of pebbles and grit to aid the digestion of tough grains (BIJ12, 2023).

During the breeding season, female house sparrows shift their diet towards protein-rich foods containing insects. These insects are foraged from tall trees and native greenery. Juvenile house sparrows also initially feed on insects during their first two weeks of life. After this initial period, their diet gradually transitions to a plant-based one (BIJ12, 2023).

As shown in Figure 82, especially in Amelandspark and Lepelaarsingel are grasses where foraging is possible. Also, the back yards have the potential to offer a place where both food and grit are present. However, not every back yard provides the combination of food and shelter, since 39% of the back yards in the Netherlands are green. So on the map, it seems a more nutritious location than it is in real life (Kullberg, 2016).

Figure 81. Possible residence of the house sparrow. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Kadaster, 2023; Kadaster, 2022; Netherlands Enterprise Agency, 2023)

Figure 82. Possible foraging areas of the house sparrow. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

CONNECTIVITY

Since the dispersal of the house sparrow is by air, no specific connections are necessary between elements. However, specific elements must be located at relatively short distances from each other, ranging from a few metres to several hundred metres from another, to create a suitable habitat for the house sparrow, as shown in Figure 83. When essential elements are missing or too far apart, this results in an unsuitable habitat (BIJ12, 2023).

Figure 83. Distances between elements of the habitat of the house sparrow (adapted from BIJ12, 2023).

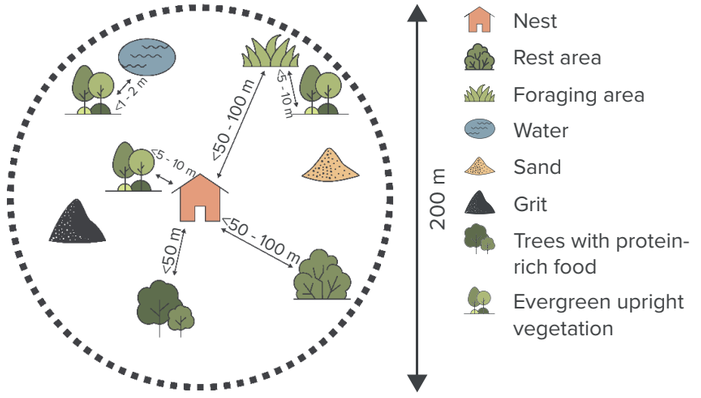


Figure 83 shows these elements and what distances are allowed between them. Figure 84 shows four locations in Carnisse where most elements converge within appropriate distances. However, each location still lacks several elements of an optimal habitat.

Figure 84. Possible habitat of the house sparrow. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

SAFETY

For the house sparrow, protecting itself from predators is crucial. By offering coverage, protection is ensured. In terms of foraging sites, shelter is necessary within 5 to 10 metres, and preferably 2 metres. Also, coverage in front of nesting sites is needed, within 5 to 10 metres, preferably 2.5 metres. This provides juveniles space to fledge and the parents to reach the nest safely and feed the young. Finally, it is essential to provide shelter within 1 to 2 metres of water sources so that they can dry out. This shelter can include densely vegetated areas, hedges, climbing plants and shrubs about 2 to 3 metres high (BIJ12, 2023)

Another danger to the house sparrow is the current trend of housing renovations. The increase of insulation in homes and the installation of bird scraps under roof tiles have led to the disappearance of nesting and resting places for house sparrows (BIJ12, 2023).

Finally, the current design of both public and private spaces poses a threat. The disappearance of greenery results in negative consequences for the habitat of the house sparrow since the shelter places disappear (Haaland & Konijnendijk van den Bosch, 2015; BIJ12,2023).

Figure 85. Shelter of the house sparrow. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

MAXIMIZATION

Figures 86, 87, and 88 show the maximized map and sections for the house sparrow. The maximization is an outcome of the analysis and the indicators provided by the Urban Ecology Department of the Municipality of Rotterdam. The outcome is based on existing structures, with private properties transformed only when necessary to reach the needs of the house sparrow.

Figure 41. House sparrow (Rhododendrites, 2022)

The map illustrates the significance of roofing tiles, which should be exposed to benefit the house sparrow. Within the streetscape, a combination of herb-rich grasslands and taller vegetation will be implemented to provide shelter for the house sparrow. The currently monotonous and low grassland in Carnisse is undergoing a quality shift to better align with the preferences of the house sparrow. Additionally, the existing shores with revetments are transformed into natural banks where the house sparrow can bathe and drink safely. In the case of the house sparrow, special consideration is given to maintaining a high diversity of vegetation and rocks on a small scale, thereby creating an optimized habitat for the house sparrow.

Figure 86. Maximization of the house sparrow. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

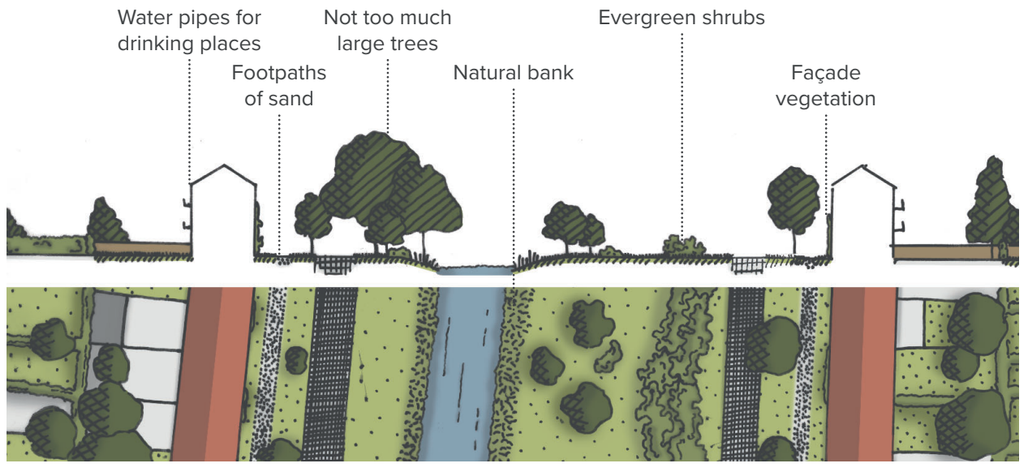


Figure 87. Section A-A": Maximization of the Lepelaarsingel for the house sparrow.

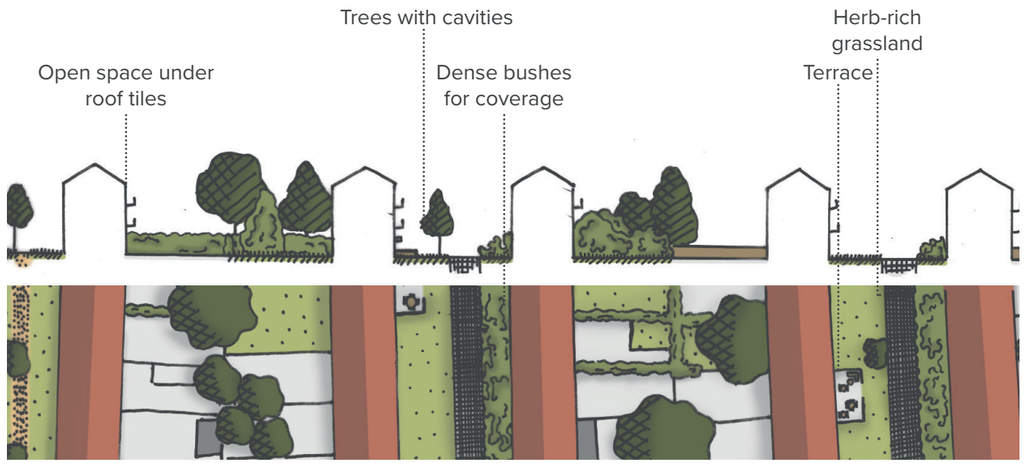


Figure 88. Section B-B": Maximization of the Klaverstraat for the house sparrow.

VAGRANT DARTER - SYMPETRUM VULGATUM

The vagrant darter (Sympetrum vulgatum) is a native dragonfly that occurs in 65% of the atlas blocks in the Netherlands and is also present across Northern, Central, and Eastern Europe, as well as in certain parts of Asia. The vagrant darter is not a pioneering species and is commonly present in areas with robust shoreline vegetation near various water body types in urban and rural settings. The vagrant darter has a one-year life cycle (NDFF Verspreidingsatlas, 2023a; Vlinderstichting, n.d.b).

As shown in Figure 89, the life cycle of the vagrant darter starts with egg deposition. The eggs overwinter and hatch during spring, after which larvae appear. The larvae undergo rapid development and hatch as adults from early June to late September. The flying season takes place from late July to mid-November, peaking between late July and mid-September. The reproductive phase takes place in August and September (Vlinderstichting, n.d.b; Nederlandse soortenregister, n.d.).

Since 1940, there has been an increase in the population of the vagrant darter, and the numbers have remained relatively stable since then. Currently, the vagrant darter is not considered an endangered species (Dijkstra, 2002; Vlinderstichting, n.d.b).

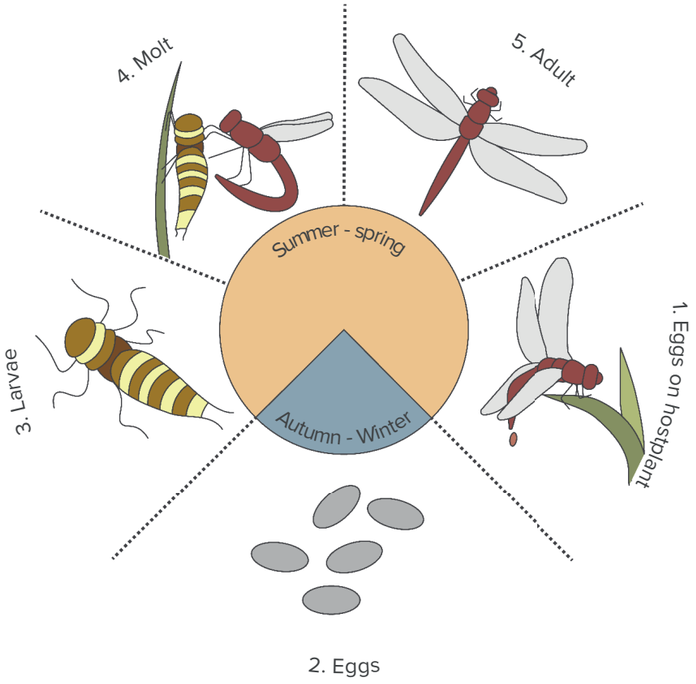


Figure 89. Life cycle of the common blue.

ENVIRONMENT

The vagrant darter resides close to stagnant and slow-flowing water structures, as long as sunlight and bank vegetation are present. This habitat includes areas like ditches, ponds, and puddles (Vlinderstichting, n.d.b). In proximity to this environment, the adult vagrant darter must have herb-rich grasslands and shrubs (personal communication). The habitat of the vagrant darter consists of three biotopes present in Carnisse, also shown in Figure 90.

Firstly, the water biotope. This biotope is present in the parks in Carnisse. Here, the vagrant darter can stay and forage during its larval stages among the bank and aquatic vegetation. Adult vagrant darters also reside and forage near this biotope.

Secondly, there is the grassland biotope. The grassland biotope surrounds the water elements in Carnisse. These areas currently consist of grasslands with some trees where the vagrant darter can forage.

Lastly, there is the brushwood biotope. This biotope is present in the backyards in Carnisse. This biotope provides herb-rich grasslands combined with taller vegetation, offering the vagrant darter opportunities for foraging and shelter for safety. All backyards are labelled as brushwood biotopes, but not every backyard provides the necessary resources. Thus, on the map, it may appear more nutritious than it is in reality.

Figure 90. Biotopes of the vagrant darter. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

RESIDENCE

The vagrant darter uses various habitats throughout its life cycle. The eggs are deposited in shallow water on shoreline vegetation, often in stagnant water and occasionally in slow-flowing water. These water elements include bigger water courses and puddles (Vlinderstichting, n.d.a). The prerequisite for these habitats is sunlight, flat shorelines, and well-developed riparian planting. The larvae also inhabit these waters, dwelling in locations with shallow, embedded mud and among the banks and aquatic plants. These dragonflies are found in all landscape types around their breeding waters but prefer brushwood vegetation and herb-rich grasslands (Vlinderstichting, n.d.b; Dijkstra, 2002; M.A. de Beaumont, personal communication, October 14, 2023).

Figure 91 shows the current habitat of the vagrant darter. Currently, several grasslands are present around the waters, but these are mowed grasslands and therefore, miss the rough aspect. In addition, natural banks are lacking, which minimizes the habitat for the vagrant darter. However, larger water bodies with nearly stagnant water are present, showing potential for this species.

AMENITIES

The food source of the larvae of the vagrant darter consists of small invertebrates that live in nutritious waters. The adult vagrant darters hunt small insects that they can find in shore vegetation and herb-rich grasslands with thickets (M.A. de Beaumont, personal communication, October 14, 2023).

Figure 92 shows that the waters are limited to two larger spaces at the Lepelaarsingel and the Amelandseplein. These water elements lack the rugged shore vegetation that attracts insects for the larvae of the vagrant darter. Next to this, there is little high vegetation and diversity in species in the grasslands, resulting in fewer attracted insects compared to areas with herb-rich grasslands and thickets. This negatively affects the foraging area of the vagrant darter. Backyards can also be a potential place where food is present. However, not every backyard provides the necessary food. This means on the map there appear to be more nutritious locations than there actually are.

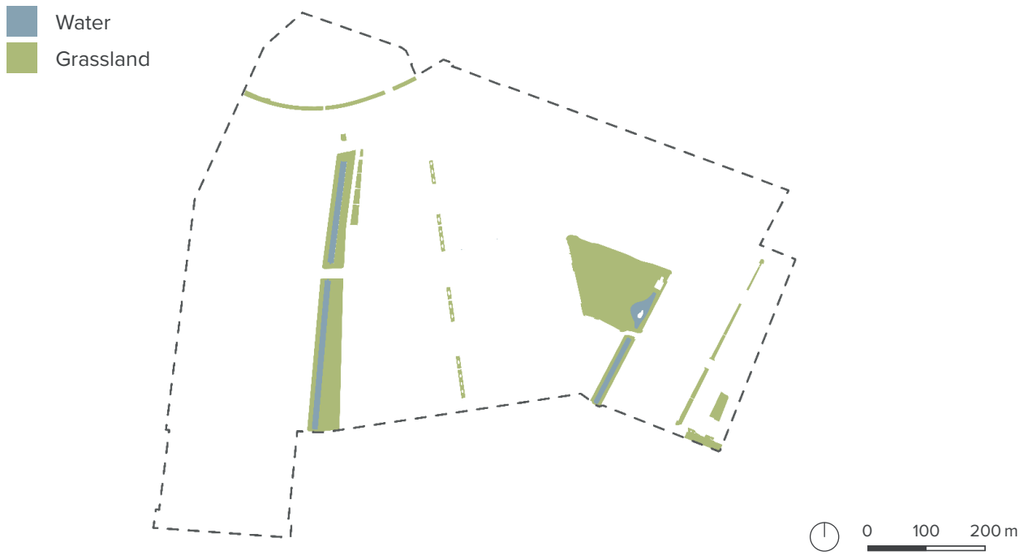


Figure 91. Possible residence of the vagrant darter. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

Figure 92. Possible foraging area of the vagrant darter. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

CONNECTIVITY

The vagrant darter is a mobile dragonfly. Nevertheless, it usually does not fly very far from suitable breeding habitats, although it is possible to do so. In the optimal situation, the connectivity for the vagrant darter consists of continuous linear elements such as banks, shrubs, and herb-rich grasslands. Due to the mobility of this species, a steppingstone connection may be present. The maximum bridgeable distance between parts that connect to the larger green structures of the surroundings should not exceed 100 meters (Vlinderstichting, n.d.b; M.A. de Beaumont, personal communication, October 14, 2023).

Figure 93 shows the currently missing link between the two larger areas of the Lepelaarsingel and Amelandseplein where the vagrant darter may reside. However, there are roads in between that could potentially facilitate this connection. Additionally, back yards have the potential to increase their quality of vegetation to better connect the habitat of the vagrant darter, thus improving the connectivity of this species.

Figure 93. Possible connections of the vagrant darter. (Collected data using Ministry of the Interior and Kingdom Relations, 2022)

SAFETY

Well-developed shore and aquatic vegetation along watercourses and ponds are necessary to ensure the protection of the eggs and larvae of the vagrant darter. Revetments should be replaced by natural banks. This provides space for shore vegetation, which provides the larvae a place to reside and the opportunity to crawl out of the water. For the bank plants, it is crucial to implement phased mowing to make the dragonfly feel more at home. Additionally, there should always be an adequate water level for these species. Drying out of the area must be prevented by avoiding drainage. For adult dragonflies, rough vegetation or herb-rich grasslands should be present where they can seek shelter (Vlinderstichting, n.d.a).

Figure 94 shows that the watersides currently have bank revetments. These prevent the growth of shore vegetation and the crawling out of the larvae of the vagrant darter, creating an unsafe location for the larvae. The larger public green spaces such as Urkersingel, Amelandseplein and Lepelaarsingel are intensively mowed, meaning ten or more times a year or very intensively maintained, disrupting the habitat of the adult vagrant darter. A large part that may contain rough vegetation in Carnisse are backyards. These are private areas, making it difficult to manage them. Here, it varies whether these are intensively maintained. Therefore, it is unclear if these areas provide the necessary shelter for the adult vagrant darter.

Figure 94. Mowing management in Carnisse and dangers to vagrant darter. (Collected data using S. Jansen, personal communication, September 6, 2023).

MAXIMIZATION

Figures 95, 96, and 97 show the maximized map and sections for the vagrant darter. The maximization is an outcome of the analysis and the indicators provided by the Urban Ecology Department of the Municipality of Rotterdam. The outcome is based on existing structures, with private properties transformed only when necessary to reach the needs of the vagrant darter.

The map illustrates the partial removal of pavement within the street pattern. The main pavement can remain in place. Additionally, the quality of the grasslands, currently characterized by monotonous and short mowing, will transform into herb-rich grassland with scattered groups of trees and bushes. The most significant change relevant to the vagrant darter pertains to the water, where revetments make way for natural banks with taller vegetation. Furthermore, aquatic plants will be introduced to provide space for the larvae of the vagrant darter to dwell.

Figure 43. Vagrant Darter. (Andy C. Wildlife, n.d.)

Figure 95. Maximization of the vagrant darter. (Collected data using Ministry of the Interior and Kingdom Relations, 2022; Municipality of Rotterdam, 2020; Kadaster, 2023)

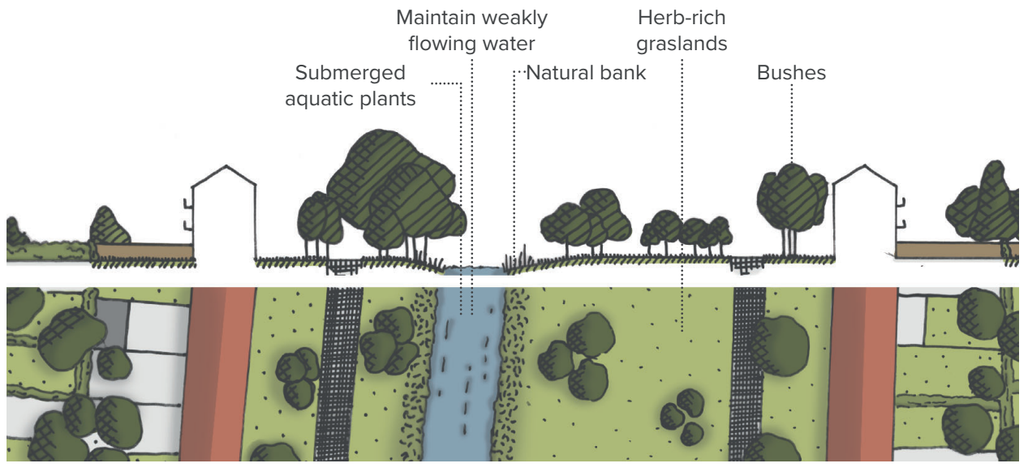


Figure 96. Section A-A": Maximization of the Lepelaarsingel for the vagrant darter.

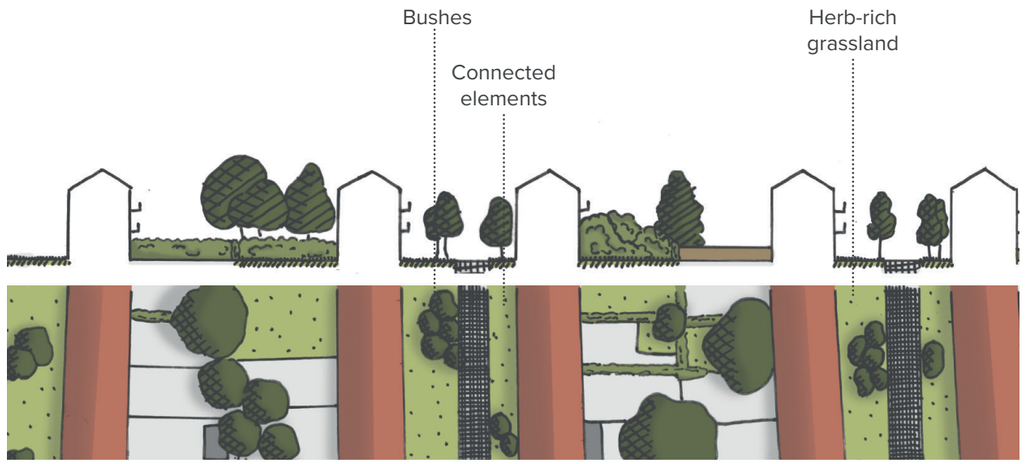


Figure 97. Section B-B": Maximization of the Klaverstraat for the vagrant darter.

