Biodiversity Implementation in a Multi-Plot Context

Enhancing biodiversity in urban area development projects. A project developer's perspective.

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Colophon

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Preface

Before you lies my master thesis, the culmination of an extensive six-and-a-half-year academic journey of studying Architecture. This graduation research is written for the Master track Management in the Built Environment at the Faculty of Architecture at Delft University of Technology. Within the walls of the Faculty of Architecture, my academic interests have developed from individual buildings to cities, with further expansion into urban area development, management, sustainability, and ultimately biodiversity. This research synthesises elements of urban area development, management, and biodiversity. The dedicated efforts of several months invested in the creation of this thesis have yielded a source of pride for the final scientific result.

Throughout the course of researching and writing this thesis, I learned about the importance of biodiversity to all of us. While acknowledging the limitations of this document in effecting global change, I hope that it serves as a catalyst for increased awareness among professionals in the built environment sector. The extent to which an individual can contribute to enhancing urban biodiversity is significant, and this thesis aims to inspire proactive engagement. I too intend to bring this awareness to my professional journey, recognising the enduring implications of biodiversity implementation in the pursuit of sustainable urban development.

I would like to express my gratitude to my TU Delft supervisors, Paul Chan and Aksel Ersoy, for their guidance and support. Thank you for your expertise, enthusiasm, and elucidation, which have greatly contributed to the refinement of this research. I also want to thank Marco Vogelzang from VORM Holding for his guidance and supervision from the practical project development perspective. Thank you for your inspiring contributions and new ideas that have enriched my research endeavours. Finally, I extend my appreciation to all professionals who participated in the interviews and workshop, and to those who supported me throughout the preceding year, for your time and commitment.

Enjoy reading.

Sincerely,

Ravelijn van Laar
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Abstract

Human activities are dismantling ecosystems and eliminating genes, species, and biotopes at an alarming rate. Habitat fragmentation caused by urbanisation and infrastructure is one of the main causes of the decline in urban biodiversity. Despite challenges, project developers can enhance biodiversity in urban areas by adopting nature-inclusive design principles and engaging in collaborative efforts to share knowledge and resources. Research has demonstrated that biodiversity is currently implemented with a focus on one plot. More emphasis should be placed on implementing biodiversity within a multi-plot context. Project developers lack a framework or step-by-step plan that can support them in this challenge, including design elements and principles, stakeholder engagement, phasing, and financial prerequisites. This research contributes by developing an implementation framework that will encourage project developers to implement biodiversity in their projects in collaboration with other stakeholders. This is achieved by answering the research question '*How can private project developers co-develop with others to enhance biodiversity across multiple plots in an area?*'

The research starts with an extensive literature review of existing research on biodiversity in the built environment, establishing a foundational framework for subsequent methods. Interviews with experts are conducted to delineate the identified problem, gaining valuable insights and knowledge from ecologists. This is followed by a focus group workshop with participants from various disciplines, in which a process is designed with biodiversity guidelines and considerations. While the expert interviews focused mainly on the role of the government, the workshop discussions emphasised the role of the project developer, highlighting an observable tension between these stakeholders that necessitates collaborative alignment within the multi-plot context.

Recognising the impact of scale, the research underscores the need for collaborative efforts across multiple plots to enhance urban biodiversity. Biodiversity thrives at broader spatial scales where interconnected networks of green areas can support larger populations and facilitate species movement. Emphasising the importance of stakeholder collaboration, the developed process and implementation framework offer valuable guidance for project developers and other stakeholders. Roles, responsibilities, and priorities of stakeholders vary per urban area development project and biodiversity ambitions, which makes biodiversity enhancement complex. Biodiversity implementation in urban area development projects requires early area analysis, consistent oversight of objectives, seamless integration of biodiversity goals into the overall vision, and continuous monitoring throughout the development process.

Keywords – biodiversity, urban area development, stakeholder collaboration, sustainability, nature-based solutions, ecosystem services, project developer

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Glossary

Concept	Source	Definition
Biodiversity	Bouwman et al. (2023)	Biodiversity serves as a comprehensive term encompassing all life forms in the natural environment and the intricate interactions between them. It includes the vast genetic variation within species and the diversity of ecosystems in which they are integral components.
Biodiversity enhancement	Benayas et al. (2009)	Biodiversity enhancement refers to efforts and actions taken to enhance the diversity and vitality of plant and animal species and ecosystems in a specific area or environment. This may include conservation, habitat restoration, and practices that promote a healthier and more diverse natural environment.
Biodiversity implementation	Duru et al. (2015)	Biodiversity implementation refers to the integration of measures, practices, and strategies in development, conservation or land management projects aimed at enhancing and sustaining biodiversity. It involves actions to protect, restore or promote a diverse range of species and ecosystems within a specific area or context.
Biotope	Sawe (2017)	A biotope is a specific area or habitat supporting a stable community of plants, animals, and organisms, interacting in a self-sustaining ecosystem. It is characterized by environmental factors like climate, topography, soil, and living organisms, and can occur in natural or human-influenced settings. A biotope is delineated at a micro-scale.
Co-development	Source: author	Co-development is the process of developing something new together with other individuals or groups and goes beyond collaboration, emphasising active stakeholder involvement and shared decision-making throughout the process. It refers to partnerships including agreements between a project developer and one or more other developing parties, including the municipality.
Ecosystems	Bouwman et al. (2023)	Ecosystems are diverse networks of relationships between living organisms. These ecosystems can adapt to anthropogenic changes but lack regenerative capacity. Ecosystems have a finite lifespan and once they die off, it is unlikely that they can be revived in the short term.
Ecosystem services	Cardinale et al. (2012)	Ecosystem services are the benefits provided by ecosystems to humans, classified into two types: provisioning services (e.g., food, timber) and regulatory services (e.g., climate regulation, disease control).
Gray infrastructure	Conservation International (n.d.)	Gray infrastructure refers to man-made or built structures like roads, dams, seawalls, pipes, gutters, and drains. These structures are typically engineered to manage water, transportation, and other urban needs and are essential for urban area development and functionality.

Green and blue infrastructure	Conservation International (n.d.), US EPA (2023)	Green infrastructure comprises natural systems such as forests, floodplains, wetlands, and soils. Blue infrastructure refers to water-related natural systems like rivers, lakes, and watersheds. Together, green and blue infrastructure captures rainwater and emulates natural processes, helping to manage water, provide habitat, and support environmental sustainability.
Ground related expenditure (GREX)	Law Insider (n.d.)	Ground-related expenditure (GREX) refers to direct project costs incurred during the implementation of improvements or developments of infrastructure and other relevant projects.
Habitat	Watson et al. (1995)	A habitat is an area wherein various species and organism groups can reproduce, encompassing the necessary biotopes for an organism's survival throughout its life cycle.
Nature-inclusive building	Wageningen University & Research (2022)	Nature-inclusive building means consciously creating space for biodiversity on, to, or in the building and its surrounding areas to support a richer diversity of plant and animal species, enhancing living conditions for both humans and animals.
Private project developer	Nikolic (n.d.)	A (private) project developer is a company or individual who buys and/or develops properties, often involving acquisition and construction of the developed real estate.
Stakeholder collaboration	Source: author	Stakeholder collaboration involves the interaction and cooperation between individuals or groups with project interests, contributing input. It denotes the cooperative interaction among all relevant parties involved in the project.
Stakeholder engagement	Source: author	Stakeholder engagement refers to the proactive and continuous process of involving and communicating with those who may influence project decisions. It ensures ongoing dialogue, meaningful relationships, and integration of stakeholder perspectives.
Urban biodiversity	De Oliveira et al. (2014)	Urban biodiversity refers to the variation of living organisms found in the ecosystems of urban areas. It is usually determined by the number of species and their abundance that may be found in a particular city or region of the city.
Urban area development	GSDRC (2016)	Urban area development comprises the comprehensive and strategic planning and development of cities and urban areas, integrating social, cultural, economic, and physical dimensions, for improvement and expansion in land use, infrastructure, and built environment.

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1 Introduction

As early as 1990, ecologists examined how fast nature and the environment were deteriorating. Hekstra and Van Linden (1990) described how habitats have been transformed into simpler systems, providing more harvest-bate products for humans. As a result, genetic diversity, species, and entire ecosystems have disappeared. The significant decline in biodiversity will impact ecosystem functionality and its ability to support human well-being (Cardinale et al., 2012). Furthermore, Bouwman et al. (2023) emphasise the central role of biodiversity and ecosystem restoration in achieving energy transition, climate adaptation, and fostering a sustainable living environment. Biodiversity loss can contribute to climate change and be exacerbated by it, creating a feedback loop that threatens both ecosystems and human well-being. As the global concern of biodiversity loss intensifies, urbanisation is also emerging as a crucial factor exacerbating biodiversity. Cities have expanded rapidly since the industrial revolution due to urban population growth. This global urbanisation trend has created a dependence on fossil fuels, which has contributed immensely to global warming and thus climate change (De Oliveira et al., 2022). In addition, urbanisation has increased habitat fragmentation, resource consumption, waste generation, and environmental degradation, collectively posing a significant threat to biodiversity. Nature has been split into smaller areas where many animals can no longer move freely and the feedback loop with climate change is becoming more severe (Bouwman et al., 2023).

1.1 Biodiversity implementation

With a combination of increasing water demand for agricultural, residential, and industrial purposes, as well as reduced water reliability due to climate change, urban areas cannot rely solely on gray infrastructure (De Oliveira et al., 2022). Sustainable urban systems require the integration of green and blue infrastructures, which enhance gray infrastructure functions. Green and blue infrastructures can be defined as a strategically planned network of natural and semi-natural areas, designed to provide diverse ecosystem services within the boundaries of cities (Veerkamp et al., 2021). Ecosystem services are the benefits ecosystems provide to people, like temperature and air quality regulation. Buildings contributing to these infrastructures offer additional environmental benefits: energy-efficient designs and systems reduce energy consumption and greenhouse gas emissions (U.S. Green Building Council, 2021); rainwater harvesting systems help in water resource conservation and stormwater management (Fletcher et al., 2015); and urban green spaces in buildings mitigate the urban heat island effect by lowering surface temperatures and enhancing evaporative cooling.

Cities can enhance biodiversity in multiple ways, for example with green roofs. Green roofs address a range of urban challenges, including water retention, reduction of operational and air pollution, and decreased energy consumption. They serve as habitats for diverse organisms. Project developers are increasingly integrating biodiversity and nature-inclusive design into their projects. With various design principles, project developers can enhance biodiversity within buildings and surrounding public spaces. Additional stakeholders, including ecologists, can contribute to ecological functionality in the built environment using resources like manuals on green roofs, soil health, and nature-inclusive construction. These efforts facilitate the establishment of native flora and fauna, fostering ecosystem resilience (Bouwman et al., 2023).

1.2 Problem statement

According to Faeth et al. (2011), preserving or reconstructing vegetation-determined natural habitats in urban areas does not ensure that other components of the biological community will follow suit. This means that while cities can enhance biodiversity with tools, manuals, elements, and principles, this may not work for the entire ecosystem. Humans directly control plants but only a small number of animals and bacteria. The remaining biological community is defined by an ecosystem 'template', shaped by ecological and evolutionary processes (Faeth et al., 2011).

Buildings can significantly enhance biodiversity by incorporating it as a fundamental aspect in design and operations. However, its implementation in urban area development projects is often hindered by six causes. Firstly, buildings are often treated as stand-alone projects, each contributing to biodiversity individually but without collaboration. Just a combination of trees and grass gives little biodiversity, especially when not looking at the project's surroundings (Aghina et al., 2023). Secondly, biodiversity is currently often seen as an afterthought or a final addition when urban area development is almost finished (Kirk et al., 2021). Therefore, protection for biodiversity is mostly symbolic and does not provide people with the necessary access to daily nature. Thirdly, the implementation of biodiversity design elements is complex, due to the diversity of ecosystem services, their multifunctionality, trade-offs, urban planning considerations, and various temporal and spatial scales (Bush & Doyon, 2019). While biodiversity design elements contribute to enhanced urban resilience, comprehensive knowledge of their mechanisms and application in urban settings is still evolving. Fourthly, there is relatively limited legislation and regulation on biodiversity in the Netherlands. The Dutch legal framework has mainly emphasised broader environmental aspects, often leaving biodiversity considerations in the background. The Building Act and the Nature Protection Act do not have tight regulations on biodiversity at municipality level (Bouwman et al., 2023). As De Oliveira et al. (2011) argue, urban governance's importance in addressing the challenges of biodiversity loss has increased due to urbanisation. City design, planning, and governance directly shape their impact on biodiversity. Municipal and city councils play a fundamental role in translating international environmental agreements into local action, with many being operationalised at the city level (De Oliveira et al., 2011). Fifthly, central governments face the challenge of translating policy into concrete actions and regulations within legislation (Bouwman et al., 2023). Sixthly, stakeholder responsibilities, roles, and risks concerning biodiversity implementation during urban area development projects are often unclear. Such projects typically involve many stakeholders, including government agencies, project developers, architects, urban planners, local communities, and environmental organisations, each with varying priorities and knowledge levels related to biodiversity (Bouwman et al., 2023). Additionally, stakeholders' varying perceptions of biodiversity risks, including financial, reputational, and legal aspects, further complicate role assignment.

Research has demonstrated that biodiversity is currently implemented with a focus on one plot. Planting a flower on a building to attract bees may not yield results if the flower is absent in the surrounding area. Focusing on a single plot is not beneficial because it limits the space available for diverse ecosystems and species, leading to ecological imbalances and reduced resilience. Therefore, more emphasis should be placed on implementing biodiversity within a multi-plot context. Project developers lack a framework that can support them in this challenge, including stakeholder engagement, phasing, design elements and principles, and financial prerequisites. This research will contribute by developing an implementation framework that encourages project developers to implement biodiversity in their projects in collaboration with other stakeholders.

1.3 Goals and objectives

The importance of enhancing biodiversity in urban areas is becoming more visible to project developers, housing associations, municipalities, and other stakeholders. Biodiversity has a strong link with urbanisation and climate adaptation, highlighting its relevance to contemporary urban challenges. Consequently, there is an increasing imperative for project developers to incorporate biodiversity into their projects, necessitating the provision of a supportive tool. Such a tool would empower project developers not only to enhance their understanding of biodiversity implementation in projects but also which stakeholders to engage. The objective of this thesis is thus as follows:

This master thesis focuses on implementing biodiversity within new construction projects in urban areas through co-development between different stakeholders and across different plots.

The main goal of this thesis is to gain a better understanding of the influence of stakeholder collaboration and co-development on the implementation of biodiversity across multiple plots (Figure 1). This goal has a number of sub-goals that help achieve the main goal:

1. Identify the specific design elements and principles that ought to be implemented in a project to enhance biodiversity.
2. Gain insight into the requisite stakeholders whose engagement is essential for biodiversity implementation.
3. Gain an understanding of the roles, responsibilities, and risks inherent in the role of the project developer or other stakeholders.
4. Find solutions for financial challenges that occur during biodiversity implementation in urban area development processes.
5. Gain an understanding of the optimal timing of biodiversity implementation within the course of a project process.

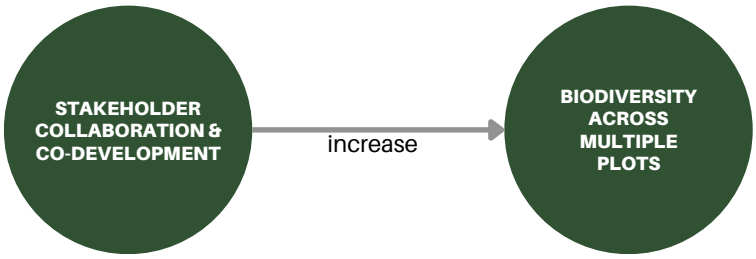

Figure 1. Simplified conceptual model (source: author).

This research focuses on multiple plots, including the buildings on a plot and the surrounding buildings and plots that are potentially owned by different entities, without distinction based on the functions of these buildings. This study exclusively focuses on new construction projects from the concept development perspective. Whether the surrounding buildings on surrounding plots are new or existing is inconsequential. The analysis will encompass a diverse set of stakeholders, including those providing advice to project developers, those engaged in permit acquisition processes, and those affected by the impacts of biodiversity enhancement, such as end-users.

1.4 Societal and scientific relevance

With this thesis, the knowledge gap between theory and practice concerning biodiversity implementation in urban area development projects will be closed. This thesis will examine measures to enhance biodiversity, identify key stakeholders and their responsibilities, assess the application of biodiversity regulations and legislation, determine phasing for biodiversity focus within projects, and evaluate the viability of biodiverse building designs in the context of non-biodiverse surrounding plots.

The outcome of this thesis will be an implementation framework including advice on biodiversity implementation for private project developers. The social relevance includes that an implementation framework can support project developers in implementing biodiversity in their projects, which benefits the urban environment and end-users, and enhances their competitiveness in tender applications. The framework provides clarity on stakeholder engagement and phasing, as well as risk and cost allocation. Risk allocation within a project significantly influences biodiversity implementation and process. Beyond project developers, this framework will benefit more stakeholders, including municipalities, architects, and contractors.

This research adds scientific relevance by generating a better understanding of biodiversity and its relationship with its context, particularly buildings and cities. Moreover, it will lead to more insight into stakeholder management for biodiversity enhancement and its connection with green and blue infrastructure. As this study is the first to explore this concept with a focus on stakeholder collaboration and co-development, the findings may serve as a foundation for further research. The primary focus of this thesis is on biodiversity enhancement within a multi-plot context. Because this has not been researched before, the result might be explorative.

1.5 Research questions

The following research question is developed to achieve the research goal:

How can private project developers co-develop with others to enhance biodiversity across multiple plots in an area?

To answer this main research question, four components have been established on which to focus:

1. Design elements and principles;
2. Stakeholder engagement;
3. Financial prerequisites;
4. Phasing.

These four components derive from the general project management triangle encompassing quality, time, and cost, with an additional emphasis on stakeholders in line with the focus of this study.

To gain the requisite knowledge to answer the main research question, four sub-questions will be addressed first. These sub-questions will be answered through a combination of theoretical and empirical research, encompassing a literature review, expert interviews, and a focus group workshop. The sub-questions are based on the four components and formulated as follows:

SQ1. Which design elements and principles enhance biodiversity across multiple plots?