CONNECTIONS TO SURROUNDINGS

Figure 98. Car roads requently used by human species. (Collected data using Via Michelin, 2023)

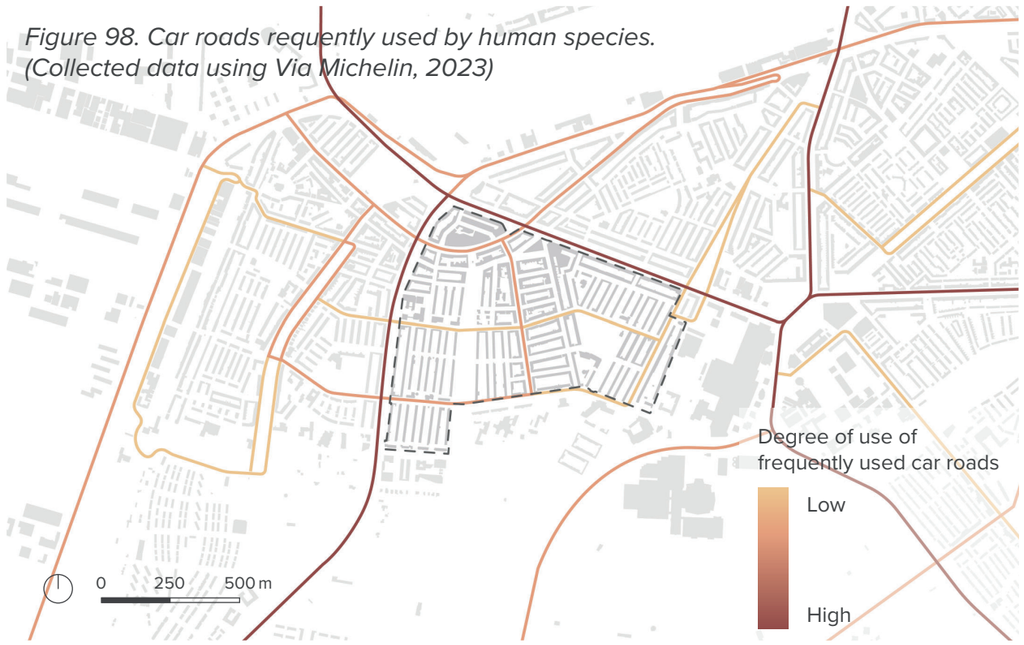


Figure 99. Bike routes frequently used by human species. (By author)

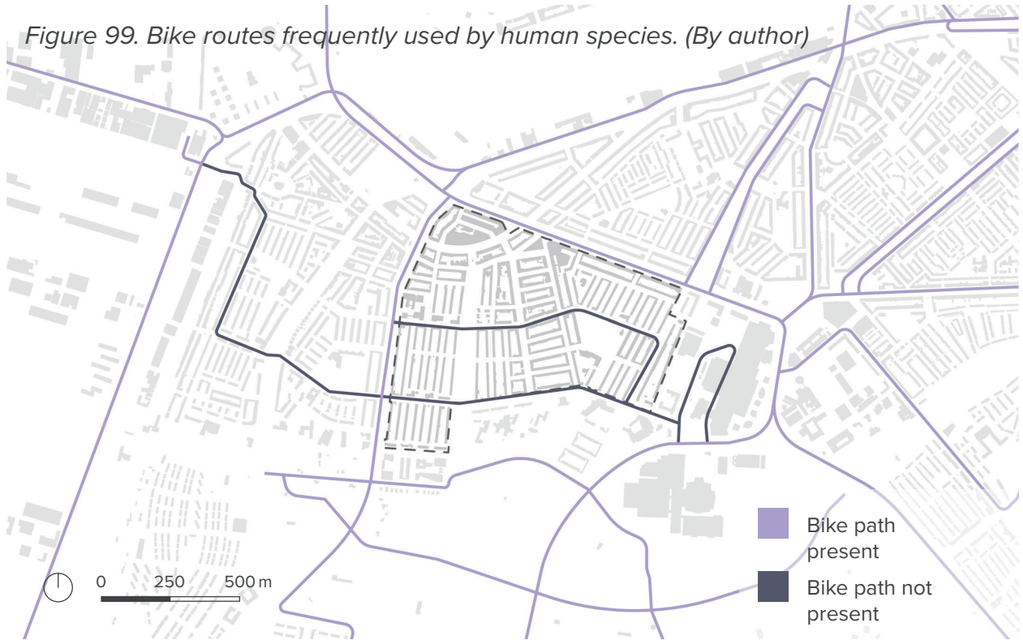


Figure 100. Bigger green structures. (By author)

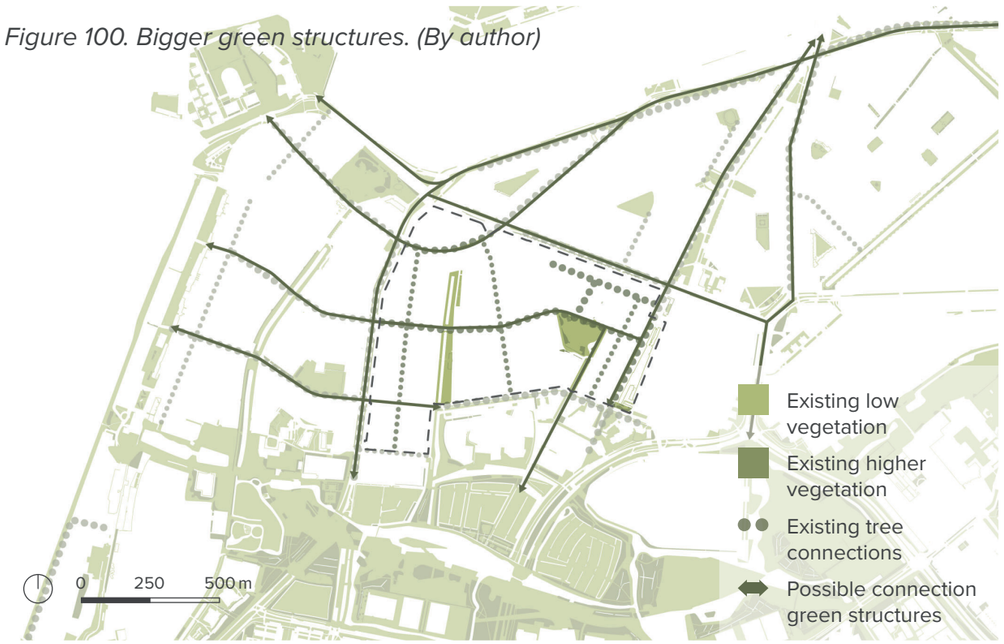
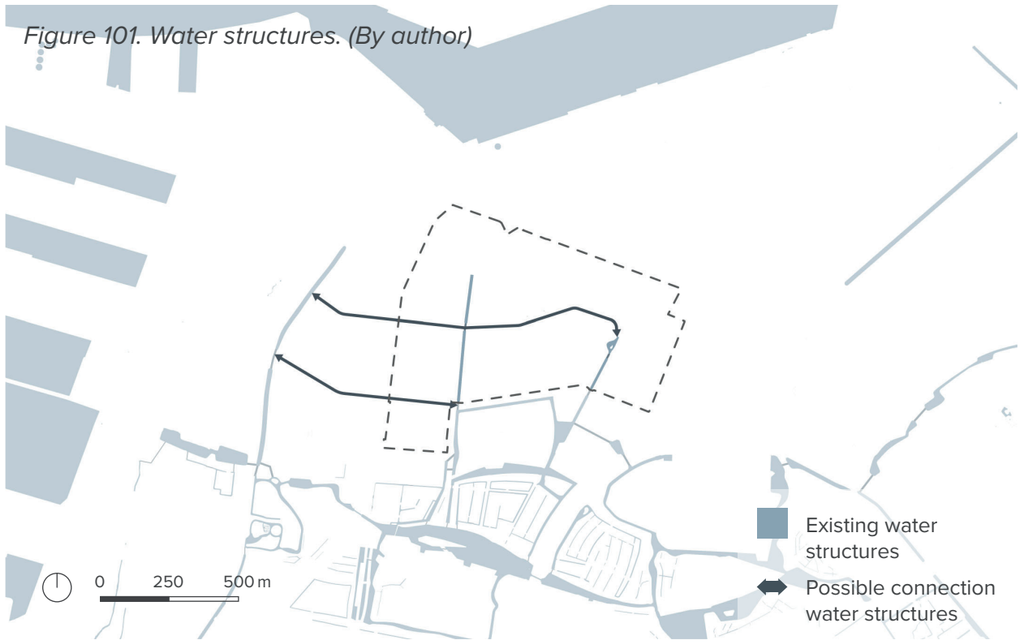


Figure 101. Water structures. (By author)



TOOLBOX

The toolbox in Figure 102, seen on this page and the next, provides an overview of the requirements that the target species set regarding their living environment related to the larger biotopes present in the Carnisse neighbourhood. These include the combined grassland and forest biotope, the water biotope, and the rocky biotope. Some biotopes are empty concerning the target species, as these species are not present in these biotopes. Therefore, they do not have specific requirements for this biotope type.

Public and private rocky biotopes are distinguished within the rocky biotope. As visible in Figure 102, the elements of the water biotope and the private rocky biotope complement each other. Because there are no internal conflicts, it is possible to design an environment that contributes to the living conditions of the various target species. This is not the case for the public rock biotope, and grassland and forest biotope. For this reason, a distinction is made within these biotopes between two groups that do not conflict since their different preferences align. Within these biotopes, the characteristics of a liveable environment for the common blue, humans and vagrant darter align, as well as those of for the common pipistrelle, the European hedgehog, and the house sparrow. The first group prefers a more open grassland landscape with visibility, while the second group wants a combination of grasslands and more shelter with higher vegetation.

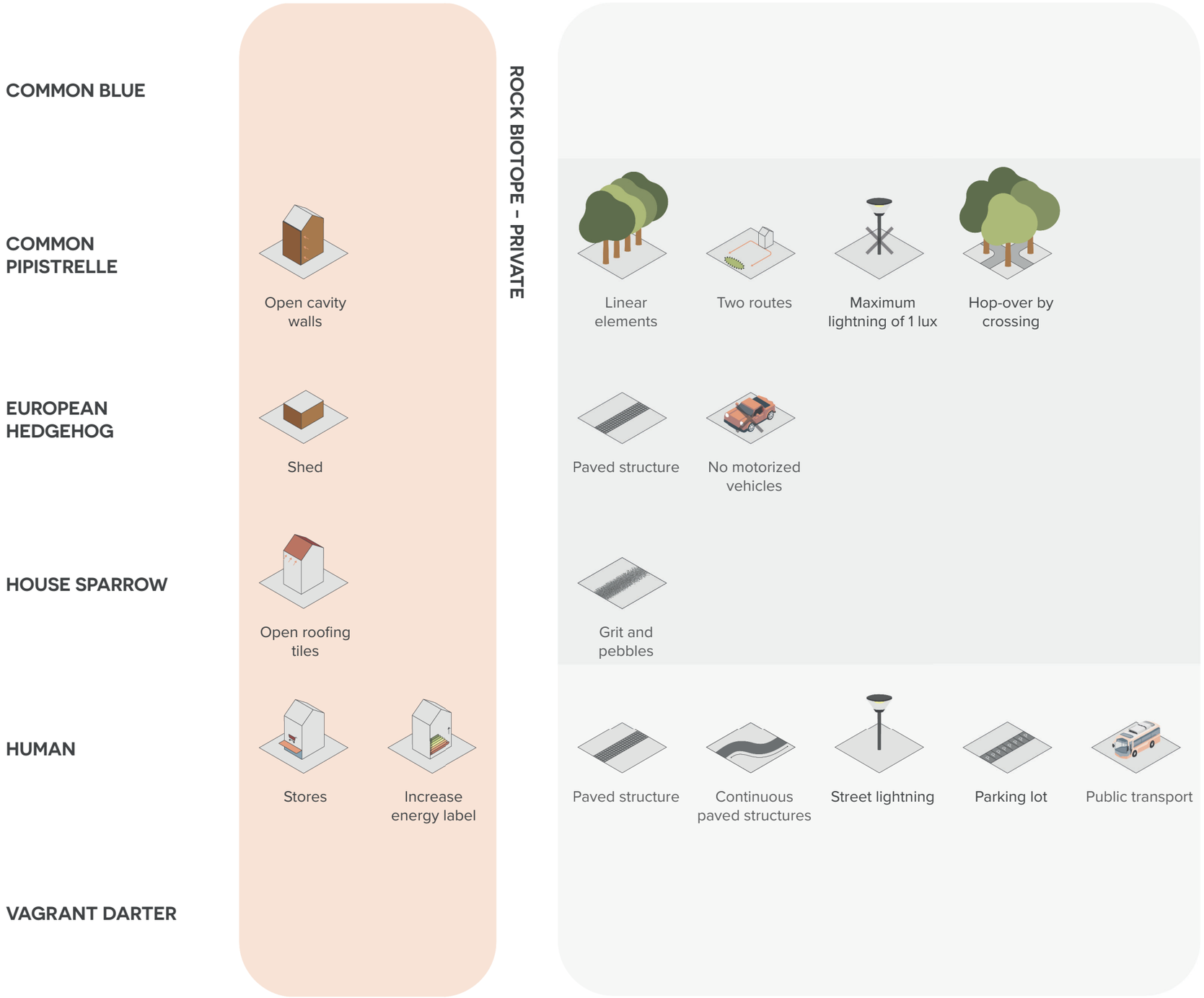


Figure 102. Toolbox rock biotope.

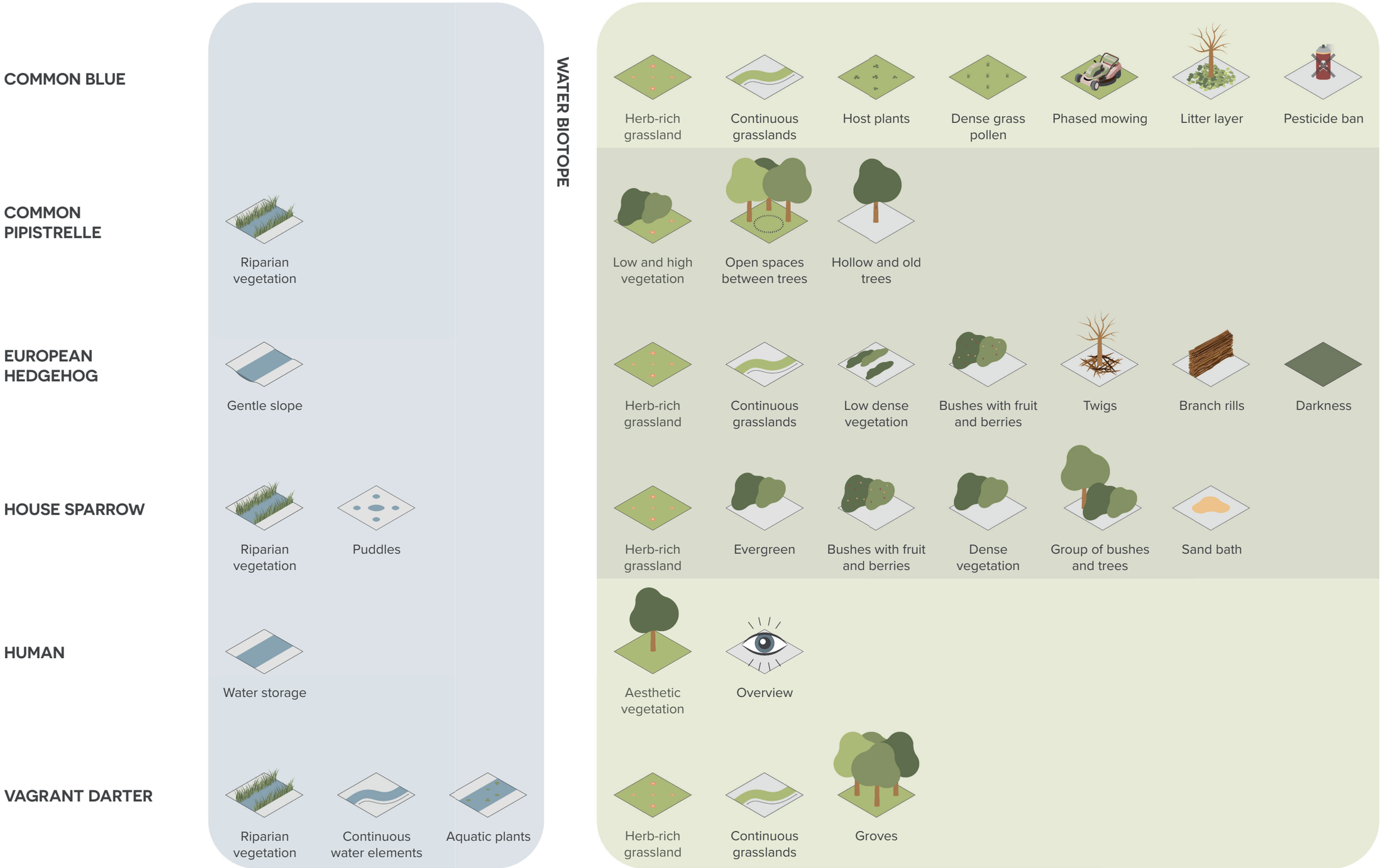


Figure 102. Toolbox water biotope and grassland biotope.

CONCLUSION

To uncover how ecological injustice occurs within Carnisse, present species and their needs related to the living environment are defined first. Target species based on the recommendations of the Urban ecologists of the Municipality of Rotterdam are chosen to investigate this, representing not only themselves but also 80% of the other species present. The target species are the common blue, common pipistrelle, European hedgehog, house sparrow, human, and vagrant darter. These species are analyzed in terms of environment, residence, amenities, connectivity, and safety. The maximizations indicate a possible translation into an optimized living environment for the target species. It turns out that the optimized living environments deviate from the current situation.

Examining the toolbox, which bundles the various requirements for the living environment of different species, it becomes apparent that these needs and wishes are not (sufficiently) reflected within the current situation. This is because Carnisse was designed and built for and by humans without considering the needs and requirements of the living environment for other non-human species at that time. This lack of consideration for the liveability of other non-human species is evident in the spatial design of the Carnisse neighbourhood. However, the current needs of humans also partly diverge from the existing spatial design of Carnisse, possibly due to the majority of the neighbourhood being established around 1940, with no urban renewal since then, while human needs have evolved.

Each target species has unique needs and requirements for the living environment. The analysis reveals that various target species may eventually utilize the same biotopes, converging at the same locations (when suitable for their needs). This convergence results in interactions between different target species. The interaction between human and non-human species is crucial as it positively contributes to the relationship, which results in ecological justice. Therefore, preserving and optimizing existing locations where these interactions occur is essential to improve the relationship between human and non-human species. Figure 103 illustrates how these interactions take place in the current biotopes.

Figure 103. Interactions between different target species in Lepelaarsingel and Klaverstraat.

Figure 104. Fusion of city and ecology. (Adapted from Tequilajazz, n.d.)

05

DESIGN

FRAMEWORK

STARTING POINTS

The goal of ecological justice is the acknowledgment of the value for an environment for the various species that are present in order to create an area that is shared by these species. In this approach the relation between the various species is central. To create a design in which the values of ecological justice are central, a few starting points are addressed that need to be kept in mind during the process of creating the design for the neighbourhood Carnisse.

The first starting point is that the toolbox that the demands and wishes of the target species concluded in chapter 4, is applied in the design of an ecological just Carnisse. The specified tools of the various target species have to be taken into account for each decision.

The second starting point is that the current buildings are preserved as much as possible. Only when, according to the designer, it is absolutely necessary for the environment of the non-human target species to adjust the private properties the choice will be made to intervene here. Because justice is a subjective concept, the need for intervention also remains subjective, for this reason it is important to remain transparent about design choices. This starting point is not in line with ecological justice, because the human is favoured compared to the other species. This consideration is however made, due to the fact that Carnisse is an intensive city neighbourhood and the human species needs a place to live. Because this area is used intensively by the human species, there is a lot of potential to improve the relation between the human and non-human species, and therefore improve ecological justice. Next to this, there is a high percentage of rental homes (50%) and privately owned homes (31%) within the neighbourhood, that could hinder the realisation of the design (AlleCijfers.nl, 2023). The consequence of this starting point is that everywhere within the neighbourhood Carnisse the connection between human homes and the environment must be adequate.

The third starting point is that context consideration, based on biotope mapping, is taken into account within the proposed design. Context consideration here replaces value equal distribution, in that work is done in an existing situation and this existing situation affects the habitat of the species currently present. The current biotopes, except the public rock biotope, present in Carnisse are optimized in the area of the own biotope, connected to the wishes of the target species living within each specific biotope. Because context consideration is applied it is possible that equal distribution, as described within ecological justice, is negatively impacted. This consideration is however made because of the impossibility of an absolute equal distribution, because an environment is always better suited to one species than for another, and because this allows extensions of the existing environment of the various target species and the species that are currently present are not disadvantaged (Wienhues, 2017). For the public rock biotope an exception is made, the public part of the rock biotope includes the concretion except buildings, or in other words the streets. The streets do not fulfil any function for 5 out of the 6 target species, in contrast to the private rock biotope, the buildings. Because the humans are the only species gaining any advantage from this type of biotope, and the humans in current city design and in the first starting point are favored relative to the other species, the decision is made to make an exception and not optimize this Biotope, but instead adjust the biotope. This biotope is dependent on the zoning, as mentioned in the next section on the fourth starting point.

The fourth starting point is that different zones are used that are leading when conflicts between wishes and demands of various target species arise during the design. As shown in the analysis of chapter 4, the target species have varying demands and needs within their habitat. When looking at these different demands and needs, there are two overarching types of biotopes that accommodate to all target species where no meaningful conflicts arise. The demands and needs of the common blue, vagrant darter and the human can be linked using the shard need for clear and open grasslands with several trees and the possibility for water (storage). The properties of the habitats of the European hedgehog, house sparrow and common pipistrelle conflict with this environment, due to their need for shelter in the form of (high) vegetation, trees and rock like elements. The difference in these demands leads to conflicts, because the available space can only have one implementation. Within the existing structures of Carnisse there is a lack of space in some cases to accommodate to all needs and wishes of the habitat of the different target species. The limitations occur partially because of the second starting point, which states that current buildings should be preserved as much as possible. Due to the limited available space and the constrasting wishes of the target species the choice is made to divide Carnisse into two zones. The specific zone will be the determining factor when conflicts arise concerning the design of the area.

The zones each encompass three target species, that are based on the division that is caused by the conflicts of wishes and demands of the target species. The common blue, the human and the vagrant darter are the leading species in the zone “open biotope”, while the European hedgehog, common pipistrelle and house sparrow are the leading species for the zone “sheltered biotope”. Outside of the areas where contex-consideration causes a conflict, the zoning will mainly influence the design of the public rock biotope.

Figure 105. Starting points.

ZONING

The division of the zones “open biotope” and “sheltered biotope” is based on the current roofstructures. The areas in Carnisse where flat roofs are the majority are linked to the open biotope. These flat roofs have the potential to form an open grassland on top of them. This transformation to green roofs within this zone is therefore treated as a necessary intervention of private properties to improve the habitat of the target species. The areas where the pitched roofs are in the majority will be linked to the “sheltered biotope”. Within this zone it is necessary for (privately owned) buildings to have cavity walls and space under the roof tiles to improve the liveability of the target species linked to this biotope. In Figure 106 the contribution of the roof environment to the zoning of Carnisse is made clear.

Despite the zoning within an area, the other target species unrelated to the zone are still taken under consideration. The goal is to create a liveable habitat for all species. Only in the case of conflict will the zoning be the determining factor.

ALL-INCLUSIVE

Because of the limited space, mainly in the current streets with homes, areas will appear that apply more to the liveability of one target species than to that of another. It is important that, despite that this is the case, the more optimized areas for specific species stay adequately connected to each other. For this reason there are all-inclusive connections. These connect the different zones and link to the connection to the surrounding areas of Carnisse. They also connect the Lepelaarsingel and the Amelandseplein. These are two areas that currently consist mainly of grassland biotopes, where every target species can make use of its habitat and both areas are optimized to become an all-inclusive environment according to context consideration.

These all-inclusive connections are localized on the horizontal, current large cityroads that can be found within Carnisse: the Gruttostraat that extends into the Utenhagestraat, the Meester Arendstraat, de Katendrechtse Lagedijk en de Wielewaalstraat. Due to the wide profile of these public spaces it is possible to create a connection that can accommodate to the wishes and needs of every target species and where the connection between these species has a central role.

Figure 106. Zoning and all-inclusive environments.

INFRASTRUCTURE FOR MOTORIZED VEHICLES

In the starting points it is stated that current buildings have to be preserved as much as possible. The preservation of structures for humans are intertwined with the necessity of connections between these homes and the surroundings. This is also the reason that enough infrastructure has to present for all humans in the entire neighbourhood of Carnisse. This infrastructure has to be available for pedestrians, cyclists and automobiles.

The necessary infrastructure for the car, both roads and parking spaces, leads to conflict with the other target species. The car and other motorized vehicles are important for people, but the necessary space provides little to no improvements to the habitats of the other species. During the starting points, it has been stated that this infrastructure has to be available to humans, and therefore there should be sufficient infrastructure for cars. Therefore, the human transcends its own zoning, which is the open biotope. Since this is in conflict with the wishes and needs of the sheltered biotope, this will be compensated by minimizing the space for cars in the entire neighbourhood.

To determine how many infrastructure is needed for the car, first a look is taken at parking spaces. The available parking spaces that are currently at ground level are moved to parking garages, so a larger area is created for public space. To create space for these parking garages, houses of humans are removed. This is however in the interest of the human species and deemed necessary for the liveability of both the human and the other target species. The parking garages are accessible for homes of humans that are within a 100 meter radius, what falls under the maximum radius of 300 metres set in this area (Overheid.nl, 2022).

Paved roads for cars are exclusively used to provide access to these parking garages. These roads cross the all-inclusive connections as little as possible and the speed limit within Carnisse will be set at a maximum of 30 km/h to decrease the chances of conflict. These roads will also provide connections to the main road network surrounding Carnisse.

To compensate for the reduced accessibility using cars for people, more space will be provided to public transport by rerouting the bus line and adding extra bus stops. All houses will be connected to these bus stops, by ensuring that every home is within 500 metres of a bus stop or a 1000 meters of a metro station. Bike lines are added as well, on the bike routes that are currently frequently used in order to encourage cycling within Carnisse.

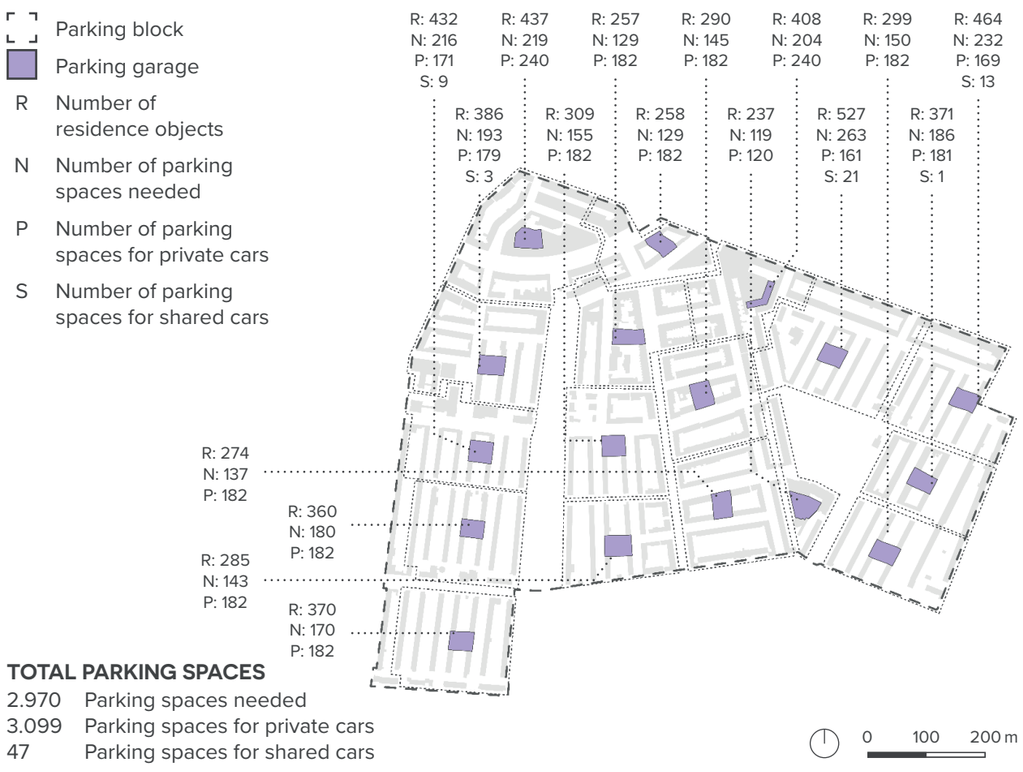


Figure 107. Parking.

Figure 108. Infrastructure for motorized vehicles.

FRAMEWORK

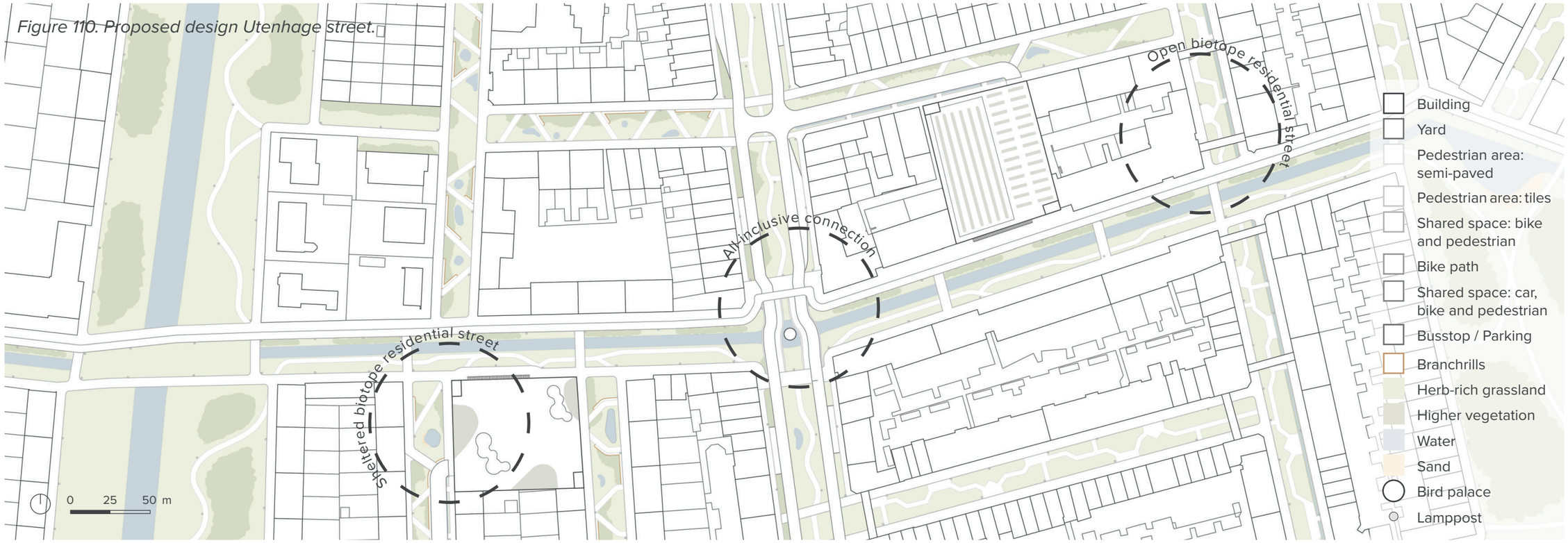
The zoning, all-inclusive connections and the necessary accessible roads for motorized vehicles lead to a framework in which the different elements are connected, shown in Figure 109. This leads to a total of five types of areas that each have their own design:

1. Open biotope residential street
2. Sheltered biotope residential street
3. All-inclusive connection
4. All-inclusive grassland biotope Amelandseplein
5. All-inclusive grassland biotope Lepelaarsingel

These different designs of the public space are each connected to the Utenhage street. In Figure 110 is a magnified view ot the design and how these different areas are connected. The design of the housing streets and the all-inclusive connections will be further elaborated using the locations that are connected to these all-inclusive connections. These designs for different connection types are applied throughout Carnisse, with the configuration based on the zoning and all-inclusive connections and areas shown within the framework. The design for these types of public spaces will depend on the stated starting points.

Figure 109. Framework.

Figure 110. Proposed design Utenhage street.



OPEN BIOTOPE RESIDENTIAL STREET

Figure 111. Impression open biotope residential street: Ebenhaëzerstraat.

IMPRESSION

The open biotope residential street emphasizes an open landscape with flower-rich vegetation, where interaction is central. Due to removing parking spaces and modifying the pavement, more space becomes available for the open grasslands.

The sidewalks provide a shared space, ensuring necessary infrastructure for pedestrians, cyclists, and, where necessary, cars. The decking in the middle of the street is a place where people can come together to barbecue or picnic with each other and with nature.

The gate functions as a green connection between the rooftops and invites people to enter the street at ground level, creating an intimate and secure feeling at the street level.

Figure 112. Current impression: Ebenhaëzerstraat.

DESIGN CHOICES

The open biotope residential street concerns various design choices that contribute to the liveability of different target species. These contributions to the living environment of the target species are explained based on the technical cross-section.

1. The flat roofs provide space for herb-rich grassland as a habitat and foraging area for the common blue and the adult vagrant darter.
2. The upward vegetation against the façade bridges the gap between the canopy and the roof landscape for the common blue and the adult vagrant darter. Additionally, the upward vegetation serves as a good hiding place for the house sparrow.
3. The green canopy connects the herb-rich roof landscape for the common blue and the adult vagrant darter. The presence of coverage also makes it suitable for the house sparrow.
4. The existing trees are preserved within the open biotope. The pear tree provides shelter for the house sparrow, and like the vagrant darter, it can forage for small insects there. Humans experience an improved habitat thanks to the air-purifying and cooling effects of the tree. The deciduous tree contributes to the shelter of the hedgehog and a habitat for the caterpillars of the common blue. Lastly, the trees contribute to the necessary connectivity for bats.

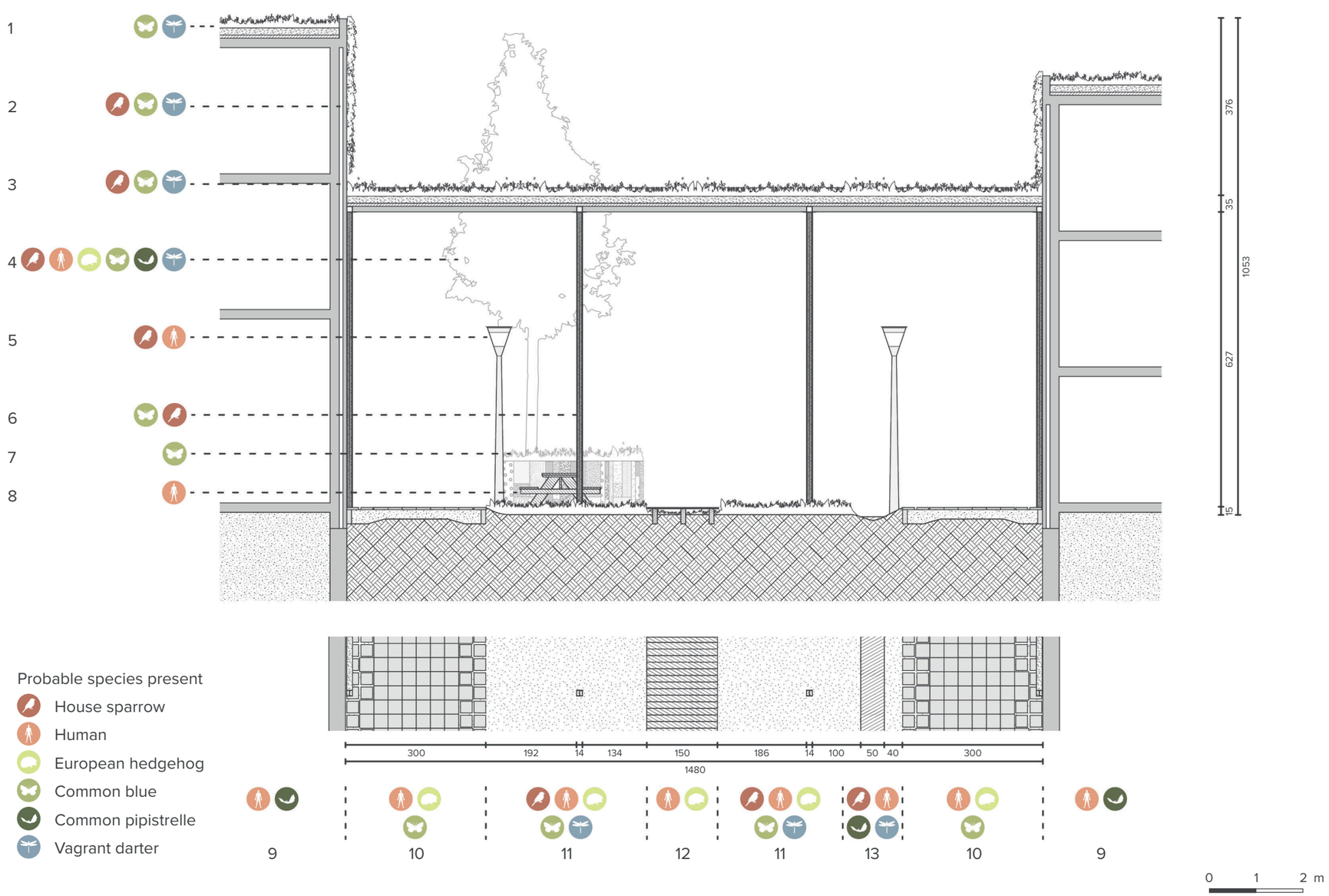


Figure 113. Technical section open biotope residential street: Ebenhaëzerstraat.

5. The lampposts are designed not to obstruct the flight paths of the common pipistrelle but to provide street lighting for humans, using bat lamp technology (Ministry of Infrastructure and Water Management, n.d.). A shallow bowl is present on top of the lamppost, where the house sparrow can take a bird bath. This way, the lamppost serves a function to several target species, as visualized in Figure 113.1. The lamppost replaces the existing lampposts in the entire neighbourhood.
6. Around the IPE profiles that support the canopy, square corten steel enclosures can be found. The corten steel has a long life span and is recyclable (Zwartgroen, n.d.). Openings in the corten steel provide access to the litter layer for the common blue between the corten steel and the IPE profiles. A section of the pillar is shown in Figure 113.2.
7. Elevated insect boxes surrounding the decks give people on the decks a secure feeling. The insect boxes provide space for various insects and the flowers on top provide space for the common blue. Figure 113.3 provides a clearer image of the elevated insect boxes.
8. The picnic table provides space for humans to interact with other human and non-human species.
9. Thanks to the open cavity walls, the houses are not only a habitat for humans but also for the common pipistrelle.
10. Thewide-setpavementaccommodates a "shared space" accessible to human cyclists and pedestrians. In exceptional cases, such as moving, it is also accessible for a car. However, its use is minimized for this purpose. Besides humans, the hedgehog also uses this pavement as a fast walking route. The common blue uses the open spaces at the edges of the tiles where the host plants of this species grow.
11. The open herb-rich grasslands provide space as foraging and habitat for the house sparrow, hedgehog, common blue, and the adult vagrant darter. Additionally, the grassland offers a cooling environment for humans.
12. The deckings provide a connection for humans to bridge the street. At the same time, the underside of the deckings provides a sheltered habitat for the hedgehog.
13. The narrow stream provides additional space for rainwater, preventing the sidewalk from flooding and causing inconvenience to humans. Due to the slope, the hedgehog can climb out when it swims or falls into the water. The stream provides a drinking place for the house sparrow and a habitat and foraging area for the larvae of the vagrant darter. Additionally, the common pipistrelle can forage in the vegetation at the water's edge.

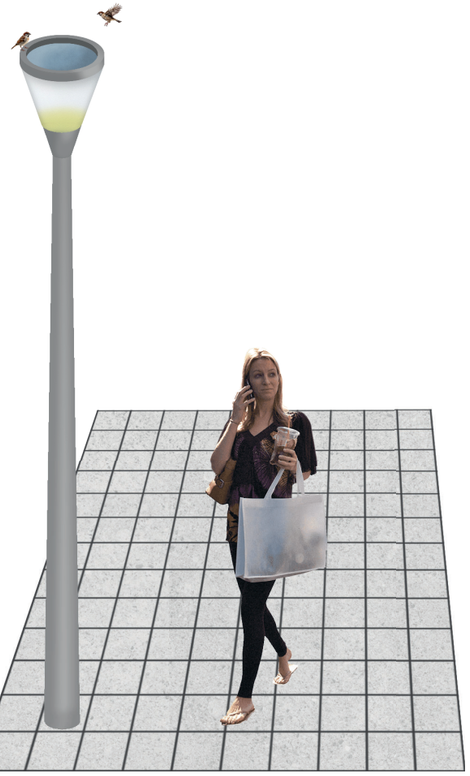


Figure 113.1. Multifunctional lamppost.

Figure 112.3. Corten steel pillar.

Figure 113.3. Flower box dividers.

Figure 114. Current map impression. (Google, n.d.)

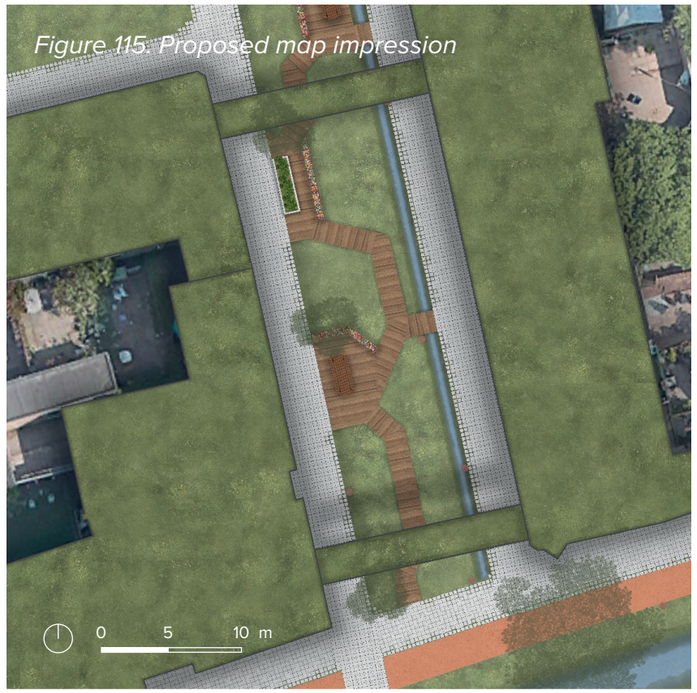


Figure 115. Proposed map impression

Aquatic plants

Bank flora OE-27 (Medigran, n.d.b)
- Achillea ptarmica
- Alisma plantago-aquatica
- Barbarea vulgaris
- Caltha palustris ssp. palustris
- Cardamine pratensis
- Filipendula ulmaria
- Galium palustre
- Hypericum tetrapterum
- Iris pseudacorus
- Jacobaea aquatica
- Lotus pedunculatus
- Lysimachia vulgaris
- Mentha aquatica
- Mentha pulegium
- Myosotis scorpioides ssp. scorpioides
- Pulicaria dysenteria
- Ranunculus repens
- Rhinanthus angustifolius
- Silene flos-cuculi
- Stachys palustris
- Thalictrum flavum
- Trifolium repens
- Valeriana officinalis
- Veronica longifolia

Grasslands

Flowered lawn M5 (Cruydthoeck, n.d.b)
- Bellis perennis
- Cardamine pratensis
- Crepis capillaris
- Erodium cicutarium
- Hypochaeris radicata
- Lotus corniculatus var. corniculatus
- Medicago lupulina
- Plantago lanceolata
- Prunella vulgaris
- Ranunculus repens
- Rumex acetosella
- Scorzoneroides autumnalis
- Trifolium dubium
- Trifolium pratense
- Trifolium repens FG
- Veronica chamaedrys

Flower mixture WV (Cruydthoeck, n.d.c)
- Achillea millefolium
- Cardamine pratensis
- Centaurea jacea
- Crepis capillaris
- Hypochaeris radicata
- Lathyrus pratensis
- Leucanthemum vulgare
- Lotus corniculatus var. corniculatus
- Lotus pedunculatus
- Lythrum salicaria
- Medicago lupulina
- Plantago lanceolata
- Prunella vulgaris
- Ranunculus acris
- Rhinanthus angustifolius
- Rhinanthus minor
- Rumex acetosa
- Rumex acetosella
- Scorzoneroides autumnalis
- Silene flos-cuculi
- Taraxacum officinale
- Trifolium dubium
- Trifolium pratense
- Trifolium repens FG
- Vicia cracca

VEGETATION

Figures 116.1 and 116.2 show the planted vegetation of the area. The open biotope primarily gives space to native lower vegetation, such as grasslands with nectar flowers and insect-attracting plants, with a blooming period from April to October. The roof vegetation remains short and needs mowing every six weeks. The grasslands are mowed 1 to 2 times a year. The harvested hay can be used elsewhere. The shore vegetation also consists of low vegetation, maintaining clarity for humans.

Vegetation in the flowerbeds and vegetable gardens can be self-planted by human residents as long as these species are native. Additionally, no extra taller vegetation and trees are planted within this biotope. The existing Pyrus trees are preserved.

Vegetation

- Crataegus monogyna
- Sambucus nigra
- Prunus spinosa
- Alliaria petiolata
- Knautia arvensis
- Persicaria
- Geranium phaeum
- Thymus vulgaris
- Ajuga reptans
- Malva sylvestris

Vegetation chosen by humans

- Native ornamental plants
- Native vegetables/ herbs

Trees

1. Pyrus communi
2. Robinia pseudoacacia
3. Alnus glutinosa
4. Salix alba

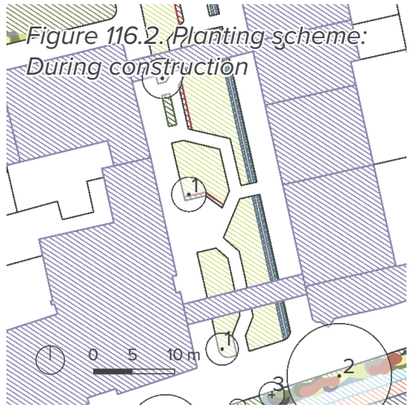


Figure 116.2. Planting scheme: During construction

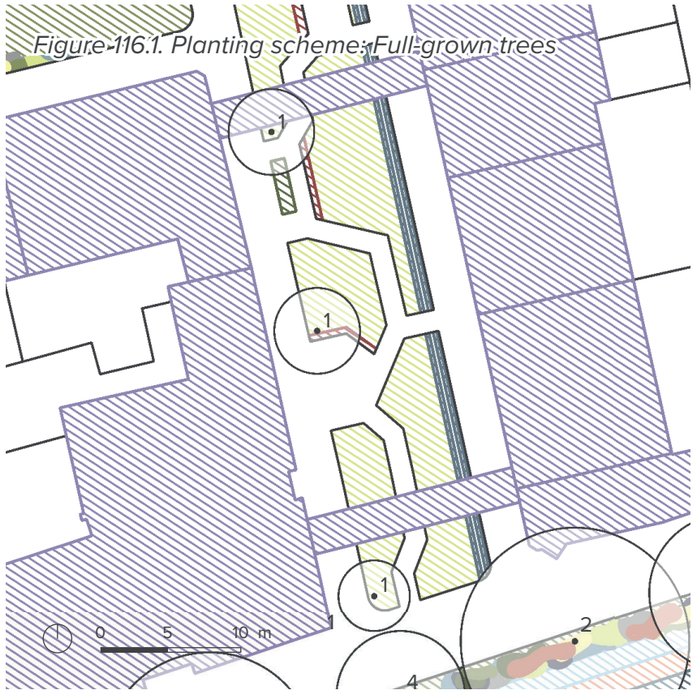


Figure 116.1. Planting scheme: Full-grown trees

SHELTERED BIOTOPE RESIDENTIAL STREET

Figure 117. Impression sheltered biotope residential street: Klaverstraat.