The first sub-question is linked to achieving the first sub-goal. The focus will be on defining biodiversity and examining design elements and principles that enhance biodiversity. The study will encompass an exploration of these design principles, including their feasibility and implications

concerning design and timing. It will analyse the measurement of biodiversity, its integration into zoning plans, and strategies for strengthening biodiverse design within the built environment.

SQ2. **Which stakeholders are important for biodiversity implementation and what are their roles?**

The second sub-question is linked to achieving the second and third sub-goals. One of the major contradictions in this research is the public versus private interest. It is important to examine the significance of specific stakeholders across various stages and their influence on biodiversity enhancement through decision-making in urban area development. Potential stakeholders will be analysed extensively, considering their respective roles and risk-bearing capacities.

SQ3. **What are the financial prerequisites of biodiversity implementation within the scope of an urban area development project?**

The third sub-question is linked to achieving the fourth sub-goal. Biodiversity implementation and enhancement have financial advantages and disadvantages. The allocation and composition of biodiversity implementation costs and their influence on design elements and procedural aspects will be explored.

SQ4. **How should an urban area development process be designed for biodiversity implementation?**

The fourth sub-question is linked to achieving the fifth sub-goal. The final step to be taken before the main research question can be answered is designing the process. The process determines when biodiversity implementation is deployed and the impact of individual roles and tasks on biodiversity implementation. When biodiversity implementation is deployed in a multi-plot context rather than a one-plot context, stakeholder collaboration becomes essential. The scale of biodiversity design will be increased. These factors significantly impact the urban area development project's process. The design of this process involves an examination of the roles, tasks, responsibilities, and rationale.

1.6 Conceptual model

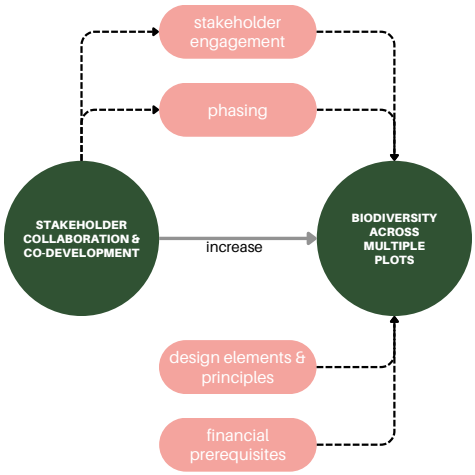

Figure 2. Conceptual model (source: author).

The conceptual model is designed based on the presumed relationships between two main concepts (Figure 2). The core concepts of this research are 'stakeholder collaboration and co-development' and 'biodiversity across multiple plots'. This research will investigate how the first concept increases the second and the way in which this relationship functions. The two core concepts are influenced by four components. As indicated earlier, these are the four components this research focuses on, each associated with a distinct sub-goal and sub-question. The relationships between these components and the two main concepts will be further explained in *Chapter 2, Theoretical Background*.

Within this research, both the terms '*biodiversity implementation'* and '*biodiversity enhancement'* are used. Since their definitions are close, it is necessary to clarify these concepts and delineate their relationship. The objective of biodiversity enhancement is to actively increase and improve existing biodiversity in a designated location. In contrast, the objective of biodiversity implementation goes beyond the direct enhancement of biodiversity and includes the systematic integration of biodiversity considerations into the overarching planning and implementation of development, conservation, or land management initiatives. In summary, while biodiversity enhancement is primarily concerned with on-site efforts to enhance biodiversity in a specific geographical area, biodiversity implementation takes a more comprehensive approach, integrating biodiversity considerations into development or conservation efforts to ensure the health and diversity of ecosystems.

In the context of this research, '*co-development'*, '*stakeholder collaboration',* and '*stakeholder engagement'* represent distinct approaches for involving relevant parties in project planning, design, and implementation. The varying definitions of the terms require clarification, including an exploration of their differences and establishing their contextual meanings within the framework of this particular study. Stakeholder collaboration involves the interaction and cooperation between individuals or groups with project interests, contributing input. Co-development is the process of developing something new together with other individuals or groups and goes beyond collaboration, emphasising active stakeholder involvement and shared decision-making throughout the process. In this particular context, co-development refers to partnerships between a project developer and one or more other developing parties, including the municipality. This cooperation involves agreements concerning aspects such as financial risk distribution. Stakeholder collaboration, on the other hand, denotes the cooperative interaction among all relevant parties involved in the project. Stakeholder engagement refers to the proactive and continuous process of involving and communicating with those who may influence project decisions. Stakeholder engagement is crucial for both stakeholder collaboration and co-development and ensures ongoing dialogue, meaningful relationships, and integration of stakeholder perspectives.

1.7 Reading guide

	PART	CONTENT
1	Introduction	Introducing the context, problem, objectives, relevance, main concepts and research questions.
2	Theoretical background	Literature review on biodiversity in the built environment, area development, financial prerequisites, and biodiversity legislation.
3	Methodology	Explaining the used methods for theoretical and empirical research.
4	Empirical study I: Expert interviews	Discussing the analysis and findings of the explorative expert interviews.
5	Empirical study II: Focus group workshop	Discussing the preparation and findings of the focus group workshop.
6	Discussion	Discussing the findings and comparing them with hypotheses and literature.
7	Conclusion	Summarising the main findings and drawing the main conclusion.
8	Recommendations	Presenting the thesis' end-result and recommendations for project developers.

Table 1. Reading guide (source: author).

2 Theoretical background

This chapter provides a foundational background for this thesis with a literature review, thereby establishing the context in which the problem is addressed. From the conceptual framework, this research focuses on four main components: stakeholder engagement, phasing, design elements and principles, and financial prerequisites. These four components are included in this chapter. The literature review begins with an overview of existing research on biodiversity in the built environment, with a specific focus on urban nature-based solutions and the relationship between biodiversity and scale. Subsequently, current design elements and principles will be discussed and the relationship between stakeholder collaboration and biodiversity enhancement will be explained.

The following section delves into the domain of urban area development, explaining its key components, including stakeholder engagement, phasing, and the influences of acquisition types. It is important to explain this to establish the framework of this research. This is followed by a discussion of the financial prerequisites associated with biodiversity implementation in urban areas.

The final part addresses biodiversity regulations and legislation. As previously noted, the main problem this research addresses is the prevalent concentration of biodiversity implementation on individual plots. This is often due to limited or even absent governmental regulations and supervision. Hence, an investigation of current regulations and legislation concerning biodiversity in the Netherlands is essential to validate this statement and identify potential barriers that can be addressed through this research. The chapter ends with conclusions and hypotheses on the four key components and the relationships between the components and the two main concepts.

2.1 Biodiversity in the built environment

Biodiversity is implemented in the built environment through urban nature-based solutions, which include initiatives aimed at protecting, managing, and restoring natural and modified ecosystems (IUCN, n.d.). Urban nature-based solutions address societal challenges and benefit both biodiversity and human well-being. Kabisch et al. (2022) outline five integrated principles for sustainable urban area development through nature-based design, planning, and implementation. These principles prioritise a systemic understanding, mutual benefits for people and biodiversity, the longevity of inclusive solutions, contextual considerations, and enhanced communication and learning. Additionally, urban nature-based solutions are recognised as integral components of cities, connected with gray infrastructure, water drainage systems, and mobility networks, serving to create resilient and liveable urban environments. Kabisch et al. (2022) further emphasise that urban nature-based solutions must align with human needs, ecological flows, and habitat requirements. They necessitate the integration of local knowledge and cultural context and hold the potential to reconnect people with nature. Biodiversity in the built environment has a lot of potential.

Because this thesis examines the relationship between biodiversity implementation and its plot context, it is important to explain the relationship between biodiversity and scale. Uchida et al. (2021) studied the impact of scale on biodiversity. Their research underlines urbanisation as both a filter and facilitator of biodiversity, with highly urbanised areas being dominated by a few human-associated species. Some organisms find refuge in natural urban green spaces, while others are (un)intentionally introduced by humans and may become feral populations (Uchida et al., 2021). Larger cities may have more extensive green spaces and greater environmental heterogeneity.

Biodiversity enhancement should consider these complex relationships and scale patterns (Uchida et al., 2021). Focusing solely on individual plots, rather than considering multiple plots within a given area, poses several challenges. Biodiversity enhancement is more effectively achieved at broader spatial scales, where buildings can create interconnected networks of green areas that enhance habitat availability, support larger populations, and facilitate species movement through collaborative efforts. Hence, collaborative efforts of buildings have a positive impact on urban biodiversity. This multi-plot collaboration is essential to enhance biodiversity in urban environments. Moreover, collaboration can help mitigate the urban heat island effect. By lowering surface temperatures and providing shade, urban nature-based solutions create microhabitats that support a wider range of species, contributing to greater urban biodiversity (Rosenzweig, 2003). In addition, buildings can profit from combined efforts. By sharing knowledge, experiences, and resources, buildings may collectively create more diverse and effective habitats (Loram et al., 2007). The absence of multi-plot collaboration in the future may lead to habitat fragmentation (Fahrig, 2003), reduced gene flow (Gilbert-Norton et al., 2010), increased risk of local extinctions (Kowarik, 2011), limited provision of ecosystem services (Bommarco et al., 2013) and ultimately result in biodiversity decrease.