Figure 118. Current impression: Klaverstraat.

IMPRESSION

The Sheltered Biotope Residential Street is a street design that places more emphasis on shelter and variation in types and heights of vegetation. Due to removing parking spaces and modifying the pavement, more space is available for the necessary shelter and vegetation.

This vegetation and shelter consists of various layers, from trees to herb-rich grassland, from shrubs to climbing plants. This way, shelter is always nearby for the target species that need these. The existing trees are preserved in this process.

Additionally, in Klaverstraat, standard access for motorized vehicles is also maintained. This street leads to one of the parking garages. The parking garage has retained the original façades, except at ground level, where façade openings are closed. The building provides space for climbing plants to create a more intimate feeling.

DESIGN CHOICES

The sheltered biotope residential street concerns various design choices that contribute to the liveability of different target species. These contributions to the living environment of the target species are explained based on the technical cross-section.

1. Play elements are structures that are not only accessible to humans but also to other small species, based on the design of McCloy + Muchemwa (2023). The outside of the elements provide rough structures with small holes that non-human species can use those to reside, see Figure 119.1.
2. The parking garage fits into the existing façade structure. Niches are created in the unused areas of the parking garage where the common pipistrelle can reside. The parking garage accommodates cars for people and also includes a bicycle storage area at ground level. The construction of the parking garage can store water. Depending on the zoning, functions are located on the roofs of the parking garages. On this parking garage, a playground is situated where interactions between humans and non-human species can occur. See Figure 119.2 for a clearer image of the parking garage.
3. Existing trees are preserved. Deciduous trees will be added to maintain connections, also during wintertime, for the common pipistrelle. Except for the common pipistrelle, the trees provide shelter and food for the house sparrow and vagrant darter. The European hedgehog uses the roots of the trees as a sheltered place, and humans experience an improved habitat thanks to the air-purifying and

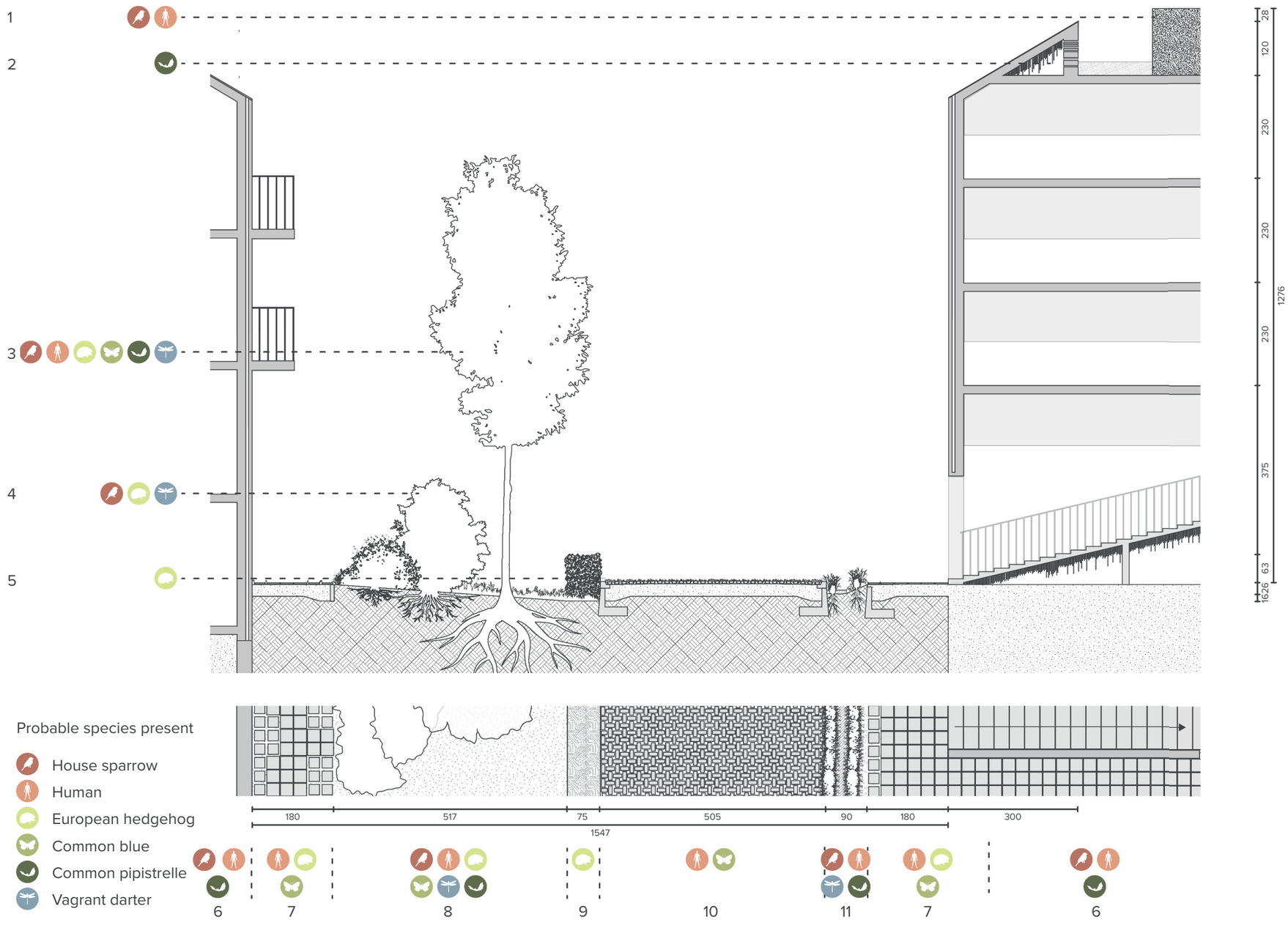


Figure 119. Technical section sheltered biotope residential street: Klaverstraat.

cooling effects of the tree.

4. Dense vegetation with fine twigs provides decking for the hedgehog and the house sparrow.
5. Elevated roads prevent the hedgehog from being on these roads and avoid collisions. Branch rills next to the road provide shelter and hibernation space for the hedgehog.
6. Thanks to the open cavity walls and exposed space under the roof tiles, buildings are not only a dwelling for humans but also for the common pipistrelle and the house sparrow.
7. Tiles with an open pattern on the side provide a walking route for humans and the European hedgehog. Open spaces between the tiles have space for the host plants of the common blue to grow and provide water drainage. Figure 119.3 shows a clearer image of these tiles. This tiling has been used throughout the planning area as materialisation to access the buildings. The bigger tiles are reused from the current situation. The smaller tiles are added and fit in with the material and colour of the existing tiles.
8. The combination of herb-rich grasslands and lower and higher vegetation provides space as foraging and/or residence for the common pipistrelle, house sparrow, hedgehog, common blue, and adult vagrant darter. Besides, the grassland and vegetation offer a cooling environment with several human health benefits.
9. Branch rills offer shelter and hibernation space for the hedgehog.
10. The open street pattern provides infrastructure for human transportation by car and bike. In between the tiles, there is space for the host plants of the common blue to grow. Figure 119.4 shows a clearer image of the street pattern. Within this street pattern, the current bricks are reused.
11. The stream provides a place to collect water in case of rainfall. Additionally, this stream serves as a bathing and drinking spot for the house sparrow. The slope on the roadside prevents the European hedgehog from entering the road where cars are present.

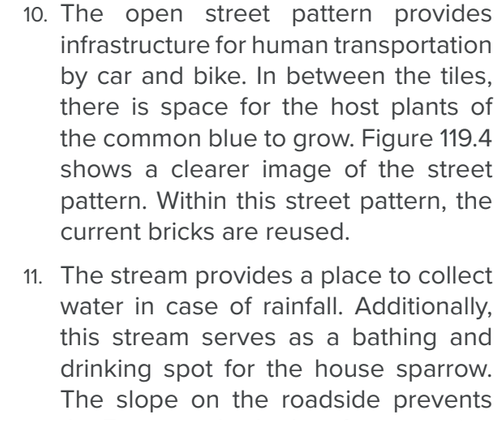


Figure 119.1. Play elements. (McCloy + Muchemwa, 2023)

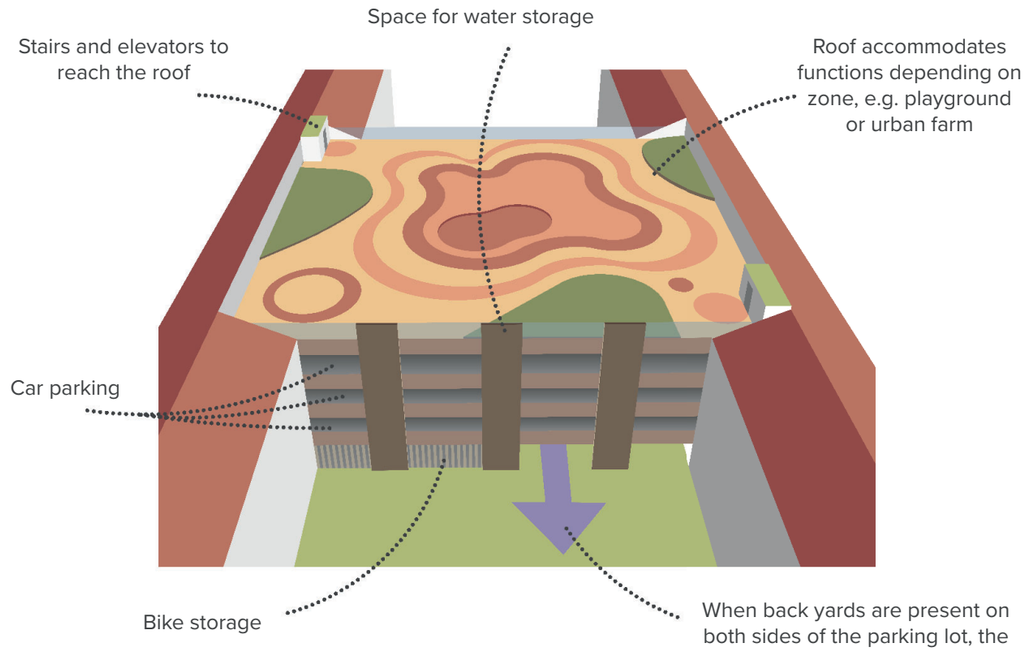


Figure 119.2. Parking garage

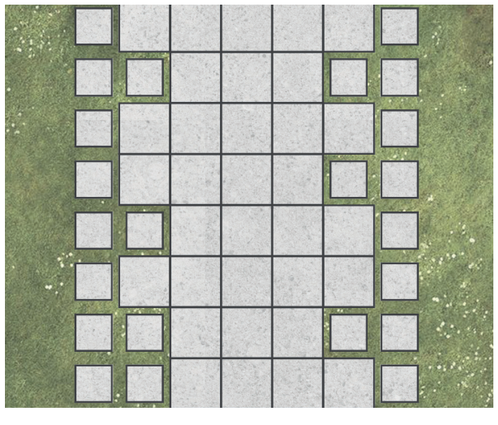


Figure 119.3. Open street tiles.

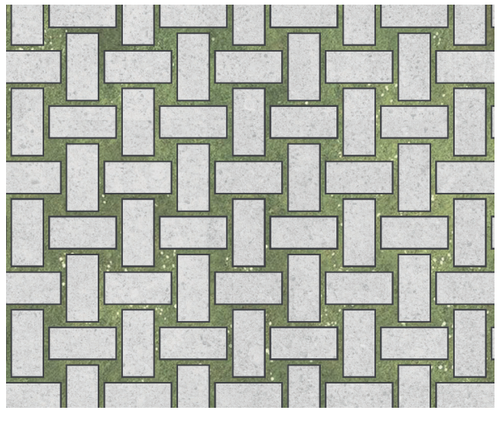


Figure 119.4. Realignment of paving bricks.

Figure 120. Current map impression. (Google, n.d.)

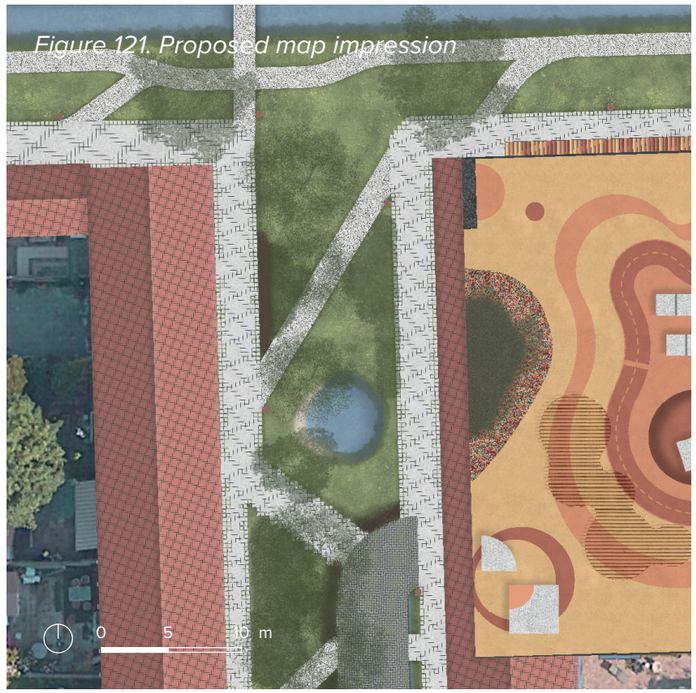


Figure 121. Proposed map impression

Aquatic plants

Submerged aquatic plants
- Potamogeton
- Myriophyllum
- Potamogeton

Rugged flora RN-28 (Medigran, n.d.b).
- Alisma plantago-aquatica
- Barbarea vulgaris
- Caltha palustris ssp. palustris
- Epilobium hirsutum
- Eupatorium cannabinum
- Filipendula ulmaria
- Galium palustre
- Iris pseudacorus
- Lycopus europaeus
- Lysimachia vulgaris
- Lythrum salicaria
- Mentha pulegium
- Rumex acetosa
- Scrophularia umbrosa
- Stachys palustris
- Symphytum officinale
- Thalictrum flavum
- Valeriana officinalis
- Veronica longifolia

Grasslands

Flowerrich grassland G2 (Cruydthoeck, n.d.a)
- Achillea millefolium
- Anthriscus sylvestris
- Barbarea vulgaris
- Centaurea jacea
- Crepis capillaris
- Daucus carota
- Heracleum sphondylium
- subsp. sphondylium
- Leucanthemum vulgare
- Lotus pedunculatus
- Pastinaca sativa subsp. sativa
- Plantago lanceolata
- Prunella vulgaris
- Ranunculus acris
- Rhinanthus minor
- Scorzoneroides autumnalis
- Silene latifolia subsp. alba
- Tanacetum vulgare
- Tragopogon pratensis subsp.
- pratensis
- Trifolium pratense
- Vicia cracca
- Vicia sativa subsp. angustifolia

VEGETATION

The sheltered biotope offers a combination of tall, wild and diverse vegetation. Herb-rich grassland consists of a flower-rich meadow where various flowers can be found, attracting different insects. Simultaneously, the maximum height of 100 centimeters of the grassland, provides cover for the European Hedgehog. For this purpose, it must be mowed in phases once a year, ensuring it remains in bloom throughout the year.

The densely vegetated areas created to provide shelter and food for the house sparrow and Europen Hedgehog include various plants and shrubs intermingled with each other. These densely vegetated areas have lower vegetation at the edges, gradually rising to taller vegetation and shrubs in the centre.

The existing trees will be preserved and supplemented with various Fagus, Acer, Alnus and Salix trees. As the trees need time to grow, various trees will be planted at the beginning of the project. Over time, when the beech trees are fully grown, the overgrown trees are moved to other locations.

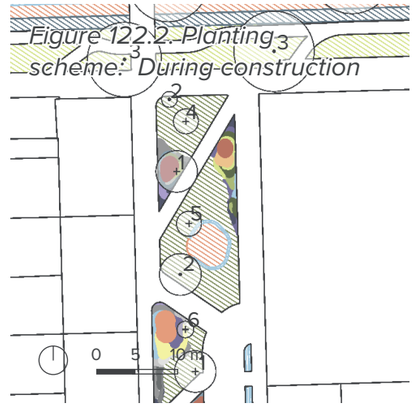


Figure 122.2. Planting scheme: During-construction

Vegetation
- Crataegus monogyna
- Sambucus nigra
- Prunus spinosa
- Alliaria petiolata
- Valeriana officinalis
- Knautia arvensis
- Persicaria
- Verbena officinalis
- Bistorta officinalis
- Geranium phaeum
- Thymus vulgaris
- Waldsteinia ternata
- Ajuga reptans
- Origanum
- Epimedium grandiflorum
- Malva sylvestris
- Echinops
- Lýthrum salicária
- Hylotelephium telephium

Trees
1. Fagus sylvatica
2. Pyrus communi
3. Tilia cordata
4. Acer negundo
5. Alnus glutinosa
6. Salix alba

Figure 122.1. Planting scheme: Full-grown trees

ALL-INCLUSIVE CONNECTION

Figure 123. Impression all-inclusive street: Utenhagestraat.

Figure 124. Current impression: Utenhagestraat.

IMPRESSION

The all-inclusive street is a place where all target species intentionally come together. Due to the broader structure of these original main roads, there is the opportunity to integrate the various needs and requirements of the target species into a cohesive whole.

By removing the parking spaces and roadways, space is created for a new street scene, where the north side accommodates taller vegetation with more trees, while the southern side of the street provides space for an open grassland. A water element separates those two sides.

In this street, various parking garages are present, which on this side are accessible to the roofs by the stairs.

DESIGN CHOICES

The all-inclusive street concerns various design choices that contribute to the liveability of different target species. These contributions to the living environment of the target species are explained based on the technical cross-section.

1. Existing trees are preserved. Willows and alders are planted on the northern bank and provide shelter for the house sparrow, and like the adult vagrant darter, they can forage for small insects here. Human liveability is enhanced due to the air-purifying effect and cooling provided by the trees. The European hedgehog utilizes the roots, and the deciduous tree contributes to the shelter of the hedgehog and serves as a habitat for the caterpillars of the common blue. Lastly, the trees contribute to the necessary connectivity for the common pipistrelle.
2. Lampposts are designed not to obstruct the flight paths of the common pipistrelle but to provide street lighting for humans using bat lamp technology (Ministry of Infrastructure and Water Management, n.d.). A shallow bowl is situated on top of the lamppost, where the house sparrow can take a bird bath. This way, the lamppost serves a function to several target species, as shown in Figure 113.1. This specific lamppost replaces the existing lampposts in the entire neighbourhood.
3. The bird palace, as designed by Studio Ossidiana (2021), is located in the middle of the water, where the European hedgehog can take a break while swimming and the house sparrow can find a place to stay. Figure 125.2 shows what this bird palace looks like.

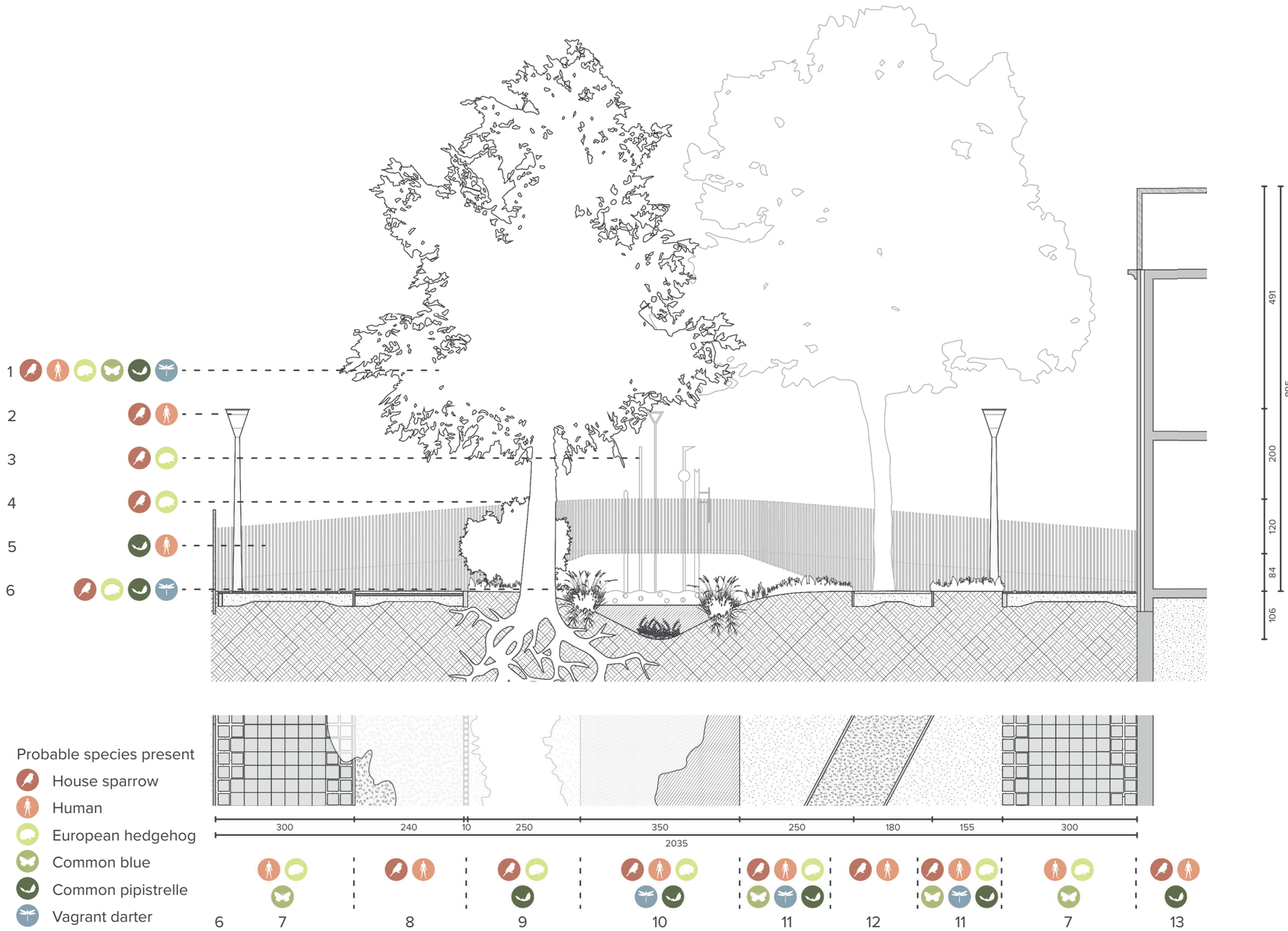


Figure 125. Technical section sheltered biotope residential street: Klaverstraat.

4. Dense vegetation with fine twigs provides decking for the hedgehog and the house sparrow.
5. The bridge is inspired by the bat bridge (2015) and includes various accommodations for the common pipistrelle, while the human species can use this bridge to cross the water element. Figure 125.3 shows what this bat bridge looks like.
6. Shore vegetation provides a hiding place for the house sparrow and the European hedgehog. For the vagrant darter and the common pipistrelle, the shore vegetation serves as a connection.
7. The wide-set pavement accommodates a "shared space" accessible to human cyclists and pedestrians. The road is wide enough for a car, in case accessibility by car is necessary, such as during relocation or in the case of an ambulance. However, car use is minimal. The European hedgehog also uses this pavement as a quick walking route. The common blue use the open spaces at the edges of the tiles where its host plants grow.
8. The bike paths are covered with red gravel, which allows humans to use the space for cycling while providing the house sparrow with grit to eat. Figure 125.1 shows what this material looks like.
9. The combination of herb-rich grassland and vegetation provides a place for the European hedgehog, common pipistrelle, and house sparrow to forage under cover. Additionally, hawthorns provide berries that are consumed by the house sparrow and hedgehog.
10. The water provides extra space for rainwater, preventing flooding. Due to the slope, the hedgehog can climb out of it when it is swimming. The water serves as a drinking and bathing spot for the house sparrow and a habitat and foraging spot for the larvae of the common darter. Additionally, the common pipistrelle can forage in the vegetation at the water's edge.
11. Open herb-rich grasslands serve as foraging and resting places for the house sparrow, hedgehog, common blue, and adult vagrant darter. Additionally, the grasslands provide a cooling environment for humans.
12. The gravel paths function as walkways for humans. Furthermore, the house sparrow can consume the gravel to aid digestion. Gravel is also present within the additional smaller pedestrian paths in the middle of the all-inclusive streets, and sheltered residential streets.
13. Thanks to the open cavity walls, the houses are a residence for both humans and the common pipistrelle.

Figure 125.1. Red pebbles. (GSB Tuinmaterialen, n.d.)

Figure 125.2. Birds Palace designed by Studio Ossidiana. (Studio Ossidiana, 2021)

Figure 125.3. Bat Bridge designed by Next Architects (Rutting, 2015).

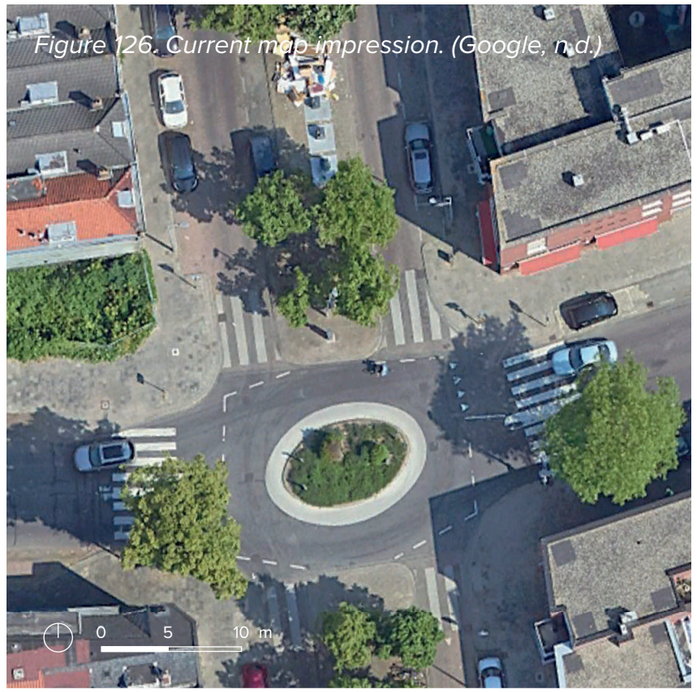


Figure 126. Current map impression. (Google, n.d.)

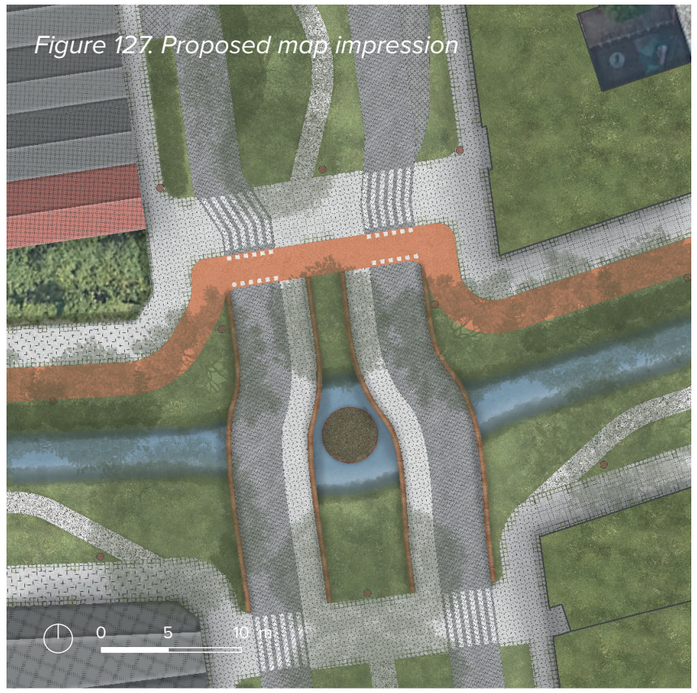


Figure 127. Proposed map impression

Aquatic plants
- Submerged aquatic plants
- Bank flora OE-27 (Medigran, n.d.b)
- Rugged flora RN-28 (Medigran, n.d.b).

Grasslands
- Flowerrich grassland G2 (Cruydthoeck, n.d.a)
- Flowered lawn M5 (Cruydthoeck, n.d.b)
- Flower mixture WV (Cruydthoeck, n.d.c)

Vegetation
- Crataegus monogyna
- Cornus
- Berberis vulgaris
- Prunus spinosa
- Alliaria petiolata
- Valeriana officinalis
- Knautia arvensis
- Persicaria
- Corylus avellana
- Verbena officinalis
- Geranium phaeum
- Bistorta officinalis
- Thymus vulgaris
- Waldsteinia ternata
- Euonymus europaeus
- Ajuga reptans
- Epimedium grandiflorum
- Malva sylvestris
- Lýthrum salicária
- Hylotelephium telephium

Trees
1. Fagus sylvatica
2. Tilia cordata
3. Acer negundo
4. Alnus glutinosa
5. Salix alba
6. Robinia

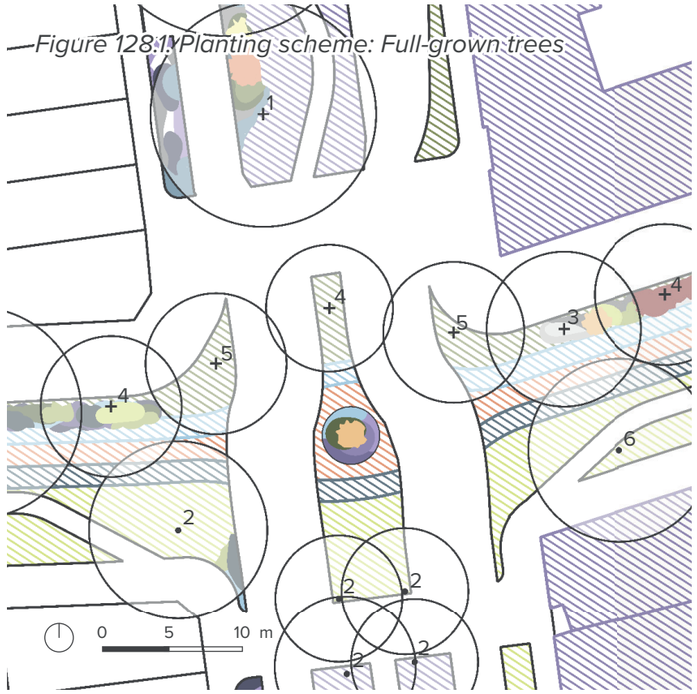


Figure 128.1. Planting scheme: Full-grown trees

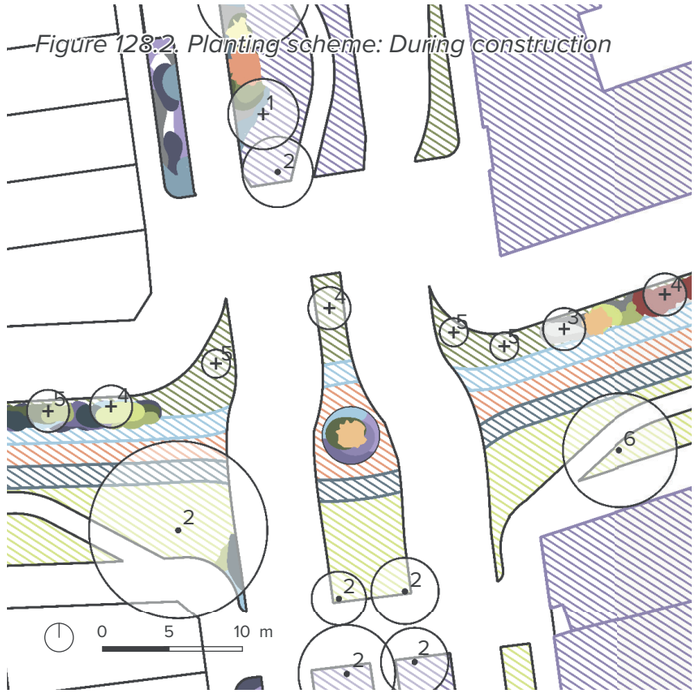


Figure 128.2. Planting scheme: During construction

VEGETATION

The all-inclusive street provides space for tall and wild vegetation on the north and open grasslands on the south. This division is also visible within the shore vegetation. The flora that flower mixes include are mentioned in the open and sheltered biotope planting schemes.

The flora grasslands and planting in the middle of the streets accessible for cars consist of lower and intensive grasslands that are also present on flat roofs to provide an overview of the traffic.

The existing trees are preserved. On the north side of the street extra trees, such as the acer negundo, salix alba and alnus glutinosa are planted. As the trees need time to grow, when the trees are growing taller, some trees are moved to other locations to maintain the necessary space for the present trees.

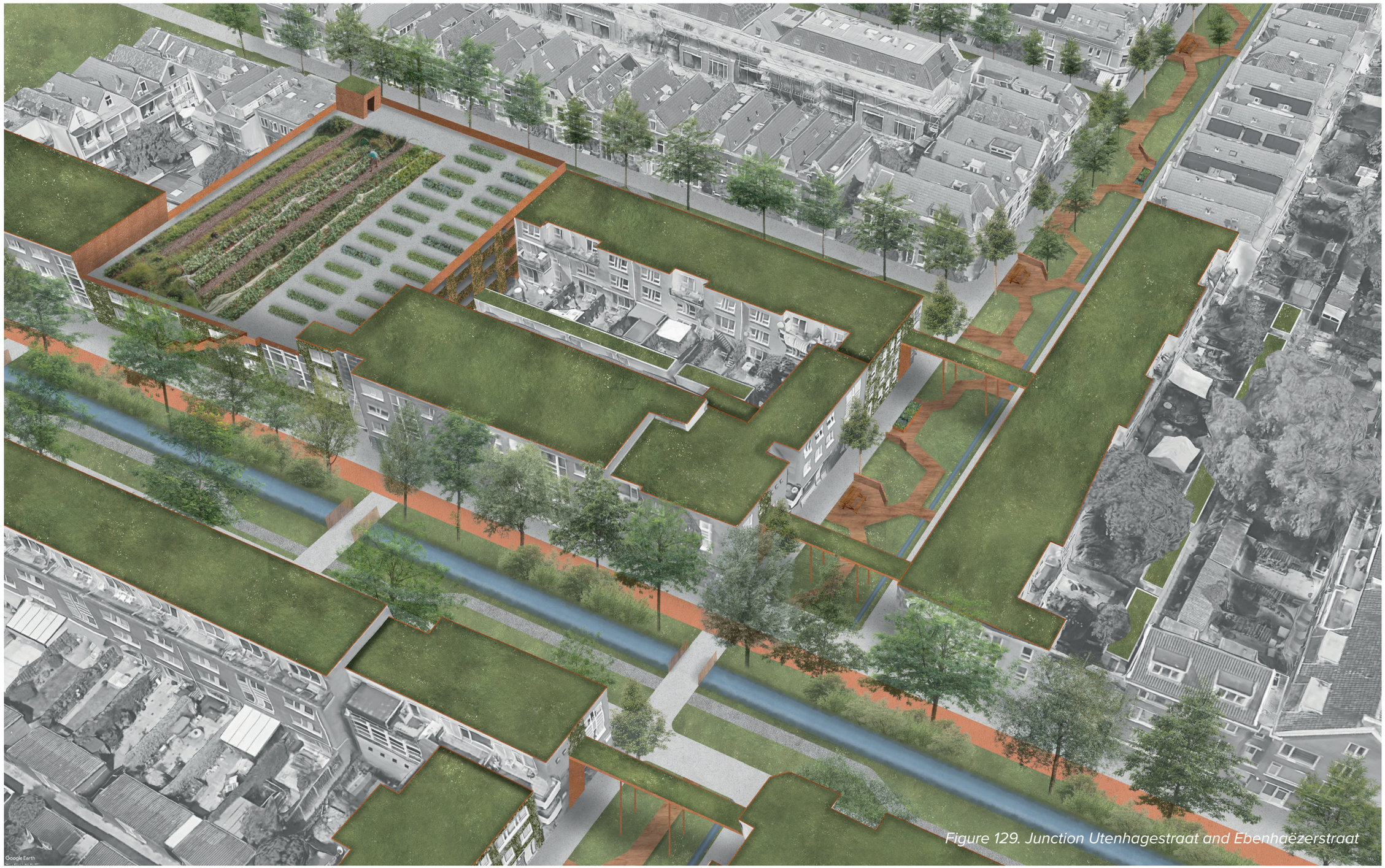
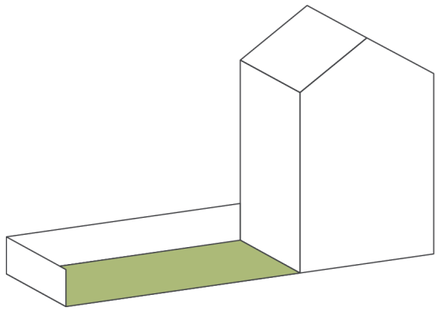


Figure 129. Junction Utenhagestraat and Ebenhaëzerstraat

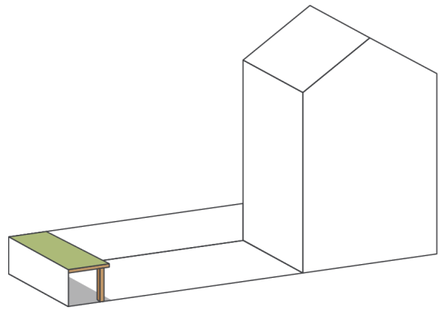
PRIVATE PROPERTY

The second starting point states that private properties will be preserved as much as possible. One reason for this is the high percentage of private owners. The necessary interventions that take place to the private properties within the design for improving ecological justice are transforming flat roofs into herb-rich grasslands, making cavity walls and the space under the roof tiles of buildings available, and the removal of several properties to make space for parking lots. However, private properties can also contribute to a more habitable environment for target species in other ways. These interventions shown in Figure 130 relate to the buildings and back yards and can be applied by residents themselves to promote ecological justice within Carnisse. The coloured icons show for which target species the intervention has positive benefits.

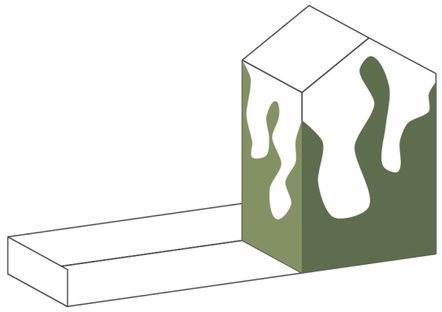
House sparrow
Human
European hedgehog
Common blue
Common pipistrelle
Vagrant darter



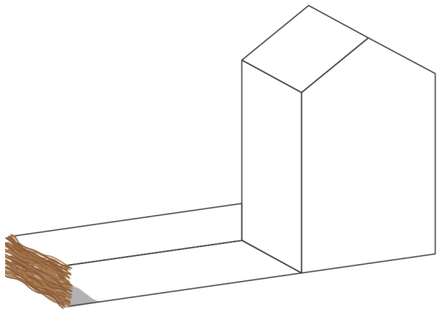
Herb-rich grassland



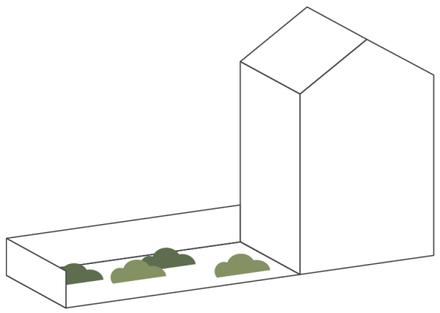
Canopy with herb-rich grassland



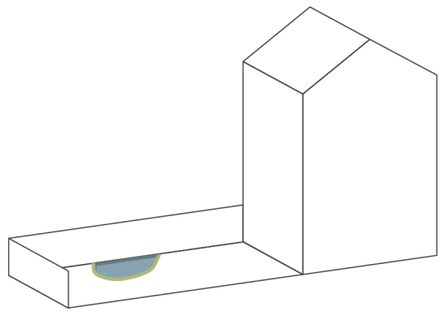
Climbing plants on façade



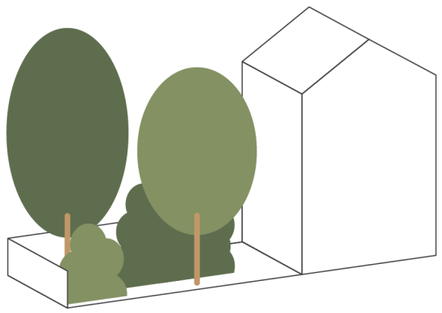
Branch rills instead of fences



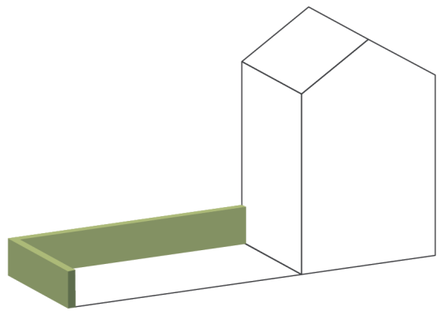
Low vegetation



Pond



Upright vegetation



Hedges instead of fences

Figure 130. Possible interventions for private properties to enhance ecological justice.

CONCLUSION

By using the starting points the values of ecological justice can be implemented in the context of Carnisse. These starting points are:

1. The specified toolbox is implemented within the design, for each design choice the different elements have to be taken into account.
2. The current privately owned properties will not be adjusted, unless the designer deems it absolutely necessary to improve the ecological justice.
3. There is the case of context consideration, unless the designer deems it absolutely necessary to improve the ecological justice.
4. When conflicts arise between different target species, zoning is used to determine the final design choice.

The first, third and fourth of these starting points are tied to the values of ecological justice. The toolbox encompasses the different target species and treats them equally. This is a contribution to participation. The elements within the toolbox show the capabilities, needed for each target species to lead a healthy and fulfilling live. Finally the toolbox also shows the relations and interactions between the different target species, which leads to recognition. Context consideration replaces the equal distribution as described in the chapter 2 Theory & methodology. The current ecological processes are recognized within context consideration by taking into account the existing biotopes. Zoning can contribute to the context consideration.

Within the design phase it is important that biocentrism and nature-based thinking are constantly present in the background, in order to ensure an ecological just design. As stated in the starting points the choices between private property and context considerations are in the hands of the designer and allows starting points to be transcended. The reasoning behind this approach is the fact that the current situation is designed for the human, and therefore inherently unjust. The terms justice and injustice are subjective in this case, so therefore not measurable. What can be considered an ecological just environment is dependent on the perception of each individual. Besided this, the current method of city design and planning also originates from a human perspective. By allowing the designer some freedom to transcend the principles that relate to the current situation, it becomes possible to better look after the non-human species. Nevertheless do choices still remain biased, because the design is still made from a human perspective and knowledge on the ideal situation for the other target species remains limited. For this reason it is also important to remain transparent during the design process regarding the implemented decisions. The final design presented in this chapter shows how the implementation of the ecological justice values can be translated into a design in the spatial context of Carnisse.

Figure 131. Proposed design Utenhage street.

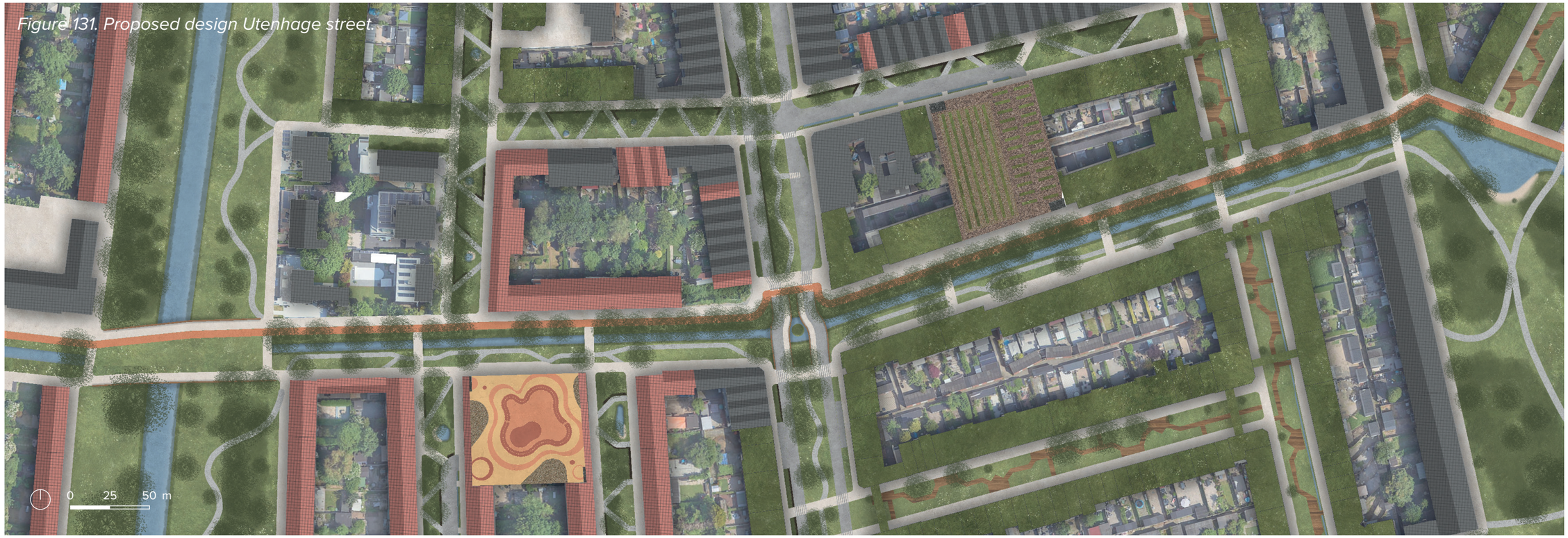


Figure 132. Collage of NPRZ and proposed urban renewal. (Adapted from De Nijl Architecten, 2021)

06

COMPARISON

COMPARISON

Current NPRZ and proposed ecological justice urban renewal concepts and spatial plans are compared in this chapter to determine the effect of ecological justice values on urban renewal. Chapter 3, Current Urban Renewal, delves into the current urban renewal in Carnisse guided by the NPRZ plan. Chapter 4 Liveability, and chapter 5 Design, explore how ecological justice values could integrate and how this affects urban renewal processes and spatial plans.