Collaboration between buildings and infrastructure can enhance green and blue elements by creating a network. Buildings that are strategically located and designed with green areas can create interconnected pathways to enhance ecological connectivity in urban areas (Hanski, 1999). Cities' fragmented habitats can be connected, making it easier for species to disperse and find resources and ultimately increasing biodiversity. When there is no network between different green areas, there are several consequences. Fragmented urban area development, as documented in prior studies (Ahern et al., 2007; Pickett et al., 2013), can result from inadequate planning and coordination between project developers and other stakeholders without considering connectivity. Land use conflicts, as identified by Benedict and McMahon (2002), can arise when project developers consider green areas as barriers to development. Infrastructure barriers, as discussed by Trombulak and Frissell (2000), are encountered when existing urban infrastructure hinders wildlife movement.

2.1.1 Current design elements and principles

As explained earlier, buildings play a crucial role in enhancing biodiversity in urban areas, especially by working together. Buildings can be designed to incorporate green areas and native plant species can be selected for cultivation, to create a cohesive ecosystem and enhance ecological processes. Native plants are adapted to the local environment, making them more resilient and attractive to local animals.

Since this study aims to investigate design elements and principles that ought to be implemented in a project to enhance biodiversity, especially in a multi-plot context, it will first examine the existing implementation of such design elements and principles.

Barnett (2002) designed a design guide explaining basic strategies that designers should consider when incorporating biodiversity into their projects. These strategies encompass:

1. Explore existing biodiversity within the area and region and its contextual relations.
2. Prioritise the preservation of native vegetation over restoration efforts.
3. Design for biodiversity by reducing the building footprint, wind tunnels, and wildlife moment obstacles.

4. Design native landscape schemes with indigenous plant species and establish buffers around ecological remnants.
5. Mitigate potential conflicts between human activities and wildlife.
6. Promote low-maintenance designs and urban renewal to restore ecosystem services.

This thesis often discusses ecosystem services, the benefits provided by ecosystems to humans. According to Aghina et al. (2023), ecosystem services provide healthy habitats for animals and people, create climate-resilient environments, and increase recreational and property values. Aghina et al. (2023) list 12 ecosystem services of nature:

1. Biodiversity;
2. CO_2 reduction;
3. Water buffer and storage;
4. Reduce heat and drought;
5. Healthy and liveable environments;
6. Air quality improvement;
7. Food production;
8. Foster social cohesion;
9. Recreational value;
10. Wind and noise mitigation;
11. Increase property value;
12. Social value.

Belcher et al. (2019) researched whether and how vegetation in and on buildings has a positive impact on biodiversity enhancement, with a focus on birds. The result of the study was that gardens on the ground support as much biodiversity as roof gardens, but also a higher proportion of synanthropes (pests and weeds). A synanthropic is a man-made biotope. Belcher et al. (2019) explain that green roofs can support more native bird species than non-vegetated roofs. The study also found that certain design elements such as the height of a green façade or roof support different species groups. This conclusion is also drawn by Aghina et al. (2023), who investigated which species may inhabit where in and on a building (Figure 3). The mentioned species are listed below (Table 2).

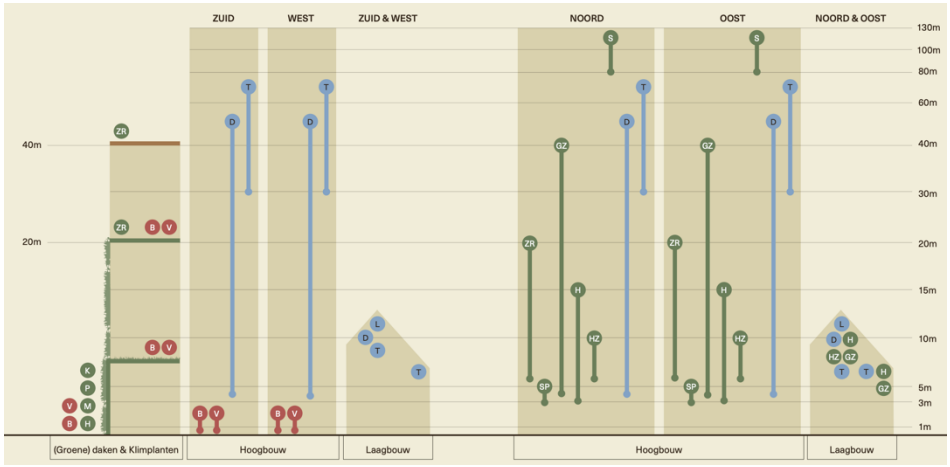

Figure 3. Where different species inhabit (Aghina et al., 2023).

Abbreviation	Birds	Abbreviation	Mammals
K	Great tit	D	Common pipistrelle
P	Blue tit	T	Bicoloured bat
M	Blackbird	L	Serotine bat
H	House sparrow		
ZR	Black redstart	Abbreviation	Insects
SP	Starling	B	Bee
GZ	Swift	V	Butterfly
HZ	House martin		
S	Peregrine falcon		

Table 2. Explanation to Figure 3 (Aghina et al., 2023).

Dover (2015) discusses key design elements in his book on green infrastructure: permeable pavements, green walls, green roofs, and street trees. These design elements can each serve as habitats for many plants and animals and thus enhance biodiversity. Mayrand and Clergeau (2018) focus mainly on green walls and green roofs, identifying them as habitats for arthropods, fungi, bacteria, and vertebrates including a few mammals.

Habitat size is critical for plant and animal populations, especially for endangered or urban-averse species that require significant areas for conservation. Determining the optimal size for green spaces that enhance biodiversity is complex because different species inhabit various spatial scales. Green walls and roofs come in a range of sizes, from a few square meters to tens of thousands of square meters, yet neither is highly effective for conserving endangered or urban-averse species (Mayrand & Clergeau, 2018).

Mayrand and Clergeau's research also delves into the relationship between green walls and roofs and their influence on species. They note that green walls, depending on their type, create unique habitats with varying species compositions. For instance, walls with herbs and shrubs attract diverse wildlife due to substrate availability and complex plant cover. Moreover, green walls and green roofs offer distinct habitats. The height of green roofs significantly impacts low-mobility species, while highly mobile species are influenced by exchanges with other plots, especially for tall buildings (those with more than five floors) (Mayrand & Clergeau, 2018). This information is important to consider when designing the framework of this thesis.

2.1.2 Collaboration for biodiversity enhancement

This research explores the connection between *'stakeholder collaboration and co-development'* and *'biodiversity across multiple plots'*. To analyse this relationship, it's crucial to understand how stakeholder collaboration influences biodiversity enhancement. Brédif et al. (2017) emphasise that enhancing biodiversity requires a cooperative approach among stakeholders who share common goals and objectives. Stakeholders must be motivated to enhance biodiversity in their projects. Brédif et al. (2017) identify five key motivations for stakeholders to enhance biodiversity, including a sense of responsibility, preserving territory, quality of life, autonomy, and resources.

Gavin et al. (2018) and Angelstam et al. (2011) echo this sentiment, advocating dynamic, partnership-based approaches for biodiversity conservation. They emphasise the need for diverse strategies involving different groups of people. The study underscores that previous conservation methods have been ineffective due to a lack of focus on shared goals.

2.2 Urban area development

This thesis adopts Heurkens' (2017) definition of urban area development. This entails a complex, long-term process of physical adaptation of a specific location to meet socio-economic and spatial needs through the collaboration of diverse stakeholders using various tools. According to De Zeeuw (2018), urban area development consists of five components: geographical boundaries, multi-functionality, incentive for change, process and planning, and involvement of public and private entities. Urban area development can be driven by market forces, government initiatives, or societal demands.

Fragmented land ownership is a major barrier to urban area development. Each landowner has the autonomy to decide on (re)development (Hobma et al., 2019). The same applies to biodiversity implementation. Each landowner has the autonomy to decide on prioritising biodiversity independently. Hence, fragmented land ownership is also a barrier to biodiversity implementation. Hobma et al. (2019) propose four strategies to address fragmented land ownership, with the later-named strategies involving higher financial risks, but also a higher degree of influence:

1. Plot development: independent development of individual plots without cooperation.
2. Organic development: owners develop at their own pace with limited cooperation, primarily for the redevelopment of public spaces.
3. Developing Apart Together (DAT): individual plots are developed within a shared vision with contractual agreements on design, phasing, branding, and cost contributions, without merging land ownership.
4. Aggregation of ownership: land ownership is acquired by a single public or private party or a joint legal entity.

These strategies are essential when analysing biodiversity implementation, especially when comparing single plots to multi-plot scenarios. The subsequent sections of this chapter will explore components of urban area development that affect biodiversity implementation and enhancement, including stakeholder engagement, phasing, and relationships between public and private entities.

2.2.1 Stakeholder engagement

Stakeholders are the directly or indirectly involved individuals and organisations who affect or are affected by a decision in an endeavour (Sterling et al., 2017). Three main stakeholder groups can be distinguished depending on the urban area development brief: private parties, public parties, and citizens and civil society organisations (Heurkens, 2017). Private stakeholders include investors, financiers, construction companies, project developers, residents, and business owners. Public stakeholders differ in their spatial scale of operation and legal-planning authorities, including central government, provinces, regions, and municipalities. Additional stakeholders encompass interest groups and consortia, such as residents, property owners, users, and associations (Heurkens, 2017). Table 3 summarises the time horizon, goals, commitment, and possible roles of involved stakeholders.