The conceptual framework divides the consequences of the adopted approach, NPRZ and ecological justice, into worldview, purpose, approach, and governance & space. These various aspects are interconnected, as one influences the other. The different aspects are categorised into concept, guiders and spatial plan, as shown in Figure 133. Based on these three categories, the two approaches to urban renewal are compared and evaluated. The concept pertains to the definition and aim of urban renewal, based on the worldview and purpose and affects how urban renewal occurs. The concept also has implications for the three category, spatial plans. Spatial plans are the spatial translation of these two aspects, guided by the approach based on existing structures and governance & space, indicating who the stakeholders are and how they come together in the physical environment.

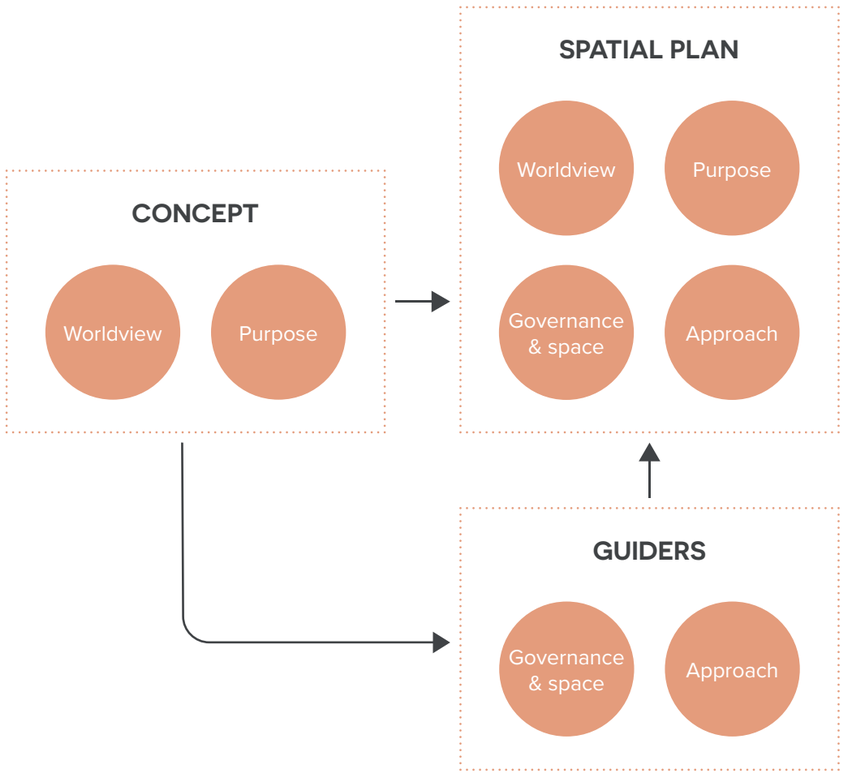


Figure 133. Framework concept to spatial plan.

CONCEPT

Anthropocentrism is evident within the current worldview of Dutch urban renewal, including the NPRZ plan. The focus of this urban renewal is on humans, as reflected in the goal of improving the liveability of its human residents. However, considering the worldview concerning the values of ecological justice leads to biocentrism, where humans are handled as equals to other life forms. Approaching urban renewal from this worldview would shift the purpose. The redefined aim of urban renewal is to improve the liveability of all living, human and non-human.

This shift in the purpose of urban renewal affects the position of humans within the renewal process. In the current form of urban renewal, such as in NPRZ, the focus is on improving the liveability of humans, with interventions for other life forms only occurring when mandated by regulations. However, in the ecological justice urban renewal, where humans share their central position with non-human species, it may result in less human influence in resolving conflicts and potentially less prioritization of human interests compared to current urban renewal. In ecological justice urban renewal, human liveability may receive less depth and consideration compared to the current urban renewal, while non-human species receive more attention as their liabilities are balanced.

Also, the approach to liveability shifts in ecological justice urban renewal compared to the NPRZ approach. The NPRZ approach shows a strong separation between social and physical aspects of liveability, reflected in physical and social domains of urban renewal, with limited overlap between the two (W. Ruiter, personal communication, October 18, 2023). In the ecological justice approach to liveability, social characteristics are directly related to physical aspects, mirroring the consideration given to non-human species. The spatial plans reflect this integrated approach where these social and physical domains converge. This integration offers advantages, as different aspects of liveability can collectively contribute to a solution rather than being independently addressed. However, in the current proposed project, this integration leads to a lesser emphasis on the social aspects, given the higher value placed on the human species.

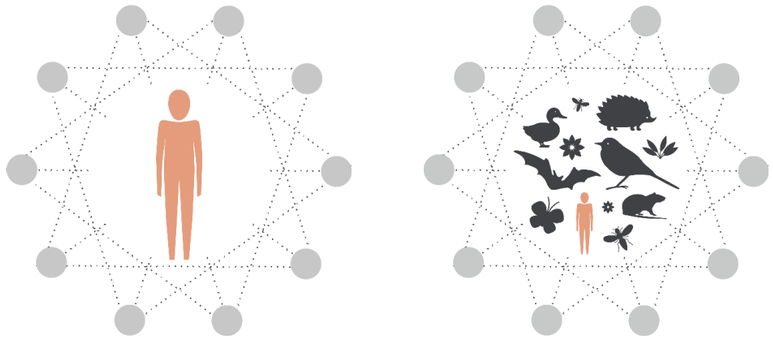


Figure 134. Left: human-centered. Right: humans need to share the central position.

GUIDERS

The approach and government & space support the concept, to create the translation towards a spatial plan. In the case of NPRZ, the approach examines the existing physical and human social structures within the planning area. This human social structure focuses on specific target groups within the human species. Building upon these existing structures, improvements or adjustments are made where necessary. Similarly, in ecological justice urban renewal, the existing structures are considered, but the focus is only on physically present ones. The qualitative characteristics of the contexts are considered during decision-making but are not immediately the starting point for further development. The difference in knowledge about different species diminishes the focus on the diverse preferences of various target groups within one species. Governance & space revolve around those who participate and the space for interaction within the project. In the case of the NPRZ plan, this exclusively involves humans. In the case of ecological justice, it extends to all present species, emphasizing encounters between humans and non-human species. Due to the non-understandable communication methods of non-human species for humans, an active participation process cannot take place. However, experts can represent these non-human species.

SPATIAL PLAN

The concept and the guiders together lead to a spatial plan. The NPRZ plan is still under construction. Therefore, the plan consists of a vision and future perspectives, described in Chapter 3, Current urban renewal. The NPRZ plan is compared to the proposed ecological justice values design, based on various aspects of liveability as described in Chapter 4, Liveability. The comparison includes residence, amenities, connectivity, and safety. The environment is not considered in this comparison since this aspect is incorporated with the other aspects of liveability.

RESIDENCE

Within the NPRZ plan, related to residence, the flow within human dwellings and a well-ordered home base are central. These elements only affect the human species and do not contribute to the liveability of other non-human target species. However, one of the aims is to create a green environment by giving more space to existing trees in the form of tree pits and adding vegetation. These elements serve as the residence for the house sparrow, hedgehog, bat, and common blue butterfly. These target species, perhaps unconsciously, also receive a residence. However, the suitability of these residence places for these target species is questionable, as the vegetation used and its management are not further explained, except for the aesthetic aspect according to human standards. This aesthetic does not always align with high plant diversity and often leads to intensive green management to keep it tidy. This contradicts the residence of the house sparrow and the hedgehog, which require rougher and denser vegetation, and the common blue, which needs the litter layer of trees and shrubs.

In the proposed plan, it is evident that only the residences of the non-human target species are improved. However, buildings change by making cavity walls accessible for the common pipistrelle and opening roof tiles for the house sparrow. This may result in reduced liveability for the human species due to potentially higher energy consumption. The residence of the common blue is improved by adding host plants, dense grass polls, and maintaining litter layers from deciduous trees. The hedgehog also uses the deciduous trees for hibernation when collected as leaf piles in tree pits. Trees and vegetation are added, as in the NPRZ plan, but to a greater extent. Additionally, diversity between plant species is enhanced to create suitable residences for different species. Finally, the added water provides a residence for the vagrant darter.

AMENITIES

Within the NPRZ plan, amenities focus mainly on meeting and playing spaces for human residents, achieved by creating space through wider sidewalks in residential streets and in the Lepelaarsingel and Amelandseplein. The NPRZ plan also emphasizes providing space for suitable economic activities in the area and offering meaningful activities such as schools and work. These three aspects are related towards human amenities. However, the greenery, trees, and tree pits also promote amenities for non-human target species. The European hedgehog, common pipistrelle, common blue, and house sparrow can forage in these areas. However, the suitability of these amenities for the needed provisions of these target species is questionable, as the vegetation used and whether it meets the needs

of the required amenities are not further explained. In many urban renewal projects, the quality is insufficient due to one-sided planting and mowed grasslands, which contradicts the required amenities for different target species.

In the proposed plan, it is clear that the focus on human amenities also includes providing economic activities and social interaction. However, in the proposed plan, the focus is both on meeting between humans and between human and non-human species. The meeting is encouraged by the green environment (WUR, n.d.b; Kennisportaal Klimaatadaptatie, n.d.). Additionally, the proposed plan focuses on diversity in vegetation within the greenery, including variations in heights and types, to create a versatile living environment for different target species. The addition of various plantings provides amenities for humans and non-human target species, as fruits from bushes and trees can be eaten by the European hedgehog, house sparrow, and humans. Moreover, the waters are enriched with water plants and natural shores, providing more space for the larva of the vagrant darter and expanding the foraging area for the common pipistrelle.

CONNECTIVITY

The NPRZ plan related to connectivity focuses on prioritizing human pedestrians and cyclists over cars. However, the entire area must remain accessible to cars, including parking spaces. The pavement used to accomplish this, does not contribute to the liveability of other non-human target species. The reduced emphasis on cars is fulfilled by the implementation of partially one-way traffic within the neighbourhood. One-way roads leave more space for pedestrians and cyclists, positively affecting humans and the European hedgehog by reducing the risk of collision with a motorized vehicle. The added greenery and front gardens contribute to improved connectivity for the European hedgehog, common blue, and vagrant darter. However, the question remains if these connections are suitable for these species, as the European hedgehog depends on slightly higher dense vegetation, while the common blue and vagrant darter prefer open grasslands. Moreover, this added greenery is in the form of stepping-stone connections and not continuous green structures, as the pavement takes precedence as a connected path. Additionally, the tree structures provide connections for the common pipistrelle.

In the proposed plan, consideration is given to the paved connections for humans, but with minimized car traffic, which may result in reduced connectivity for humans. Also, parking spaces on the ground level are moved to parking garages, which means that human residents may have to walk further to reach their cars than in the NPRZ plan. This is however compensated within the proposed plan by improving pedestrian, cycling, and public transport connections, enhancing human connectivity. By moving parking spaces and minimizing roads accessible to cars, more room is created, which gives space to improve the connectivity of low and high green and water structures. This leads to improved liveability for all non-human target species. However, this may result in a less attractive living environment for humans, as this shape of greenery may be perceived as wilderness. The added trees contribute to enhancing the connectivity of the common pipistrelle.

SAFETY

Within the NPRZ urban renewal plan related to safety, the focus is on crime control, primarily addressed from the social domain and visibility in public spaces. Visibility in public spaces goes together with lampposts, which have a positive effect on humans but a negative impact on the common pipistrelle, and low vegetation. Low and open vegetation can coexist with open grasslands, thus expanding the habitat of the vagrant darter and the common blue. However, this visibility often leads to mowed monotonous grassland. Indirectly, the design contributes to the safety of the European hedgehog, as street vegetation and front gardens provide hiding places during movement and foraging, reducing space for cars.

In the proposed plan, the focus is not on crime control. However, offering nature in the environment, based on the various needs of the target species, contributes to reduced urban crime, indirectly affecting the human residents of Carnisse (Shepley et al., 2019. On the other hand, increased greenery may impact the perceived safety, as some areas lose visibility. Regarding street lighting, it remains present for human safety, but specific lighting is adapted to prevent hindering the liveability of the common pipistrelle. Water storage is added, contributing to the safety of all different target species by protecting various habitats from flooding. Additionally, the water elements contribute to cooling the environment, positively affecting human health (STOWA & Stichting RIONED, 2014). The water has a natural shore, protecting the European hedgehog against drowning. Lastly, the safety of the common blue and vagrant darter increases by phased mowing and a ban on pesticide use. Although, this includes more intensive management for the human species, making it potentially challenging.

POSITIVE EFFECTS OF GREEN AND WATER AMENITIES

From the comparison, it is evident that improving the liveability of non-human target species aligns with adding green and water amenities. Specific green and water amenities contribute uniquely to the habitat of the respective target species. However, high-quality and diverse green amenities also impact the liveability of the human species. Increased and diverse vegetation correlates with improved air quality, reduced urban heat island effect, enhanced water quality, increased biodiversity, improved health due to less stress and lower risks of cardiovascular diseases, depression, and anxiety disorders, increased social interaction leading to reduced loneliness and enhanced social cohesion, and reduced urban crime (Shepley et al., 2019; Kennisportaal Klimaatadaptatie, n.d.).

Water in public spaces provides storage for rainwater and has a cooling effect on the living environment, contributing to a more pleasant environment for humans (STOWA & Stichting RIONED, 2014). Although the proposed plan slightly shifts focus away from human liveability, it simultaneously results in positive effects on the human species.

POSITIVE EFFECTS OF INCREASED BIODIVERSITY

By improving the liveability of non-human target species, biodiversity increases within the area, primarily due to increased diversity in flora and possibly fauna. This positively affects ecosystem services within the neighbourhood, leading to improved air quality, climate, water management, the well-being of human residents, and increased awareness of nature. Additionally, there is better protection against diseases, and fewer pests are present (WUR, n.d.a; Vink et al., 2017).

SPATIAL COMPOSITION

Finally, we examine how the various focal points of the NPRZ and ecological justice-based plan come together in the perspectives. Although these perspectives are not in the same location, they provide impressions of the same streets. First, the residential streets are visible in Figures 135, 136, and 137. In all three streets, greenery is implemented. In NPRZ, this takes the form of tree pits and front gardens, while in the proposed designs, low and higher vegetation is present throughout the entire street. The type of vegetation varies per zone. Due to the comparatively reduced addition of greenery, the liveability of non-human target species remains limited, reducing the positive side effects of these green amenities and biodiversity compared to the proposed plan. Additionally, the higher percentage of pavement increases the risk of waterlogging.

Figures 138 and 139 show the future perspective of the city streets. Both perspectives show that more space is given to vegetation. Within the NPRZ plan adding tree pits and front gardens, and in the proposed plan removing the paved road. Both plans also provide more space for cyclists and pedestrians. However, in the NPRZ plan, the focus on car accessibility remains, which involves paved roads and parking spaces, not contributing to the liveability of other target species.

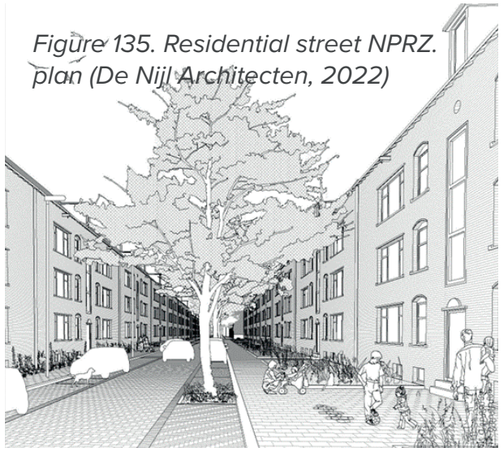


Figure 135. Residential street NPRZ. plan (De Nijl Architecten, 2022)

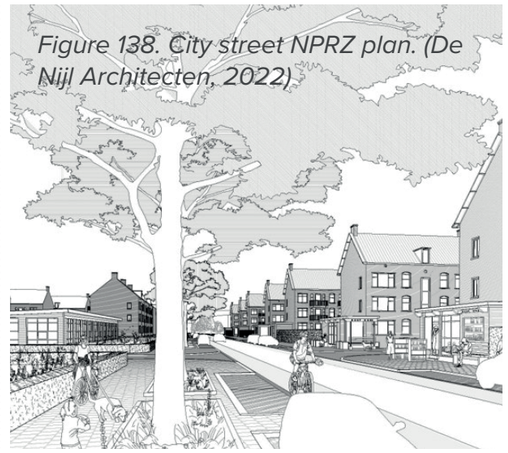


Figure 138. City street NPRZ plan. (De Nijl Architecten, 2022)

Figure 136. Residential street proposed plan.

Figure 139. City street proposed plan.

Figure 137. Residential street proposed plan.

CONCLUSION

To determine the influence of ecological justice values on urban renewal concepts and spatial plans in Carnisse, the NPRZ plan and the proposed plan based on ecological justice values have been compared. This comparison takes place at the conceptual, guiding principles (guiders), and spatial plan levels.

Within the concept and guiders, it is evident that incorporating ecological justice values into urban renewal leads to a revision of the approach and purpose of urban renewal. The proposed plan includes more stakeholders as more species gain consideration. This shift changes the goal of urban renewal, which in the NPRZ plan focuses on improving human liveability, but in the plan based on ecological justice on the well-being of all present species in the area. Due to this change in purpose, the position of human residents within urban renewal changes. They now have to share their space with non-human residents, resulting in relatively less consideration for humans and more for non-human species, as their interests are balanced.

Furthermore, the ecological justice values approach aims to reduce the strong separation between the social and physical domains present in current urban renewal practices. This reduction leads to more integrated solutions, replacing interventions that work independently due to their confinement to physical domains. However, in this thesis, the social aspect of humans is less thoroughly analyzed due to a lack of knowledge about the other target species.

The spatial plan shows the effect of interventions from the NPRZ and ecological justice values plan on the different target species. This analysis covers residence, amenities, connectivity, and safety. The comparison reveals that the NPRZ plan focuses more on the human species, but its interventions may likely also have indirect and unconscious positive effects on other target species. However, the extent of these positive effects is questionable. The proposed plan, based on ecological justice values, aims to enhance the living environment specifically for non-human target species and shows interventions that improve the living environment for both human and non-human target species. Research also indicates that meeting the needs and requirements of different non-human target species through various green amenities leads to positive effects on humans, thereby shifting the focus back to human liveability.

Figure 132. Collage of NPRZ and proposed urban renewal (Adapted from De Nijl Architecten, 2021)

Figure 140. Strengthening the bond between humans and nature. (EVA, n.d.)

07

CONCLUSION AND REFLECTION

CONCLUSION

The research question of this thesis is *"How can values of ecological justice contribute to a spatial design that improves urban renewal in Carnisse, Rotterdam?"*. The answer to this question is provided by combining the answers of the different sub-questions addressed in chapters 3, 4, 5 and 6.

The approach to urban renewal has evolved over the years, with the area-based approach playing an increasingly significant role. This approach focuses on an integral design involving both social and physical interventions, aiming to achieve an ideal form of urban renewal. This is also the case in Carnisse, where an urban development plan has been established under the guidance of NPRZ. In the renewal of this neighbourhood, the emphasis is on the participation of human residents to improve their liveability. Other present species are not considered in this process, leading to ecological injustices in the stages preceding and simultaneous to the spatial design development. The consequences of this approach are evident in the proposed design for Carnisse, where social and physical interventions take place for the benefit of the human species. Non-human species may experience positive side effects, such as the creation of a greener environment. However, this does not necessarily mean that this greener environment aligns qualitatively with the needs of non-human species.

To better incorporate the values of ecological justice into urban renewal, it is crucial to first identify the species present and understand the desires and needs of these different species. A toolbox can be developed based on this information, providing an overview of the elements needed to create a liveable environment for both human and non-human species. Additionally, by analyzing the current urban structure, it can be determined which biotopes are essential for each species and which different species converge in different biotopes. This convergence and interaction among different species contribute to strengthening the relationship between human and non-human species, in other words, the core of ecological justice.

Subsequently, the translation of the values of ecological justice into a spatial design is made based on various principles. In the case of Carnisse, these principles are:

1. The specified toolbox is implemented within the design, considering different elements for each design choice.
2. The current privately owned properties will not be adjusted unless the designer deems it necessary to improve ecological justice.
3. There is the case of context consideration unless the designer deems it necessary to improve ecological justice.
4. When conflicts arise between different target species, zoning is used to determine the final design choice.

Throughout the design process, biocentrism and nature-based thinking continue to play a role in striving for an ecologically just design. Subjectivity exists in this design process because justice is not measurable, and individuals may perceive it differently. Due to this subjectivity, it is important to maintain transparency about design choices during the translation into the spatial design.

Comparing the proposed design, based on the values of ecological justice, with NPRZ's urban renewal plan reveals that ecological justice values contribute to increased inclusivity by incorporating not only humans but also other present species within urban renewal. By considering both human and non-human species in the design, there is a greater emphasis on integrated urban renewal, as opposed to the current sectorized urban renewal. The integrated approach stems from the interconnectedness of social and physical domains concerning the liveability of non-human species, a relationship not present in the human definition of liveability. This integrated approach results in more efficient interventions since the aspects are no longer treated independently, preventing duplication of efforts.

The second consequence of expanding the number of stakeholders is that human liveability within the NPRZ plan receives relatively more attention than in the proposed plan related to ecological justice values. This occurs due to the attempt to provide equal depth to all target species, leading to less focus on human liveability and more attention to non-human target species compared to the NPRZ plan. However, the focus on the liveability of these non-human target species contributes not only to the living environment of these species but also to the living environment of humans. This is due to the positive effects of green and water amenities on humans, resulting in expanding ecosystem services. It may be concluded that ecological justice values in urban renewal contribute to both, improved liveability for non-human species, valuable from an Arcadian position, and human liveability and climate adaptation, valuable from a resource point of view.

REFLECTION

LIMITATIONS AND FURTHER RESEARCH

Ecological justice as a subjective concept

Justice is a subjective concept. Therefore, what sounds just to one person is not necessarily just for another. For this reason, making decisions during the project was sometimes challenging. An intervention may have positive outcomes for one entity but simultaneously negative ones for another. Since subjectivity was inevitable in the design, I tried to make the rationale behind my choices as transparent as possible. This way, the reader can decide whether they agree or not. In making choices during this thesis, the well-being and liveability of non-human species are often prioritized, since humans are already many steps ahead of non-human species in terms of liveability.

I think ecological justice remains an idealistic theory rather than an achievable destination. Nevertheless, striving for this ideology in urban planning is commendable. However, creating a fully ecologically just neighbourhood is impossible, as an environment is always more liveable for one individual or species than another. It is essential to create a liveable place for all different species, even if it means dealing with limited space in some cases.

For further research, it may be interesting to find out if it would be possible to measure ecological justice to see how an area can be designed and evaluated by considering all present species.