Research by Boiral and Heras-Saizarbitoria (2017) delves into the mechanisms to address biodiversity concerns through stakeholder engagement. They identify four primary factors influencing stakeholders' motivations: (1) self-regulation and relationships with governmental authorities, (2) complexity and knowledge management, (3) legitimacy and social responsiveness, and (4) commercial and strategic goals.

Jones-Walters and Çil (2011) emphasise the significance of stakeholder engagement in biodiversity policy and practice. The European Commission has funded initiatives to explore stakeholder engagement, including case studies, stakeholder workshops, and participatory methodologies. Stakeholder engagement has proven effective in species conservation management, offering valuable insights for the implementation of ecological networks and local biodiversity action plans (Jones-Walters & Çil, 2011).

Stakeholders	Municipality	Project developer	Property manager	Users
Time horizon	Long-term	< 5 years	Long-term	< 2 years
Goals	Creating and increasing social values	Protecting Creating and increasing social values	Creating and increasing returns from operations	Adapting environment for own benefit or target group
Commitment	Implementing policies	More quality of environment Larger usability or volume Better reputation	Better usability Reduced maintenance costs Better reputation More clients Expansion of target group	Suggesting ambitions Contribute to costs
Position and possible roles at initiation stage	Initiator Permit issuer Partner Director Investor Owner	Initiator Permit issuer Partner Director Investor Owner	Initiator Partner Investor Owner/tenant	Initiator Partner Investor Demanding client

Table 3. Time horizon, goals, commitment, and roles of stakeholders in urban area development (van Gameren, 2011).

2.2.2 Phasing

Four phases can be distinguished in the literature on urban area development and real estate development (Heurkens, 2017; Kersten et al., 2019; De Zeeuw, 2018):

1. Initiative and exploration: formulating a vision and ambition, identifying potential stakeholders, assessing the initiative's feasibility, and establishing project goals based on a strategic evaluation of land policy and market knowledge.
2. Plan formation and feasibility: concurrent calculating and designing of potential development plans, establishing agreements between public and private entities; the iterative process of integrating program, design, finances, and process to achieve a plan with the ultimate objective of public-law adoption of the zoning plan.
3. Development and construction: making agreements for execution, task allocation, risk management, obtaining legal permits before implementation, and ultimately delivering the project. Focusing on practical aspects, emphasising clear responsibilities and implementation.
4. Operation and maintenance: designating stakeholders for operation and maintenance, ensuring a sustainable cost-benefit ratio, and identifying potential future developments.

Urban area development is an iterative process, where process steps need to be repeated and adjusted regularly (De Zeeuw, 2018).

2.2.3 Public-private partnerships

Urban area development involves coordination between public and private interests, leading to concrete agreements for physical-spatial improvements (Heurkens, 2017). Public parties pursue policy objectives, while private parties seek business objectives. This often results in contractual and organisational public-private partnerships, encompassing legal, financial, organisational, and relational aspects. Collaboration between public and private entities in urban area development varies (Heurkens, 2017), aligning with development strategy, government land policy, financial capacity, and municipal risk profiles (Kersten et al., 2019). This collaboration also accounts for location-specific ownership conditions. The roles of stakeholders in different models and their involvement in process phases are depicted in Table 4. The coloured cells indicate the stakeholder(s) in charge. The selection of public and private stakeholders for these models depends on factors like land ownership, land policy, socio-political considerations, finances, location, and expertise. Notably, the relationships between these parties influence the prioritisation of biodiversity implementation.

Phase	Sub-phase	Public development	Concession	Building claim	Joint venture	Private development
Initiative and exploration	Initiative	Government	Government	Government/ market	Government/ market	Government/ market
Plan formation and feasibility	Vision and program	Government	Joint	Joint	Joint	Market
	Plan formation	Government	Market	Joint	Joint	Market
Development and construction	Land exploitation	Government	Market	Government	Joint	Market
	Project development	Government / market	Market	Market	Joint / market	Market
	Construction	Market	Market	Market	Market	Market
Operation and maintenance	Maintenance public area & infrastructure	Government	Government/ market	Government/ market	Government/ market	Government/ market
Government land policy	Active		< >			Passive/facilitating

Table 4. Public-private partnership models in urban area development (Kenniscentrum PPS, 2006; De Zeeuw, 2018).

2.3 Financial prerequisites for biodiversity

Green and blue infrastructure offers ecological and social benefits, but also financial benefits. It can reduce the urban heat island effect and yield an attractive Return On Investment (ROI) (Enzi et al., 2017). Moreover, greening a building can reduce heating and cooling costs, resulting in energy and resource savings. This contributes quality of life in cities, fostering happiness, productivity, and reduced absenteeism. Enzi et al. (2017) explored the relationship between greening buildings and the financial market, particularly focusing on the green roof industry's substantial growth. This sector continues to expand, offering significant revenue potential, while income from building vegetation maintenance is set to increase, providing long-term and sustainable employment opportunities. Maintenance costs for buildings with green design elements are comparable to those of conventional buildings when considering lower energy demands and extended envelope lifespan. However, there may be up-front installation and maintenance costs.

According to Kats (2003), buildings with green design elements offer financial benefits that conventional buildings do not, including energy and water savings, waste reduction, better indoor environmental quality, enhanced employee comfort and productivity, reduced employee health costs, and lower operational costs. Buildings with green design elements have high cost-effectiveness, particularly when integrated early in the project planning process (Kats, 2003).

In conclusion, designing green and blue infrastructure and buildings with green design elements has financial benefits. Biodiversity enhancement in the built environment indirectly affects these financial benefits. Design elements that enhance biodiversity differ per urban area development project regarding financial advantages, disadvantages, and prerequisites.

2.4 Biodiversity regulations and legislation

As previously discussed, two issues surround biodiversity regulations: their limited extent and the challenges faced by municipalities in translating policy into action. Municipalities play a fundamental role in prioritising biodiversity implementation in urban areas. This section focuses on existing regulations and legislation. We start at the global scale, subsequently narrowing the focus to the laws and regulations within the Netherlands.

Three decades ago, the Convention on Biological Diversity (Rio de Janeiro, 1992) was established, involving 193 nations to promote biodiversity conservation (Cardinale et al., 2012). Despite this agreement, global biodiversity loss persisted, leading to the formulation of new targets and the establishment of a new assessment body, the Intergovernmental Platform on Science and Policy for Biodiversity and Ecosystem Services (IPBES) – an international organisation dedicated to enhancing the influence of science on public policy regarding biodiversity and ecosystem services.

The European Union (EU) has adopted an ambitious biodiversity recovery plan outlined in its Biodiversity Strategy for 2030 and the Green Deal (Hermoso et al., 2022). These policies aim to address biodiversity loss, emphasising habitat restoration, expanding protected areas, and improving funding and governance. The strategies present long-term plans for nature preservation and restoration, underscoring the importance of greener European cities (Kort, n.d.). As noted by Hermoso et al. (2022), future conservation efforts require improved coordination, greater integration of conservation across sectors, increased funding, and enhanced governance. While the EU has common rules and funding, it has struggled with coordination among member states, policy integration, funding adequacy, and stakeholder participation. European nature policy, as outlined by Kort (n.d.), focuses on conserving biodiversity and safeguarding sensitive European ecosystems, primarily through the Natura 2000 network. In addition, the EU has regulations on non-native and wild animal species.

In the Netherlands, the national government is responsible for adapting European policies into national frameworks, while provinces further develop these in provincial strategies (Kort, n.d.). The Nature Program (2020) signifies a collaborative effort between national and provincial authorities to enhance nature and biodiversity, aligning with the Nature Pact. Central to Dutch nature policy is the Nature Network Netherlands (Natuurnetwerk Nederland, NNN), a network encompassing nature areas and connecting zones, previously known as the National Ecological Network (Ecologische Hoofdstructuur, EHS). The network is managed by national and provincial governments.

In 2013, the Dutch national and provincial governments signed the Nature Pact, outlining ambitions and funding for national nature policy until 2027 (Planbureau voor de Leefomgeving, 2023). The pact includes the Nature Inclusive Agenda, involving various organisations in defining specific nature inclusiveness goals. Governments are now tasked with translating these goals into practical

policy, including the conservation and restoration of urban biodiversity (Veerkamp, 2023). Municipalities, as key actors in shaping public spaces, had to adopt an environmental vision by December 31, 2023, under the Environment Act (Omgevingswet) (Vereniging van Nederlandse Gemeenten, n.d.), outlining their long-term ambitions and policy goals for the entire municipal area.

In Dutch policy, aside from the Environment Act (Omgevingswet), the Nature Conservation Act (Natuurbeschermingswet) and the Dutch Spatial Planning Act (Wet Ruimtelijke Ordening) are essential laws for biodiversity implementation (Ministerie van Algemene Zaken, 2022b). The Nature Conservation Act (Natuurbeschermingswet) offers some protection for specific habitats and species, but its focus has been more on the preservation of natural areas outside urban settings. The Dutch Spatial Planning Act (Wet ruimtelijke ordening) addresses land use planning, but it has historically given limited attention to urban biodiversity conservation.

The Ministry of Agriculture, Nature, and Food Quality (LNV) has two initiatives for greener cities: the Participation Table on Nature-Inclusive Building for construction companies and the National Roofing Plan for more green roofs in cities (Ministerie van Algemene Zaken, 2022d). In 2017, the Participation Table on Nature-Inclusive Building (PTNIB) launched with the ambition of nature-inclusive building as the new normal, in collaboration with many different partners (DuurzaamDoor, 2021). Knowledge sharing and learning from each other were central. The core group worked on three action points: Community of Practice (CoP) transition to nature-inclusive building, staging nature-inclusive building, and customised research (DuurzaamDoor, n.d.). The table continued from 2021 in the following composition: 1) Entrepreneurs (NEPROM, DS Landscape Architects); 2) Bottom-up research (Vogelbescherming, IVN, WUR); 3) Education (Academy of Architecture, WUR); and 4) Government (province of Noord-Holland, RVO/DuurzaamDoor).

The National Roofing Plan (NDP) focuses on four points: sharing collective knowledge with the entire sector, anchoring in local and regional policies, incentivising funding, and publicising the social benefits (National Roofing Plan, n.d.). The initiative launched in 2019 to embed solutions through roofs in urban planning, procurement, the construction process, and the current built environment. The goal of the NDP is to provide guidance, tools, and examples (Bouwman, 2020). So far, the initiative has mainly generated name recognition and awareness of materials and benefits. Both initiatives are not linked to regulations and are driven by private and public (not social) parties.

The ministry also commissions companies. For example, LNV asked OSKA (Overleg Standaarden Klimaatadaptatie) to make an inventory of existing biodiversity standards, revealing a strong demand among municipalities and stakeholders for standards integrating knowledge and insights on biodiversity and nature-inclusive construction (Kennisportaal Klimaatadaptatie, 2023). OSKA established the ‘Nature Inclusive Building Action Team’ and proposes a national nature-inclusive building scoring system, adaptable for local use by municipalities.

In the context of urban area development, the Dutch legal framework comprises various elements, including zoning plans, master plans, and urban design plans. Zoning plans serve as detailed legal translations of urban design plans, with the ambition to initiate new municipal spatial policies (De Zeeuw, 2018). First, the master plan and urban design plan are agreed upon by public and private parties. The zoning plan follows when the content is established. The Environment Act (Omgevingswet) offers the potential to better integrate biodiversity as a significant environmental value within zoning plans.

2.5 Conclusion

Drawing upon the literature review, hypotheses will be formulated for each of the four components identified in Figure 4. Initially, the relationships between these components and the two main concepts are elucidated. *'Stakeholder engagement'* and '*phasing'* can be considered as mediating variables, serving as intermediaries in the relationship between stakeholder collaboration and co-development and biodiversity across multiple plots. The impact of stakeholder collaboration and co-development on biodiversity is channelled through the engagement of relevant stakeholders and the well-structured phasing of biodiversity implementation. *'Design elements and principles'* and *'financial prerequisites'* can be viewed as moderating variables, influencing the strength of the relationship between stakeholder collaboration and biodiversity on multiple plots. The effect of stakeholder collaboration on biodiversity across multiple plots is amplified when employing appropriate design elements and principles for biodiversity enhancement and when considering the financial prerequisites of biodiversity implementation.

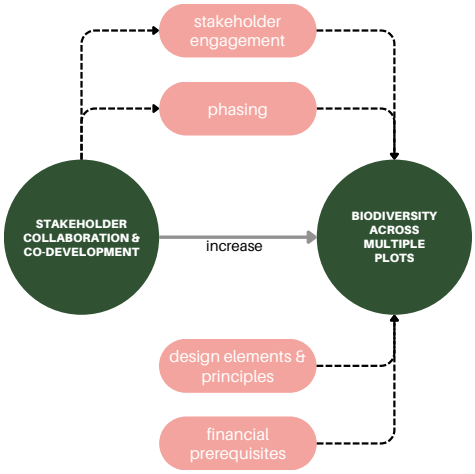

Figure 4. Conceptual model (source: author).

The implementation of design elements and principles that prioritise native vegetation, incorporate green infrastructure, and consider connectivity of green spaces will significantly enhance biodiversity across multiple plots in urban areas. The empirical research will further explore which design elements and principles need to be incorporated into urban area development projects to answer sub-question 1.

Stakeholder engagement, involving private and public stakeholders, citizens, and civil society organisations is crucial for achieving successful biodiversity enhancement. It is clear from the literature what the goals, commitments, positions, and possible roles of the municipality, project developers, property managers, and users are. The next step is to delve deeper into additional stakeholders and the responsibilities of the different stakeholders, which will be examined through empirical research to answer sub-question 2.

Financial planning and allocation are crucial for successful biodiversity implementation within the scope of an urban area development project. Additional financial barriers will be further investigated during the expert interviews to answer sub-question 3.

From the literature, the stages of an urban area development process are clear. To answer sub-question 4, a process integrating biodiversity implementation will be designed during the focus group workshop.

3 Methodology

3.1 Research strategy

In order to gain a better understanding of the influence of stakeholder collaboration and co-development on the implementation of biodiversity across multiple plots, first the research methodology employed in this study will be explained. The methodology encompasses research types and research design, followed by an in-depth explanation of the research methods. Subsequently, the Data Management Plan is presented, including data collection, data analysis, data plan, and ethical considerations. Finally, the chapter explains the research outputs, encompassing deliverables and a timeline.

3.1.1 Research types

This research combines theoretical and empirical research methods. The theoretical research has an exploratory purpose, gathering preliminary information and generating new insights on biodiversity implementation on multiple plots in urban areas. As the main research question is open-ended, exploratory research will be conducted to acquire a foundational understanding of the subject. The empirical research comprises expert interviews, also conducted in an exploratory manner, and a focus group workshop, primarily geared towards qualitative research. The workshop uses a format similar to a research by design method. This consists of a pre-design phase, a design phase, and a post-design phase (Roggema, 2016). The qualitative research focuses on understanding and interpreting social phenomena from the perspective of the key stakeholders.

3.1.2 Research design

The research framework explains the relationships between the different methods and the process of the research (Figure 5). The research framework is based on the 'Double Diamond' model of the Design Council (2005). It consists of two diamonds, with the first focusing on problem identification and the second on problem-solving. Each diamond consists of two phases.

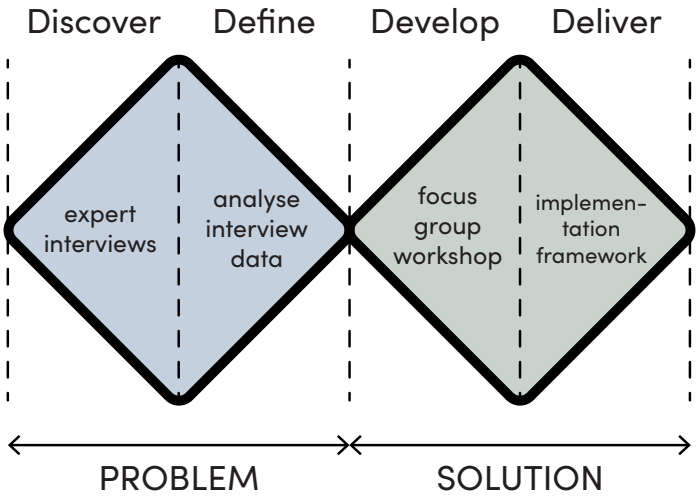

Figure 5. Research framework (author), based on Double Diamond (Design Council, 2005).

The first diamond facilitates problem comprehension and necessitates engagement with individuals impacted by the problem (Design Council, 2005). The first phase of this diamond involves exploratory expert interviews to explore and discover the problem. The second phase revolves around problem definition, achieved through an analysis of the expert interview data. The second diamond encourages diverse perspectives for addressing a clearly defined problem, seeking inspiration from external sources, and collaborating with diverse stakeholders (Design Council, 2005). The third phase entails the development of the solution through the workshop with a focus group. In this phase, an urban area development process is formulated through discussions and design sessions. The fourth and final phase encompasses the delivery of the solution, concluding in the thesis' end-result: the biodiversity implementation framework.

The sub-questions are addressed without a predetermined order, as each research method – literature review, expert interviews, and focus group workshop – contributes to answering each sub-question. In the *Conclusion* chapter, the merging of insights from all methods will lead to comprehensive conclusions and answers to each sub-question.

3.2 Theoretical research

The literature review provides a foundational background to establish the context in which the problem is addressed. The literature review examines the key concepts relevant to the subject and provides background knowledge. It serves as the knowledge base for the forthcoming empirical research. Previous findings are studied, important topics are explained, and discrepancies are clarified.

3.2.1 Literature review

The literature review starts with a review of existing research on biodiversity in the built environment, with an emphasis on design elements, principles, and collaboration for biodiversity implementation and enhancement. This foundational knowledge is needed to answer sub-question 1 (*Which design elements and principles enhance biodiversity across multiple plots?*) and sub-question 2 (*Which stakeholders are important for biodiversity implementation and what are their roles?*). The literature review then examines urban area development and its components, to establish the scope of urban area development within which this research takes place. This information is needed to answer sub-question 4 (*How should an urban area development process be designed for biodiversity implementation?*). Financial prerequisites for biodiversity implementation are addressed to answer sub-question 3 (*What are the financial prerequisites of biodiversity implementation within the scope of an urban area development project?*). Finally, the literature review addresses biodiversity regulations and legislation, crucial for understanding the prevalent focus on individual plot implementation and potential barriers to be addressed in this research.