Limited research on species

Due to time constraints and limited knowledge about different target species, the analysis of these target species remained relatively superficial. The superficial analysis of other non-human target species led to the attempt to conduct an equally in-depth study for humans, which resulted in less focus on human liveability than is the case within the NPRZ plan. Additionally, due to time constraints and limited knowledge about the needs and requirements of both human and non-human target species, some elements may be missing in the field of liveability.

This research only examined six target species. To further improve the liveability of the present species, it is advisable to expand this number and explore further, for example, considering soil fauna and emphasizing different interactions. Besides, having more time makes it possible to go deeper into the core of the needs and problems faced by the target species.

Lack of the social aspect

NPRZ's proposal extensively addresses the social aspect of urban renewal, which contradicts this graduation project, where the social aspect is not an independent entity. This decision was made since, for non-human target species, the social domain is one-to-one related to the physical domain. Due to the decision to equalize the focus on liveability among all target species, this social aspect for humans is incorporated within the physical domain as well. On one hand, this results in a more integrated approach to the physical and social domain. On the other hand, due to limited time and research on other species, this resulted in a more superficial approach to the social aspects of human liveability, which is a limitation of this thesis.

In further research, more time could be spent to investigate the desires of the different target species, which results in equally more attention to the social aspect of the human species.

Consequences of more greenery

Within this thesis, a detailed examination of the management afterwards, required for the proposed plans and the plans of NPRZ, has not been conducted. Increased greenery results in more specific maintenance, which must be carried out by humans. Besides, within the proposed plan, spontaneous plant growth should be allowed to flourish. However, this can also coincide with planting that contributes to hay fever symptoms among human residents, despite considerations in the planting plan. Furthermore, more greenery also entails an increased need for water during the summer months, which, during prolonged droughts and water shortages, can pose problems. Future research can focus more on the management and choice of plants to provide low-maintenance planting. Currently, only the required soil, environment, physical characteristics of the vegetation, and whether the flora is native is considered. Additionally, climate change introduces new and different climates even within this area, which could result in other use of flora.

Realisation

Only after the realisation of the project can the effects of incorporating ecological justice values into urban renewal processes and spatial plans be truly examined. Even then, it will take years, in which ecological justice within the location continues to grow, given the time nature requires to develop.

The impact of ecological justice values within urban renewal processes and spatial plans can be investigated by counting existing species, studying human liveability, and examining the effects of climate change in this area compared to similar neighbourhoods where there is no emphasis on ecological justice values. Furthermore, a greater focus on a design that aligns with the liveability of non-human species does not guarantee their immediate presence. If this is not the case, it will also result in reduced positive effects on the human residents of Carnisse.

TRANSFERABILITY OF THE PROJECT

This graduation project focuses on Carnisse in Rotterdam, but elements of this thesis are transferable to other equal projects. The revised aim of urban renewal helps to increase ecological justice within the urban renewal process by including more species than just human species. This will also affect the currently sectorized approach between the social and physical domains.

The translation of ecological justice values into a spatial design is based on the existing context and present species in the neighbourhood. Applying equal interventions may not have the same effect due to variations in existing structures, habitats, target species and ownership arrangements. However, analyzing the present (target)species, context consideration, and zoning, based on characteristics of the context, could be applied to other areas facing urban renewal to create area-based solutions that increase ecological justice. Overall, subjectivity in choices made and the degree of bias in the designer can result in different outcomes while attempting to increase ecological justice similarly. Nevertheless, inspiration can be drawn from this project's approach and spatial outcome to create a more ecologically just design in another neighbourhood facing similar issues.

RELEVANCE

Scientific relevance

Environmental and ecological justice are closely related to one another. Environmental justice covers the distribution of environments among human beings, and ecological justice covers the relationships between humans and the rest of the natural world (Low and Gleeson, 1998). Even when closely related, environmental justice gained significantly more interest in the past decades (Wienhues, 2020, p. 9). This is also the case within the field of urbanism. Due to a lack of attention towards ecological justice, there is not much research about this within the built environment. Also, the actual translation towards the built environment is missing to test how this theory could work in these environments.

Urban renewal development is an ongoing process within the Netherlands, and its approach shifts over time. Every way of urban renewal has its advantages and disadvantages. By approaching from the ecological justice perspective, there will be positive effects on the liveability of both human and non-human species, which makes it possible to create a climate adaptive environment.

Societal relevance

Implementing ecological justice within urban renewal will lead to socio-economic justice for the human citizens of Carnisse due to the positive effect of greenery within the living environment. Currently, there are relatively many problems related to liveability in the neighbourhood. The human residents of Carnisse have a relatively lower income than the rest of Rotterdam and the Netherlands, which makes them vulnerable to climate change.

By approaching from the ecological justice perspective, the aim is to improve liveability for both human and non-human species. This is also the case in climate adaptation: ecological justice demands a just distribution of environments for all species. Giving space to flora and fauna results in a more resilient built environment towards climate change. This has positive benefits for both human and non-human citizens. There will be more co-existence benefits, such as the connection between people and nature that affects each other positively. For example, people will have improved health, less stress and encounter less crime and aggression. Also, people will be more concerned about nature and what is beneficial for all non-human species. This approach to urban renewal not only looks at the short term but also in the long-term, where the proposed plan will cause fewer climate and health-related problems for residents in the future.

Ethical consideration

Increasing and improving the urban structure by strengthening ecological justice values could increase housing prices due to added and improved green areas. As a result, current human residents might move to a better neighbourhood. Due to increased housing prices, the area might no longer provide space for low-income groups.

In addition, a big question is: to what extent should there be equality between human and non-human species? For example: is one animal equal to one human? Or should this relationship be seen differently? And what are the roles and expectations of other living species present in Carnisse? What is expected from both - humans and plants or animals? While justice is a concept conceived by humans, is it fair to expand this to other living beings that did not choose this and who cannot directly communicate within this principle?

GENERAL REFLECTION

Link to the master track

The graduation project aims to propose a comprehensive design for Carnisse at the neighbourhood level by exploring alternative solutions for the built environment. The connection between the graduation project and the urbanism master track lies in the quest for an innovative approach to the challenges of today's and tomorrow's world. The current form of urban planning must adapt, taking into account not only humans but also all other living beings with whom humans share their environment. Providing space for all present living species in an environment is crucial to combat current climate change, preserving and enhancing ecosystem services, and adhering to an ethical perspective that recognizes that all living beings should have the right to live a fulfilling life. By examining various scales and identifying the dynamics and relationships within these scales, solutions arise at the neighbourhood and street-level scale, where the actual interactions between humans, non-human species, and the physical environment occur. The outcome, a master plan for the neighbourhood, including detailed depictions of the physical environment, is akin to previous courses in the urbanism master track.

Methodology

The graduation project employs maximization and optimization methods, with a theoretical foundation systematically analyzing the needs and desires of different target species. This analysis helps understand the requirements and guides the project accordingly. Implementing these needs within the neighbourhood during the maximization process contributed to understanding the target species and what needs to be changed to create an ideal scenario. For the future, I think this is a useful approach when there is a case

of different elements that have equal importance. However, during the optimization process, questions arise about how different maximization designs can result in a "fair design" accommodating various stakeholders. To address this, a toolbox was created from the analysis, and the translation to design was made based on this toolbox and various principles.

Figure 141. Looking over the water in Amelandseplein.

08

BIBLIOGRAPHY

LITERATURE

Aghina, N., Roeke, T., & Sloots, I. (2023). *Natuurinclusief ontwikkelen: een praktische gids met stappenplan en checklists.* NPN Drukkers B.V. https://synchroon.nl/wp-content/uploads/2023/03/SYN_Natuurinclusief_Digitale-versie.pdf

Allecijfers.nl. (2023). *Statistieken buurt Carnisse.* https://allecijfers.nl/buurt/carnisse-rotterdam/

Anthropocentrism. (2023, n.d.). In *Britannica*. https://www.britannica.com/explore/savingearth/anthropocentrism#:~:text=Anthropocentrism%2C%20philosophical%20viewpoint%20arguing%20that,many%20Western%20religions%20and%20philosophies.

Atlas Leefomgeving. (2021). *Kwetsbare buurten voor klimaatrisico's*. Retrieved June 1, 2023, from https://www.atlasleefomgeving.nl/kwetsbare-buurten-voor-klimaatrisicos

Beatly, T. (2011). The Importance of Nature and Wildness in Our Urban Lives. In Beatly (Ed.), *Biophilic Cities: Integrating Nature into Urban Design and Planning.* (1-16). Island Press.

BIJ12. (2017). *Kennisdocument Gewone dwergvleermuis Pipistrellus pipistrellus.* Versie 1.0 July 2017. BIJ12. https://www.bij12.nl/assets/BIJ12-2017-004-Kennisdocument-Gewone-dwergvleermuis-1.0.pdf

BIJ12. (2023). *Kennisdocument Huismus Passer domesticus. Versie 2.1 February 2023.* BIJ12. https://www.bij12.nl/wp-content/uploads/2023/02/Kennisdocument-Huismus-versie-2.1-februari-2023.pdf
(BIJ12, 2023)

Bos, F., Bosveld, M. Groenendijk, D., van Swaay, D., Wynhoff, I., & De Vlinderstichting. (2006). *De dagvlinders van Nederland - Nederlandse fauna dl. 7.* KNNV Uitgeverij

Central Statistical Office [CBS], Netherlands Environmental Assessment Agency [PBL], National Institute for Public Health and the Environment [RIVM], Wageningen University & Research [WUR] (2016). *Verlies natuurlijkheid in Nederland, Europa en de wereld.* Compendium voor de leefomgeving. https://www.clo.nl/indicatoren/nl1440-ontwikkeling-biodiversiteit-msa

Chapin III, F. S., Zavaleta, E. S., Eviner, V. T., Naylor, R. L., Vitousek, P. M., Reynolds, H. L., Hooper, D. U., Lavorel, S., Sala, O. E., Hobbie, S. E., Mack, M. C. & Díaz, S. (2000). Consequences of changing biodiversity. *Nature, 405,* 234-342. https://doi.org/10.1038/35012241

Cramp, S. & Perrins, C. M. (1994). The Brids of the Western Palearctic. Volume 8. Crows to Finches. In S. Cramp & C. M. Perrins (Eds.), *Handbook of the Birds of Europe, the Middle East, and North Africa: The Birds of the Western Palearctic.* (pp. 1-956). Oxford University Press

Cruydthoeck. (n.d.a). G2 *Bloemrijk grasland - zware grond.* Retrieved January 7, 2024 from https://www.cruydthoeck.nl/g2-bloemrijk-grasland-zware-grond-zakje-voor-15-25m2

Cruydthoeck. (n.d.b). *M5 Nectar onder het maaimes.* Retrieved January 7, 2024 from https://www.cruydthoeck.nl/m5-nectar-onder-het-maaimes

Cruydthoeck. (n.d.c). *WV - Weidevogelgeluk voor boerenlandvogels.* Retrieved January 7, 2023. https://www.cruydthoeck.nl/media/69/75/00/1663593209/WV%20Weidevogelgeluk%20bloemenmengsel%20voor%20boerenlandvogels%20Cruydt-Hoeck%202022.pdf

Cuvelier, S., Degrande, J., Merveillie, L., Spruytte, S., & Vervaeke, J. (2007). *Dagvlinders in West-Vlaanderen - Verspreiding en Ecologie 2000-2006*. Z.W.V.V.K.

Biocentrism. (2023, April 4). In *Britannica*. https://www.britannica.com/topic/biocentrism

Daalder, R. (2000). De stad: kerngebied voor de mens. *De Levende Natuur 101*(6), 224-226.

De Froe, A. (1959). Evolutie en menswording. *De Gids, 122*(1), 42-64

Deliège, G. & van Damme, S. (2019). *Dierschap*. Gompel&Svacina bvba.

De Nijl Architecten. (2022). R*uimtelijk toekomstperspectief Carnisse 2035: Wijk & gemeente Rotterdam*. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8

De Vlinderstichting (n.d.). *Icarusblauwtje - Polyommatus icarus.* Retrieverd September 29, 2023, from https://www.vlinderstichting.nl/vlinders/overzicht-vlinders/details-vlinder/icarusblauwtje

Dijkstra, K. (2002). Sympetrm vulgatum Steenrode heidelibel. In K.D.B. Dijkstra & A.J. de Winter (Eds.), *De Nederlandse Libellen*. (pp. 380-382). KNNV

Douglas, M. (1966). *Purity of Danger, An analysis of the concepts of pollution and Taboo.* Routledge.

Ducarme, F., & Couvet, D. (2020). What does 'nature' mean? *Palgrave Communications 6*(14). 1-8. https://doi.org/10.1057/s41599-020-0390-y

Ecology (2023, October, 25). In *Britannica*. https://www.britannica.com/science/ecology

Ecopedia (n.d.a). Gewone dwergvleermuis. https://www.ecopedia.be/dieren/gewone-dwergvleermuis

Ecopedia (n.d.b). *Gewone rolklaver.* Retrieved September 29, 2023 from https://www.ecopedia.be/planten/gewone-rolklaver

FLORA van Nederland. (n.d.a). *Kleine klaver - Trifolium dubium*. Retrieved September 29, 2023 from https://www.floravannederland.nl/planten/kleine_klaver/

FLORA van Nederland. (n.d.b.). *Hopklaver - Medicago lupulina*. Retrieved September 29, 2023 from https://www.floravannederland.nl/planten/hopklaver/

Geologie van Nederland (n.d.) *Mens Homo sapiens.* https://www.geologievannederland.nl/fossielen/zoogdier-beschrijvingen/mens

Gleeson, B., & Low, N. (1998). *Justice, Society and Nature*. Routledge. https://doi.org/10.4324/9780203006689

Government of the Netherlands. (n.d.). *Human rights of the Netherlands.* https://www.government.nl/topics/human-rights/human-rights-in-the-netherlands

Haaland, C., Konijnendijk van den Bosch, C. (2015). Challenges and strategies for uban green-space planning in cities undergoing densification: A review. *Urban Forestry & Urban Greening, 14*(4), 760-771. https://doi.org/10.1016/j.ufug.2015.07.009

Humphreys, R. (2016). Biocentrism. In H. Have (Ed.), *Encylopedia of Global Bioethics.* (pp. 263-272). Springer Cham.

In.Fact.Research & Circusvis (2022). *Onderzoek midterm-review NPRZ pijler wonen: Eindrapportage.* Circusvis. Retrieved November, 25, 2023, from https://www.circusvis.nl/post/onderzoeksrapport-nprz-midterm-pijler-wonen

Kadastrale Kaart. (n.d.). *Buurt: Carnisse*. https://kadastralekaart.com/buurten/carnisse-BU05991572
Kennisportaal Klimaatadaptatie (n.d.). *Welke andere voordelen heeft groen in de stad?* https://klimaatadaptatienederland.nl/kennisdossiers/groen-in-de-stad/voordelen/

Kind, J., van Koers, G., Popering-Verkerk, J., Visser, V., De Nijs, T., & Koopman, R. (2020). *Verkenning naar de wisselwerking tussen sociale veerkracht en klimaatadaptatie.* https://klimaatadaptatienederland.nl/@258259/verkenning-sociale-veerkracht-klimaatadaptatie/

Krijn, M., Epe, M.J. Limpens, H.J.G.A., Louwe Kooijmans, J., & Visser, H. (2021). *Effecten van energetische verbetering van woningen op beschermde gebouwbewonende soorten* (A&W report 20-280). Altenburg & Wymega ecologisch onderzoek. https://www.zoogdiervereniging.nl/sites/default/files/2022-03/2021.10%20Effecten%20van%20energetische%20verbetering%20van%20woningen%20op%20beschermde%20gebouwbewonende%20soorten%20%5B2020.082%5D.pdf

Kullberg, J. (2016). *Tussen groen en grijs: een verkenning van tuinen en tuinieren in Nederland* (SCP 2016-21). Sociaal en Cultureel Planbureau. https: alphen.groei.nl/fileadmin/Afdelingen/afdeling_alphen_aan_den_rijn/Archief/q_Website_documenten/Documenten/Tussen_groen_en_grijs_WEB.pdf

Lahr, J., Lammertsma, D., Bijlsma, R., Weeda, E., Buij, R., & Snep, R. (2014). Nederlandse biodiversiteit. *Landschap, 4*, 195-203.

Lörzing, H., Harbers, A., & Schluchter, S. (2008). *Krachtwijken met karakter*. (PBL-34). Drukkerij de Maasstad. https://www.pbl.nl/publicaties/krachtwijken-met-karakter

Mak, A., & Stouten, P. (2014) Urban regeneration in Rotterdam: economic and social values. *European spatial research and policy 21*(1), 102-122 10.2478/esrp-2014-0008

Mandemakers, J., Leidelmeijer, K., Burema, F., Halbersma, R., Middeldorp, M., & Veldkamp, J., (2021). *Leefbaarometer 3.0: Instrumentontwikkeling.* Ministry of the Interior and Kingdom Relations. https://www.volkshuisvestingnederland.nl/documenten/rapporten/2022/04/14/rapport-leefbaarometer-3.0-instrumentontwikkeling

McCloy + Muchemwa. (2023). *Urban playground.* https://www.mccloymuchemwa.com/URBAN-PLAYGROUND

Medigran (n.d.a). *Oeverflora OE-27.* Retrieved January 7, 2024 from https://medigran.nl/product/oeverflora-oe-27/?gad_source=1&gclid=Cj0KCQiAtOmsBhCnARIsAGPa5yY2QZ0AKepgvAXWiMHLgz_nRkWrqQZXF1-g4yanLqjfMgu1F3xlLgsaAltCEALw_wcB

Medigran (n.d.b). Ruigteflora RN-28. Retrieved January 7, 2024 from https://medigran.nl/product/ruigteflora-rn-28/

Ministry of Agriculture, Nature and Food Quality. (n.d.a). *Gewone dwergvleermuis (Pipistrellus pipistrellus)* https://minlnv.nederlandsesoorten.nl/content/gewone-dwergvleermuis-pipistrellus-pipistrellus

Ministry of Agriculture, Nature and Food Quality (n.d.b). *Rode lijsten*. Retrieved December 11, 2023, from https://minlnv.nederlandsesoorten.nl/content/rode-lijsten
Anthropocentrism. (2016, January 11). In *Britannica*. https://www.britannica.com/topic/anthropocentrism

Ministry of Agriculture, Nature and Food Quality. (n.d.c). *Rode lijsten: soort van Rode Lijst Zoogdieren* https://minlnv.nederlandsesoorten.nl/content/rode-lijsten-soort-van-rode-lijst-zoogdieren

Ministry of Infrastructure and Water Management. (n.d.). *Vleermuisvriendelijke verlichting (Batlamp).* https://www.rijkswaterstaat.nl/leefomgeving/duurzame-projecten/natuur/vleermuisvriendelijke-verlichting

Ministry of the Interior and Kingdom Relations. (2022). *Nationaal Programma Leefbaarheid en Veiligheid*. Volkshuisvesting Nederlnd. https://open.overheid.nl/documenten/ronl-b338d560857e-5f1227939ee0e47ac14db6d6ee63/pdf

Mulder, J. (1996). Waarom lopen egels op de weg?. *Zoogdier, 7*(3), 20-24.

Municipality of Rotterdam. (2021). *De Veranderstand - Werken aan een wereldstad voor iedereen Omgevingsvisie Rotterdam* [Environmental vision]. https://www.ruimtelijkeplannen.nl/documents/NL.IMRO.0599.OV2021Rotterdam-va01/d_NL.IMRO.0599.OV2021Rotterdam-va01.pdf

Municipality of Rotterdam (n.d.a). *Nationaal Programma Rotterdam Zuid (NPRZ).* Retrieved December 11, 2023, from https://www.watdoetdegemeente.rotterdam.nl/begroting2021/paragrafen/nationaal-programma-rotte/#:~:text=Het%20Nationaal%20Programma%20Rotterdam%20Zuid%20(NPRZ)%20is%20een%20samenwerkingsverband%20van,van%20Rotterdam%20Zuid%20te%20verbeteren.

Municipality of Rotterdam. (n.d.b). *Zuiderpark*. https://www.rotterdam.nl/zuiderpark

Naggs, F. (2017). Saving living diversity in the face of the unstoppable 6th mass extinction: a call for urgent international action. *The Journal of Population and Sustainability, 1*(2), 67-81. 10.3197/jps.2017.1.2.67

Nationaal Programma Rotterdam Zuid [NPRZ] (2013). *Handelingsperspectief wijk Carnisse.* Retrieved November, 25, 2023, from https://www.nprz.nl/over-nprz/onze-documenten/handelingsperspectieven

Nationaal Programma Rotterdam Zuid [NPRZ] (2023). *Uitvoeringsplan 2023-2027.* Retrieved November, 25, 2023, from https://nprz.nl/over-nprz/onze-documenten/uitvoeringsplan

Nature. (n.d.). In *Britannica*. https://www.britannica.com/dictionary/nature#:~:text=a%20%3A%20the%20physical%20world%20and,is%20not%20made%20by%20people

Natuurmonumenten. (n.d.). *Egel*. https://www.natuurmonumenten.nl/dieren/egel

Natuurpunt. (n.d.). *Gewone dwergvleermuis.* https://www.natuurpunt.be/pagina/gewone-dwergvleermuis

NDFF Verspreidingsatlas. (2023a). *NDFF Verspreidingsatlas Libellen.* https://www.verspreidingsatlas.nl/l0990

NDFF Verspreidingsatlas. (2023b). *NDFF Verspreidingsatlas Zoogdieren.* https://www.verspreidingsatlas.nl/8496090

NDFF Verspreidingsatlas. (2023c). *NDFF Verspreidingsatlas Zoogdieren Pipistrellus pipistrellus.* https://www.verspreidingsatlas.nl/8496199

Nederlandse soortenregister (n.d.). *Steenrode heidelibel Sympetrum vulgatum.* https://www.nederlandsesoorten.nl/linnaeus_ng/app/views/species/nsr_taxon.php?id=169747&cat=152

Netherlands Environmental Assessment Agency [PBL] (2015). *Aanpassen aan klimaatverandering - Kwetsbaarheden zien, kansen grijpen* (PBL-rapport 1454). Planbureau voor de Leefomgeving. https://www.pbl.nl/sites/default/files/downloads/Aanpassen_aan_klimaatverandering_WEB_2.pdf

Netherlands Environmental Assessment Agency [PBL] (2020). Balans van de leefomgeving 2020. *Burger in zicht, overheid aan zet* (PBL Vol. 4165). PBL. https://www.pbl.nl/sites/default/files/downloads/pbl-2020-balans-van-de-leefomgeving-2020-4165.pdf

Next Architects. (2015). *Vlotwateringbrug: Bat Bridge.* https://www.nextarchitects.com/nl/vlotwateringbrug/

Nieboer, N. (2005). The disputable role of the built environment in liveability. *ENHR Conference: Housing: New Challenges and Innovations in Tomorrow's Cities, Reykjavik.*

Oregon explorer (n.d.). *Human habitats.* https://oregonexplorer.info/content/human-habitats?topic=83&p-topic=62

Overheid.nl (2022). *Beleidsregeling Parkeernormen auto en fiets gemeente Rotterdam 2022*. https://lokaleregelgeving.overheid.nl/CVDR671029/1#paragraaf_3.2

Pedersen Zari, M. (2015). Ecosystem Services Analysis in Response to Biodiversity Loss Caused by the Built Environment. *Sapiens, 7*(1), 1-14. http://journals.openedition.org/sapiens/1684

Pedersen Zari, M. (2018). The importance of urban biodiversity - an ecosystem services approach. *Biodiversity International Journal, 2*(4), 357-360. 10.15406/bij.2018.02.00087

Pineda-Pinto, M., Frantzeskaki, N., & Nygaard, C.A. (2022). The potential of nature-based solutions to deliver ecologically just cities: Lessons for research and urban planning from a systematic literature review. *Ambio, 51*, 167-182. https://doi.org/10.1007/s13280-021-01553-7

Randrup, T.B., Buijs, A., Konijnendijk, C.C., & Wild, T. (2020). Moving beyond the nature-based solutions discourse: introducing nature-based thinking. *Urban ecosystems, 23,* 919-926. https://doi.org/10.1007/s11252-020-00964-w

Reumer, J. W. F., & Epe, M. J. (1999). Biotope mapping in Rotterdam - the back-ground of a project. *DEINSEA, 5,* 1-8.