3.3 Empirical research

The empirical research consists of explorative interviews with experts and a workshop. The explorative interviews with experts will be conducted in phase 2 with carefully selected experts, concurrently with the literature review. The knowledge and insights gained from both the literature review and the expert interviews will form the foundation for the workshop. A focus group will be used to conduct the workshop.

3.3.1 Expert interviews

The explorative expert interviews are used to acquire understanding and knowledge about current biodiversity implementation practices. Much information has been gathered from the literature on the four components of the conceptual framework. The expert interviews will identify current barriers and future recommendations related to these four components, which will be used in the focus group workshop. In addition, the findings will provide insight into current incorporated design elements and principles, stakeholder involvement, financial barriers, and the importance of biodiversity implementation during a process.

The explorative nature of this research necessitates semi-structured and open-ended interviews. The interviews will collect the specialised knowledge of experts in the field. The following step-by-step plan will be adhered to for the interviews with experts:

1. Identify and select experts.
2. Prepare for expert interviews.
3. Develop interview protocol (*Appendix I*).
4. Conduct the interviews.
5. Analyse the data obtained from the expert interviews.

Several strategies can be used to identify experts. Flick (2009) defines experts as individuals who are particularly competent as authorities or have technical process-oriented and interpretive knowledge related to their specific field of work. According to Flick (2009), expert interviews should be semi-structured to provide structure for data analysis while maintaining an open conversation. The strategy for attracting and finding experts is through the author's network. The experts are ecologists, biologists, or biodiversity experts or -consultants, working for private or public parties.

A schedule and guide for the interviews will be prepared. However, with the semi-structure, there will be room for new questions that relate the interviewees' answers. A guide also ensures that the interview does not get lost in topics that are not relevant and allows the expert to extemporise his or her topic and outlook (Flick, 2009). In preparation for the interviews, a systematic framework was developed to guide the interview process, including three parts:

1. Questions regarding the experts' background and professional experience;
2. Questions about their specific involvement with biodiversity in the built environment;
3. Questions about their perspectives on the future image of biodiversity in a multi-plot context.

This systematic framework comes together in the interview protocol (*Appendix I*) along with the interview requirements and an introduction to the study. An Informed Consent form (*Appendix II*) was prepared for participants to sign at the beginning of the interviews. The aim is to conduct 10 to 15 interviews.

During the research process of conducting expert interviews, it is important to find common insights and to corroborate; to get additional confirmation from multiple interviewees to support findings and interpretations. By gathering diverse perspectives and experiences, responses can be compared to explore similarities or patterns, and convergence or agreement. In this way, the credibility and reliability of the results is ensured.

3.3.2 Focus group workshop

The focus group workshop is the third phase of the Double Diamond framework. By integrating findings from the literature review and the expert interviews, a foundation is established for the development of the framework. During the workshop, statements derived from the expert interview data will be deliberated upon and a process will be designed. As an exploratory research endeavour, the workshop will adopt a semi-structured format. This means that statements, a situation outline, and a process outline will be prepared to provide guidance. However, the discussion itself will remain open-ended, allowing participants to actively shape the discussion based on their individual perspectives.

The workshop has two objectives. Firstly, it aims to gather diverse perspectives from various stakeholders. It is noteworthy that the expert interviews have primarily involved ecologists and individuals specialising in green infrastructure and biodiversity. Given their expertise, these participants naturally prioritise biodiversity as an important aspect within any project. However, it should be acknowledged that other stakeholders may possess alternative interests and priorities that supersede biodiversity concerns. Thus, the workshop will bring together individuals with different disciplines to foster a multiplicity of perspectives.

The second objective involves the development of a process that elucidates the critical junctures for biodiversity enhancement and implementation. It is essential to ascertain the specific responsibilities and tasks of each stakeholder concerning biodiversity implementation at various stages. In designing this process, particular emphasis will be placed on two of the four components of this research: stakeholder engagement and financial prerequisites. Furthermore, the next step is to explore the potential collaboration and co-development strategies that can enhance biodiversity in a multi-plot context. Consequently, the workshop will also address the surrounding project area and its connectivity with adjacent green areas. Each phase will be evaluated to determine the feasible measures that can be undertaken to enhance biodiversity.

3.4 Data collection

The collected data will entail a combination of primary and secondary sources. The primary data will be acquired directly by the researcher during the exploratory interviews with experts and the focus group workshop, rendering them relatively easy to authenticate. Secondary data will be sourced from existing publications, forming the basis of the literature review. These secondary data, although not directly obtained by the researcher, will be examined beforehand and deemed reliable for analysis and synthesis. The secondary data will be sourced primarily from the academic search engine Google Scholar.

The primary data collected during the interviews and workshop is conducted in the Dutch language, as all participants involved are Dutch. To facilitate analysis, interpretation, and address the research questions, these data will be translated into English. This translation process enables a comprehensive examination of the primary data, enabling the researcher to draw valid conclusions and insights. Although the data will be translated into English, the interviewees' quotes will be presented in Dutch. Keeping the quotes in Dutch contributes to the authenticity, integrity, and precision of their expressions. In addition, this aligns with principles of research transparency and fidelity, ensuring the accurate representation of interviewees’ words and reducing the risk of distortions that may occur during the translation process.

Collecting a lot of data from different sources poses the risk of getting lost in the information (Baxter & Jack, 2015). To mitigate this, a computerised database is often utilised to organise and manage the data, ensuring accessibility for independent examination. This approach enhances study reliability by enabling the researcher to track and organise data sources (Baxter & Jack, 2015). Certain programs can facilitate the recording of source data, storage, and search capabilities.

The data collection process for expert interviews involves three stages: the interview, transcription, and interpretation (Flick, 2009). The strengths of interviews are the face-to-face contact and the personal relationship, based on verbal and non-verbal communication, so they are preferably conducted physically. This allows the researcher to stimulate the dialogue in detail and specifics. However, a digital platform like Teams may be used if preferred by the interviewee. Working with a local sample simplifies logistics but can limit representation (Flick, 2009). Prior to the interviews, participants receive the interview protocol (*Appendix I*) and consent is sought for participation in the study and data processing. The interviews are recorded and transcribed for analysis.

The data collection process for the workshop also encompasses three stages: the pre-design phase, the design phase, and the post-design phase (Roggema, 2016). When feasible, the workshop will be conducted physically, bringing together all participants in person. A digital platform like Teams is used when preferred by the participants. Before the workshop, participants will receive the protocol (*Appendix I*) and will be requested to provide consent for study participation and data processing. The workshop will be recorded.

3.5 Data analysis

The data collection and data analysis should be performed concurrently (Baxter & Jack, 2015). To analyse the data, the program ATLAS-ti will be used. Thematic analysis of interview transcripts, employing predetermined codes through closed coding, will be the primary approach, with open coding if needed. ATLAS-ti can work with different sorts of text documents, and it supports operations on textual and conceptual levels (Flick, 2009). The program displays the primary text with all associated codes and comments in several windows on the screen.

Nineteen codes are established, presented in Figure 7 in *Chapter 4: Empirical Study I*. Using ATLAS-ti, each text segment is associated with one or more codes, and these codes then include extensive summaries of the collective insights experts provided on the corresponding content. There is interconnectivity between certain codes, and ATLAS-ti facilitates the visualisation of these relationships, which provides an analytical advantage for drawing conclusions about each code. This feature increases the interpretive depth of the study. After coding, the codes are grouped into themes (Figure 7). Estimating the time for data interpretation in ATLAS-ti is difficult. Sufficient time should be included for technical preparation, for example, installation and removal of errors.

The workshop follows a research by design method format, collaboratively designing a strategy for urban biodiversity implementation with the focus group. Discussions on statements will contribute valuable data for designing the implementation framework, the thesis's ultimate output. The focus group workshop will result in a designed process and a recorded discussion.

3.6 Data plan

A comprehensive data management plan is set up to address various aspects of data processing, including data collection, storage, organisation, sharing, and retention. Wilkinson et al. (2016) explain the FAIR Data Principles—Findability, Accessibility, Interoperability, and Reusability—

which guide to effective data management and sharing for increased reusability of research data. The interview and workshop data are securely stored and regularly backed up on password-protected devices. To facilitate efficient organisation and retrieval, a standardised naming convention and file structure will be used. Sensitive personal information, recorded during and collected for the interviews and the workshop, will be pseudonymised (e.g., Participant 1, Participant 2). To protect the privacy and interests of the participants, personal information will not be shared. At the end of the study, all collected data will be properly documented, archived, and made available for future reference or possible reuse, ensuring long-term value and reproducibility of research findings. Feedback on correct interpretation will be sought through an interview summary during the study.

3.7 Ethical considerations

The growing sensitivity to ethical issues in research has led to the formulation of many ethical codes and the creation of ethics committees in many areas (Flick, 2009). Codes of ethics are created to regulate researchers' relationships with the people they want to study. Flick (2009) explains four ethical theories:

1. Non-maleficence: researchers should avoid harming participants.
2. Justice: all people should be treated equally.
3. Beneficence: research on humans should produce some positive and identifiable benefit rather than simply be carried out for its own sake.
4. Self-determination: research participants' values and decisions should be respected.