Richards, R. (2014). Urban Renewal. In: A.C. Michalos (Ed.) *Encyclopedia of Quality of Life and Well-Being Research*. (pp. 6867-6868). Springer.

Roggema, R. (2017). Research by Design: Proposition for a Methodological Approach. *Urban Science, 1*(1), 2. https://doi.org/10.3390/urbansci1010002

Schouten, C.J. (2017, November 30). *Besluit van de Minister van Landbouw, Natuur en Voedselkwaliteit van 18 november 2017, nr. 17174206, houdende vaststelling van een geactualiseerde Rode Lijst Vogels.* Overheid.nl. https://zoek.officielebekendmakingen.nl/stcrt-2017-68427.html#extrainformatie

Shepley, M., Sachs, N., Sadatsafavi, H., Fournier, C., & Peditto, K. (2019). The Impact of Green Space on Violent Crime in Urban Environments: An Evidence Synthesis. *International Journal of Environmental Research and Public Health, 16*(24), 5199. https://doi.org/10.3390/ijerph16245119

Starfinger, U., & Sukopp, H. (1994). Assessment of urban biotopes for nature conservation. In E. A. Cook & H. N. van Lier (Eds.), *Landscape planning and ecological networks.* (pp. 89-115). Elsevier.

Stevis, D. (2000). Whose Ecological Justice? *Strategies: Journal of Theory, Culture & Politics 13*(1), 63-76. https://doi.org/10.1080/10402130050007520

Stouten, P. (2016). Urban Design and the Changing Context of Urban Regeneration in the Netherlands. *European spatial Research and Policy, 23*(1), 111-126. https://doi.org/10.1515/esrp-2016-0006

STOWA & Stichting RIONED. (2014). *Water in de openbare ruimte heeft risico's voor gezondheid* (2014-28). Stichting RIONED. https://www.stowa.nl/publicaties/water-de-openbare-ruimte-heeft-risicos-voor-de-gezondheid

Studio Ossidiana. (2021). *Birds Palace.* https://riccardodevecchi.net/Studio-Ossidiana-Bird-Palace

Sukopp, H., & Weiler, S. (1988). Biotope mapping and nature conservation strategies in urban areas of the Federal Republic of Germany. *Landscape and Urban planning, 15*(1-2), 39-58. https://doi.org/10.1016/0169-2046(88)90015-1

Ujang, N., Zakariya, K. (2015). The Notion of Place, Place Meaning, and Identity in Urban Regeneration. *Procedia Social and Behavioral Sciences, 170*. 709-717. 10.1016/j.sbspro.2015.01.073

Urban renewal (2023, November 5). In *Britannica*. https://www.britannica.com/topic/urban-renewal

Uytenhaak, R., Melet, E., & Mensink, J. (2008). *Steden vol ruimte: Kwaliteiten van dichtheid*. 010.

van Dorst, M.J. (2005). *Een duurzaam leefbare woonomgeving: Fysieke voorwaarden voor privacyregulering* [Doctoral thesis, Delft University of Technology]. http://resolver.tudelft.nl/uuid:6af7e7a1-0572-4678-a5e5-cc31af2d9d3f

van Kleunen, A., Foppen, R., & van Turnhout, C. (2017). *Basisrapport voor de Rode Lijst Vogels 2016 volgens Nederlandse en IUCN-criteria* (Sovon report 2017/34). Sovon Vogelonderzoek Nederland. https://www.vogelbescherming.nl/docs/beb59b77-ff0f-41df-ae56-e7b598e5e0e9.pdf?_ga=2.81571415.1960723047.1695715560-1699545943.1694782797
van Koppen, K. (1997). Terug van Arcadië. In Keulartz, Korthals (Ed.), *Museum Aarde: natuur, criterium of constructie?* (pp. 71-87). Boom.

van Koppen, K., van der Hoek, D., Leemeijer, A.M. Stortenbeker, C.W. (1984). *Natuur en mens: Visies op natuurbeheer vanuit levensbeschouwing, wetenschap en politiek.* Pudoc Wageningen. https://edepot.wur.nl/319168

Veenhoven, R. (1993). *Happiness in nations : subjective appreciation of life in 56 nations 1946-1992.* Erasmus University Rotterdam. https://personal.eur.nl/veenhoven/Pub1990s/93b-part1.pdf

Veenhoven, R. (2000). *Leefbaarheid Betekenissen en meetmethoden.* Erasmus Universiteit Rotterdam. http://hdl.handle.net/1765/8786

Vink, J., Vollaard, P., & Zwarte, N. de (2017). *Stadsnatuur maken.* nai010.

Vlinderstichting. (n.d.a). *Beheer voor libellen.* https://www.vlinderstichting.nl/libellen/alles-over-libellen/bescherming-en-beheer-libellen/beheer-voor-libellen/

Vlinderstichting. (n.d.b) *Steenrode Heidelibel Sympetrum Vulgatum*. https://www.vlinderstichting.nl/libellen/overzicht-libellen/details-libel/steenrode-heidelibel

Vogelbescherming Nederland. (n.d.). *Huismus.* Retrieved September 26, 2023, from https://www.vogelbescherming.nl/ontdek-vogels/kennis-over-vogels/vogelgids/vogel/huismus#Bescherming (Vogelbescherming Nederland, n.d.)

VZinfo (2023). *Levensverwachting | Leeftijd en Geslacht*. https://www.vzinfo.nl/levensverwachting/leeftijd-en-geslacht#:~:text=Levensverwachting%20voor%20mannen%2080%2C1,levensjaren%20op%20een%20bepaalde%20leeftijd.%20)

VZinfo (n.d.). *Bevolking | Bevolkingsomvang*. https://www.vzinfo.nl/bevolking/bevolkingsomvang#:~:text=-Bevolking%20sinds%201900%20meer%20dan,1%2C0%25%20per%20jaar.

Wageningen University & Research [WUR]. (2018). *Groen in de stad: Biodiversiteit* [Brochure]. https://library.wur.nl/WebQuery/wurpubs/544257

Wageningen University & Research [WUR]. (n.d.a). *Biodiversity* [Factsheet]. https://edepot.wur.nl/460542

Wageningen University & Research [WUR]. (n.d.b). *Groen & wonen* [Factsheet]. https://edepot.wur.nl/412102

Wassenberg, F. (2010). Towards Sustainable Urban Renewal in the Netherlands. *Open House International 35*(2), 15-24. 10.1108/OHI-02-2010-B0003

Well-being (n.d.). In *Britannica*. https://www.britannica.com/dictionary/well%E2%80%93being

Werkwijzer. (n.d.). *Geschiedenis in vogelvlucht*. https://wijkwijzer.org/verdieping/over-de-wijkaanpak/geschiedenis-in-vogelvlucht#:~:text=%E2%86%92%20Stadsvernieuwing&text=Voornaamste%20doel%20hiervan%20is%20het,sociale%20structuren%20en%20zittende%20bewoners

Werner, P. (1999). Why biotope mapping in populated areas?. *DEINSEA, 5,* 9-26.

Wienhues, A. (2017). Sharing the Earth: A Biocentric Account of Ecological Justice. *Journal of Agricultural and Environmental Ethics 30,* 367-385. https://doi.org/10.1007/s10806-017-9672-9

Wienhues, A. (2020). *Ecological Justice and the Extinction Crisis.* Bristol University Press. https://doi.org/10.2307/j.ctv16t671c

Xie, N., Wang, H., & Feng, D. (2015). Coating materials to increase pavement surface reflectance. In F. Pacheco-Torgal, J.A. Labrincha, L.F. Cabeza, C.-G. Granqvist (Eds.), *Eco-Efficient Materials for Mitigating Bilding Cooling Needs: Design, Properties and Applications.* (pp. 13-35). Woodhead Publishing.

Zoogdiervereniging. (2011). *Een vleermuisvriendelijke kleur voor verlichting.* https://www.zoogdiervereniging.nl/nieuws/2011/een-vleermuisvriendelijke-kleur-voor-verlichting

Zoogdiervereniging. (2023). *Egeltelling op 16 en 17 september: omarm de egel.* https://www.zoogdiervereniging.nl/nieuws/egeltelling2023

Zoogdiervereniging. (n.d.). *Egel*. https://www.zoogdiervereniging.nl/zoogdiersoorten/egel

Zwartgroen. (n.d.). *De 2 nadelen van cortenstaal.* https://www.zwartgroen.nl/de-nadelen-van-cortenstaal/#:~:text=Hoewel%20cortenstaal%20enkele%20nadelen%20heeft,snel%20zal%20roesten%20of%20corroderen.

FIGURES

Figure 1. Natuurmonumenten. (n.d.). Rotterdams platteland [Photograph]. https://www.natuurmonumenten.nl/natuurgebieden/rotterdams-platteland
Figure 2. Plan bureau voor leefomgeving. (n.d.). Oorzaken van verlies aan biodiversiteit in Europa, 2010 [Image]. https://data.pbl.nl/api/embed/infographic/data/nl/lb14/245g/02/245g_lb14_02_nl.pdf4
Figure 3. Pedersen Zari, M. (2015). Built environment drivers of biodiversity loss [Image]. https://www.researchgate.net/publication/270510353_Ecosystem_Services_Analysis_in_Response_to_Biodiversity_Loss_Caused_by_the_Built_Environment
Figure 4. By author
Figure 5. Vivara pro (n.d.). IB GZ 03 Inbouwsteen Gierzwaluw (renovatie) [Image]. https://www.vivarapro.nl/shop/inbouwstenen/inbouwstenen-gierzwaluw/ib-gz-03-inbouwsteen-gierzwaluw-renovatie/
Figure 6. Traas buillding care. (n.d.). Vogelschroot - Voorkomt vogeloverlast onder dakpannen [Image]. https://traasbuildingcare.nl/vogelschroot/
Figure 7. Musement (n.d.). Kasteel en vestigingstad Carcasonne [Image]. https://www.musement.com/nl/carcassonne/kasteel-en-vestingstad-carcassonne-v/
Figure 8. Braakman, M. (2019). Natuurlijk Orgniseren Deel 1: Bouwen aan innovatiekracht en wendbaarheid met wetten van de natuur [Image]. https://www.inner-kompas.nl/artikelen-voor-organisaties/2019/4/2/natuurlijk-organiseren-deel-1-bouwen-aan-innovatiekracht-en-wendbaarheid-met-de-wetten-van-de-natuur
Figure 9. By author.
Figure 10. Pedersen Zari, M. (2015). Relationship between humans, ecossytems and climate [Image]. https://www.researchgate.net/publication/270510353_Ecosystem_Services_Analysis_in_Response_to_Biodiversity_Loss_Caused_by_the_Built_Environment
Figure 11. Modernista (n.d.). Led straatverlichting voor de openbare ruimte [Image]. https://modernista.nl/led-straatverlichting-voor-de-openbare-ruimte/
Figure 12. By author
Figure 13. By author
Figure 14. By author, contains data from: National Institute for Public Health and the Environment [RIVM]. (2021a). *Klimaatrisico.* [Data set]. https://data.rivm.nl/geo/ank/wms?
National Institute for Public Health and the Environment [RIVM]. (2021b). Leefbaarheid buurten. [Data set]. https://data.rivm.nl/geo/ank/wms?
Figure 15. By author, contains data from: National Institute for Public Health and the Environment [RIVM]. (2021c). Kwetsbare buurten. [Data set]. https://data.rivm.nl/geo/ank/wms?
Nationaal Programma Rotterdam-Zuid [NPRZ]. (Carthographer). (2023). Het werkgebied van NPRZ [Map]. https://www.nprz.nl/media/483/download/NPRZ%20Uitvoeringsplan%202023-2027%20%28def%29.pdf?v=1
Figure 16. Meijendel, L. van, Hinterthür, H., & Bet, E. (2008). Het uitbreidingsplan voor de Linker Maasoever van Granpré Molière c.s. uit 1921 [Drawing]. https://www.elsbet.nl/dl/CH%20verkenning%20Rotterdam%20Zuid.pdf
Figure 17. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 18. By author
Figure 19. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 20. By author
Figure 21. By author
Figure 22. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 23. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 23.1. By author
Figure 23.2. By author
Figure 23.3. By author
Figure 23.4. By author
Figure 23.5. By author
Figure 23.6. By author

Figure 23.7. By author
Figure 23.8. By author
Figure 23.9. By author
Figure 23.10. By author
Figure 23.11. By author
Figure 23.12. By author
Figure 24. By author
Figure 25. Gleeson, B., & Low, N. (1998). Justice, Society and Nature [Painting]. https://doi.org/10.4324/9780203006689
Figure 26. By author
Figure 27. By author
Figure 28. By author
Figure 29. By author
Figure 30. By author
Figure 31. By author
Figure 32. By author
Figure 33. Grootenhuijs, H. (2022). Sloop woningen aan de Hilledijk vanwege de aanstaande vernieuwing van de Tweebosbuurt [Photograph]. https://stadsarchief.rotterdam.nl/zoeken/
Figure 34. By author
Figure 35. By author, contains data from: Nationaal Programma Rotterdam-Zuid [NPRZ]. (Carthographer). (2023). Het werkgebied van NPRZ [Map]. https://www.nprz.nl/media/483/download/NPRZ%20Uitvoeringsplan%202023-2027%20%28def%29.pdf?v=1
Figure 36. In.Fact.Research & Circusvis (2022). Geadviseerde verhaallijn NPRZ tweede tien jaar [Image]. https://www.circusvis.nl/post/onderzoeksrapport-nprz-midterm-pijler-wonen
Figure 37. De Nijl Architecten (2022). Overzicht middellange termijn [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 37.1. De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 37.2. De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 37.3. De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 37.4. De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 37.15. De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 38. Johnson, S. (2015). Common Blue (Polyommatus icarus) [Photograph]. https://www.flickr.com/photos/119679149@N03/18836230400/in/photolist-uGuB47-xvfbPa-vfyxfV-rfYbhg-t8HGzk-sJVq7W-GHKfFA-noVKNq-o3uiXz-8raysG-qsVEzE-Hybp8u-ohi2sJ-9Rgtd6-GUCc93-yu8E9a-HDZHcj-Hbtkox-HZnrf7-tnwL5Q-KiLcgh-xyGhWP-HRPaks-ohio2N-nK6DSyresultaten/?mivast=184&mizig=299&miadt=184&miview=gal&milang=nl&mistart=125&mif1=7&mif4=true&mizk_alle=stadsvernieuwing
Figure 39. Vishal Mahale Wildlife (n.d.). Common pipistrelle [Photograph]. https://nl.pinterest.com/pin/55521007899337849/
Figure 40. Terwiel, T. (2015). Egel [Photograph]. https://vroegevogels.bnnvara.nl/community/fotos/zoogdieren/egel/237380
Figure 41. Rhododendrites (2022). Male house sparrow in Prospect Park [Photograph]. https://en.wikipedia.org/wiki/House_sparrow#/media/File:House_sparrow_male_in_Prospect_Park_(53532).jpg
Figure 42. Barnes, G. (2020). Ethnic female gardener planting flower in pot [Photograph]. https://www.pexels.com/photo/ethnic-female-gardener-planting-flower-in-pot-6231730/
Figure 43. Andy C. Wildlife (n.d.). Vagrant darter - Schulensmeer, Flanders [Photograph]. https://nl.pinterest.com/pin/759067712170579644/
Figure 44. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 45. By author
Figure 46. By author
Figure 47. By author
Figure 48. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 49. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). Basisregistratie: *Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Kadaster. (2022). *Platte daken in Nederland (BAG)* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/e90a8483-77d1-40ab-89fc-344842047637
Figure 50. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Figure 51. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Figure 52. By author
Figure 53. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Kadaster. (2022). *Platte daken in Nederland (BAG)* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/e90a8483-77d1-40ab-89fc-344842047637
Figure 54. By author
Figure 55. By author
Figure 56. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 57. By author, contains data from: Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Netherlands Enterprise Agency [RVO]. (2022). *Energielabels van gebouwen* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/8dff9ab0-dc82-4143-866f-2c08450abf61
Figure 58. Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 59. By author, contains data from:

Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Netherlands Enterprise Agency [RVO]. (2022). *Energielabels van gebouwen* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/8dff9ab0-dc82-4143-866f-2c08450abf61
Figure 60. By author, contains data from: Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Netherlands Enterprise Agency [RVO]. (2022). *Energielabels van gebouwen* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/8dff9ab0-dc82-4143-866f-2c08450abf61
Figure 61. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 62. By author
Figure 63. By author
Figure 64. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Centraal bureau voor de statistiek [CBS] (2017). *Bestand bodemgebruik* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/d9bf1ce1-5197-409e-b19e-340e50afafc4
Figure 65. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 66. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 67. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 68. By author
Figure 69. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 70. By author
Figure 71. By author
Figure 72. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 73. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Netherlands Enterprise Agency [RVO]. (2022). *Energielabels van gebouwen* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/8dff9ab0-dc82-4143-866f-2c08450abf61
Figure 74. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Centraal bureau voor de statistiek [CBS] (2017). *Bestand bodemgebruik* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/d9bf1ce1-5197-409e-b19e-340e50afafc4
Figure 75. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 76. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 77. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 78. By author
Figure 79. By author
Figure 80. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Centraal bureau voor de statistiek [CBS] (2017). *Bestand bodemgebruik* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/d9bf1ce1-5197-409e-b19e-340e50afafc4
Figure 81. By author, contains data from: Netherlands Enterprise Agency [RVO]. (2022). *Energielabels van gebouwen* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/8dff9ab0-dc82-4143-866f-2c08450abf61
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Kadaster. (2022). *Platte daken in Nederland (BAG)* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/e90a8483-77d1-40ab-89fc-344842047637
Figure 82. By author, contains data from:
Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Figure 83. BIJ12. (2023). Afstanden tussen de elementen die zich in de functionele leefomgeing van de huismus bevinden [Image]. https://www.bij12.nl/wp-content/uploads/2023/11/Kennisdocument-Huismus.pdf
Figure 84. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-

6b2f044b3246
Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 85. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-vie
Figure 86. By author, contains data from: Kadaster. (2023). *BAG* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/aa3b5e6e-7baa-40c0-8972-3353e927ec2f?tab=general
Municipality of Rotterdam. (2020). *Openbare webservice Beheer Buitenruimte Rotterdam* [Data set]. https://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-vie
Figure 87. By author
Figure 88. By author
Figure 89. By author
Figure 90. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 91. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 92. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 93. By author, contains data from: Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-viewer/
Figure 94. By authorster.nl/geonetwork/srv/dut/catalog.search#/metadata/918e4b3a-6af8-452e-a1fb-6b2f044b3246
Ministry of the Interior and Kingdom Relations. (2022). *Basisregistratie: Grootschalige Topografie (BGT)* [Data set]. https://app.pdok.nl/lv/bgt/download-vie
Figure 96. By author
Figure 97. By author
Figure 98. By author, contains data from: Via Michelin. (Cartographer). (2023). *Verkeersinformatie Rotterdam* [map]. https://www.viamichelin.nl/web/Verkeer/Verkeersinfo-Rotterdam-2901-Zuid_Holland-Nederland
Figure 99. By author
Figure 100. By author
Figure 101. By author
Figure 102. By author
Figure 103. By author
Figure 104. Tequilajazz. (n.d.). Leaf and city [Image]. https://www.dreamstime.com/royalty-free-stock-photos-leaf-city-image12009398#res26615551
Figure 105. By author
Figure 106. By author
Figure 107. By author
Figure 108. By author
Figure 109. By author
Figure 110. By author
Figure 111. By author
Figure 112. By author
Figure 113. By author
Figure 113.1. By author
Figure 113.2. By author
Figure 113.3. By author
Figure 114. Google. (n.d.). [Google maps-map of the Ebenhaëzerstraat, Rotterdam]. Retrieved January 3, 2024, from https://www.google.com/maps/@51.8890543,4.4805056,141m/data=!3m1!1e3?entry=ttu
Figure 115. By author
Figure 116.1. By author
Figure 116.2. By author
Figure 117. By author
Figure 118. By author
Figure 119. By author
Figure 119.1. O'Donovan, L. (2023). Urban Playground / McCloy + Muchemwa [Photograph]. https://www.archdaily.com/1004326/urban-playground-mccloy-plus-muchemwa/64b900dcedf1696a0270ab13-urban-playground-mccloy-plus-muchemwa-photo?next_project=no
Figure 119.2. By author
Figure 119.3. By author
Figure 119.4. By author
Figure 120. Google. (n.d.). [Google maps-map of the Klaverstraat, Rotterdam]. Retrieved January 3, 2024, from https://www.google.com/maps/@51.8890543,4.4805056,141m/data=!3m1!1e3?entry=ttu
Figure 121. By author
Figure 122.1. By author
Figure 122.2. By author
Figure 123. By author
Figure 124. By author
Figure 125. By author
Figure 125.1 GSB Tuinmaterialen. (n.d.). Mediterranea Split 8-12 mm(Zak) [Photograph]. https://www.jansensierbestrating.nl/grind-en-split/grind-en-split-in-zakken/mediterranea-split-8-12-mmzak
Figure 125.2 Studio Ossidiana. (2021). Birds palace [Photograph]. https://riccardodevecchi.net/Studio-Ossidiana-Bird-Palace
Figure 125.3 Rutting, R. (2015). Vlotwateringbrug: Bat Bridge [Photograph]. https://www.nextarchitects.com/nl/vlotwateringbrug/
Figure 126. Figure 120. Google. (n.d.). [Google maps-map of the Utenhagestraat, Rotterdam]. Retrieved January 3, 2024, from https://www.google.com/maps/@51.8890543,4.4805056,141m/data=!3m1!1e3?entry=ttu
Figure 127. By author
Figure 128.1. By author
Figure 128.2. By author
Figure 129. By author
Figure 130. By author
Figure 131. By author
Figure 132. By author & De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 133. By author
Figure 134. By author
Figure 135. De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 136. By author
Figure 137. By author
Figure 138. De Nijl Architecten (2022). Toekomstperspectief [Image]. https://gemeenteraad.rotterdam.nl/Reports/Document/34830dd2-7de6-4848-a242-1d9f9526a4bd?documentId=accacae0-7e93-4f43-bee5-6a1c7622f9f8
Figure 139. By author
Figure 140. EVA (n.d.). [Image]. https://www.evagreentech.com/
Figure 141. By author