In this master thesis, there is a commitment to maintain high standards of research ethics in all phases of the study. The necessary approvals will be obtained before the start of the study. It should be clear that participants attend voluntarily. Informed consent will be obtained from all participants, and their confidentiality, privacy, and anonymity will be maintained. Participants are given clear and understandable information about the study, its purpose, potential risks, and their right to withdraw their participation at any moment. They are not required to answer a question if they do not wish to do so. Any personal or sensitive information collected during the study will be securely stored, if required for this thesis, and used only for the intended research purposes. Ethical guidelines for data processing, storage, and sharing will be met to protect the identity of participants and ensure responsible use of data. In addition, participants are quoted in the results, rather than putting a spin on their answers, to present the data correctly and make the results valid.

3.8 Research output

3.8.1 Deliverables

The expected deliverable is an implementation framework that will guide project developers to implement biodiversity as an integral part of the design and concept development process in their projects, emphasising collaboration with other stakeholders and surrounding plots. Such a framework benefits the city and end-users and can enhance tender success. It comprises a concept development process guide, specifying objectives, deliverables, and milestones, and delineating the roles, responsibilities, and agreements of relevant stakeholders crucial for biodiversity implementation in a multi-plot context. Additionally, the research endeavours to identify practical barriers to

biodiversity implementation in a multi-plot context and proposes potential strategies to mitigate them. These recommendations are intended to expedite the transition to biodiverse cities.

3.8.2 Timeline

Figure 6 presents an overview of the research plan, detailing tasks, milestones, and deliverables, along with interdependencies across five phases (P1 to P5). P1, completed in April 2023, introduced the initial research framework. P2, finalised in June 2023, encompassed the research problem, literature review, relevance, questions, methods, and objectives. P3, presented in October 2023, involved conducting, transcribing, and coding the interviews, and preparing for the focus group workshop. The findings from the expert interviews were compared to the literature study and the outcome discussed during the workshop. P4, culminated in December 2023, signified the conclusion of the empirical research. P5, concluded in January 2024, involves the final report and presentation, incorporating the last feedback.

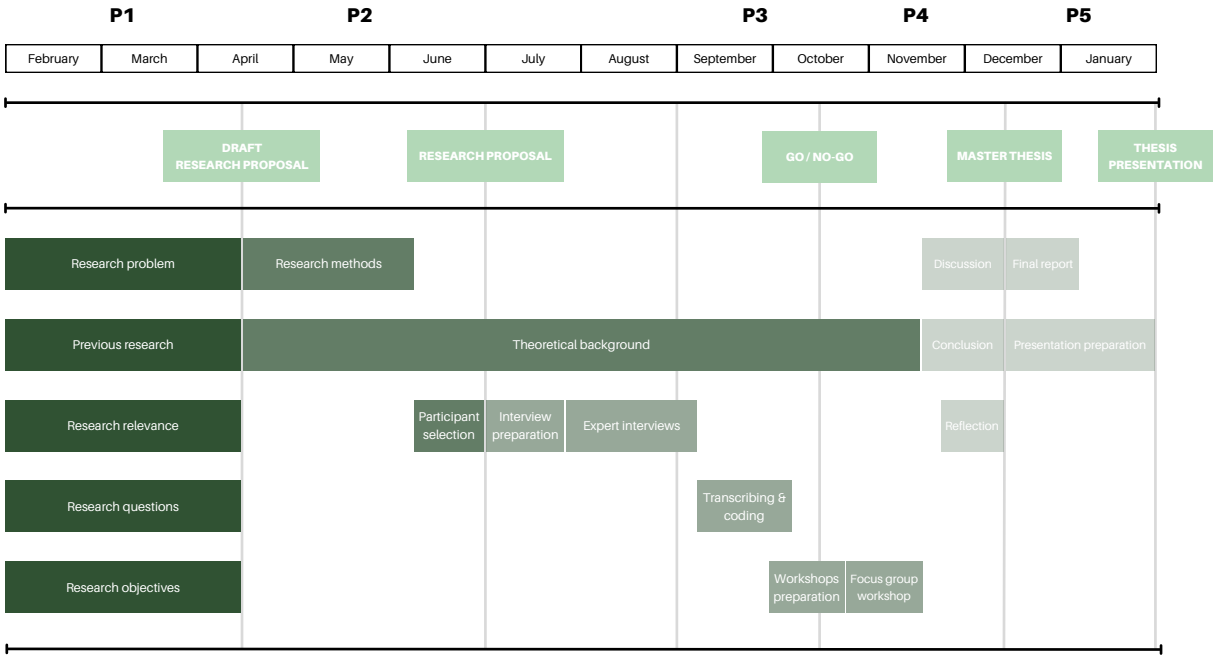

Figure 6. Research plan including P phases and deadlines (source: author).

3.8.3 Dissemination and audiences

This section outlines the strategy for disseminating the findings to ensure broad accessibility, knowledge translation, and meaningful engagement. This research is aimed at private project developers who want to gain more insight into implementing biodiversity in their projects. To bridge the gap between research and policy, this research will be openly accessible to relevant governmental bodies, municipalities, and organisations. Research participants' (interviewees and workshop participants) contributions are highly valued. Therefore, regular updates and feedback are provided to participants to ensure transparency and share the progress of the study. The valuable insights and input from all contributors are acknowledged. In addition, in line with ethical guidelines, anonymised research data will be made available for further analysis.

4 Empirical study I: Explorative expert interviews

This chapter presents the different stages of the expert interviews: the preparation, the interview, the transcription, and the interpretation. The backgrounds of the participants are briefly discussed. Subsequently, the codification procedures used for data analysis are explained, connected to various themes. The Analysis and Findings sections discuss the interpretation and outcomes of the interviews. These findings are organised in three temporal contexts: current situation, desired future situation, and time independent. These temporal contexts will be explained later. As this is a qualitative study, textual conclusions are provided for each code. An overall conclusion is presented at the end of the chapter.

4.1 Participants information

For the expert interviews, invitations were sent to 17 individuals distinguished in their respective fields of expertise. Ultimately, 11 interviews were conducted. The categorisation of the parties where the interviewed experts work is presented in Table 5.

Employed at	#
Knowledge institution / University	4
Private sustainability and greening consultancy firm	3
Municipality	3
Self-employed	1

Table 5. Categorisation of expert employers (source: author).

4.2 Coding

To analyse the interview data, a set of 19 variables was established upon which the experts offered substantial insights. In the program ATLAS-ti, used to analyse data, these 19 variables were designated as codes. The codes are grouped according to six themes: what, when, who, why, where, and how. Table 6 shows the temporal context in which experts addressed the codes. For example, the experts discussed the aspect of ‘maintenance’ in a future-oriented context (indicated as desired future situation), because they were talking about how maintenance should be performed and integrated in the future. The code ‘maintenance’ is thus linked to the temporal context ‘desired future situation’ in Figure 7, a visualisation of Table 6.

Besides the current and desired future contexts, the experts talked about some variables as time independent variables. This conveys that these codes are not exclusively affiliated with a current barrier or future vision; rather, they pertain to both or neither. For example, the experts discussed the aspect of 'reason for biodiversity implementation' as something consistent in significance both presently and in the future. The importance of biodiversity implementation is as strong now as it is in the future. Time independent variables are highlighted in pink in Figure 7. Some variables were delineated in both current and future contexts. These are linked to both the temporal context of current situation and the temporal context of desired future situation.

Theme	Variable	Temporal context	Explanation
What	Biodiversity	Current situation	Definition and components of biodiversity in cities and how to measure biodiversity.
	Design elements and principles	Desired future situation	Building components and guidelines that enhance biodiversity to incorporate in a project.
	Maintenance	Desired future situation	Maintenance principles to incorporate in a project.
When	Phasing and process	Desired future situation	When biodiversity should be considered during the process.
Who	Stakeholder engagement	Current situation	From where the biodiversity demand originates.
		Desired future situation	Stakeholder to engage in biodiversity implementation and their responsibilities, roles, and tasks.
Why	Biodiversity importance	Time independent	Reasons for biodiversity implementation.
	Regulations and legislation	Time independent	Which directives and norms containing biodiversity to incorporate in a project.
	Biodiversity demands & ambitions	Desired future situation	Which ambitions to adhere to in a project.
	Barriers and considerations	Current situation	Barriers and considerations to overcome regarding what, when, who, why, where, and how.
	Budget	Time independent	Financial considerations in biodiversity implementation, expected to be present in the future.
Where	Scale	Desired future situation	Scale level at which biodiversity should be implemented.
	One-site context	Current situation	The problems of biodiversity implementation on only one site. This code is included in 'barriers and considerations'.
	Multi-site context	Desired future situation	Principles and advantages of biodiversity implementation on multiple plots.
	Plot conditions	Desired future situation	Principles about the plots surrounding area to adhere to in a project.
	Green and blue infrastructure	Desired future situation	Principles about the surrounding green and blue infrastructure to adhere to in a project.
	Public-private partnerships	Time independent	The influence of acquisition types and public-private relationships on a projects vision and considerations.
How	Stakeholder collaboration	Current situation	The problems of lack of collaboration between stakeholders in a project. This code is included in 'barriers and considerations'.
		Desired future situation	How to improve collaboration with especially ecologists.
	Plot collaboration	Desired future situation	How biodiversity should be implemented on multiple plots.
	Future vision changes	Desired future situation	Changes for the future regarding what, when, who, why, where, and how.

Table 6. Expert interview data codes and their explanation (source: author).

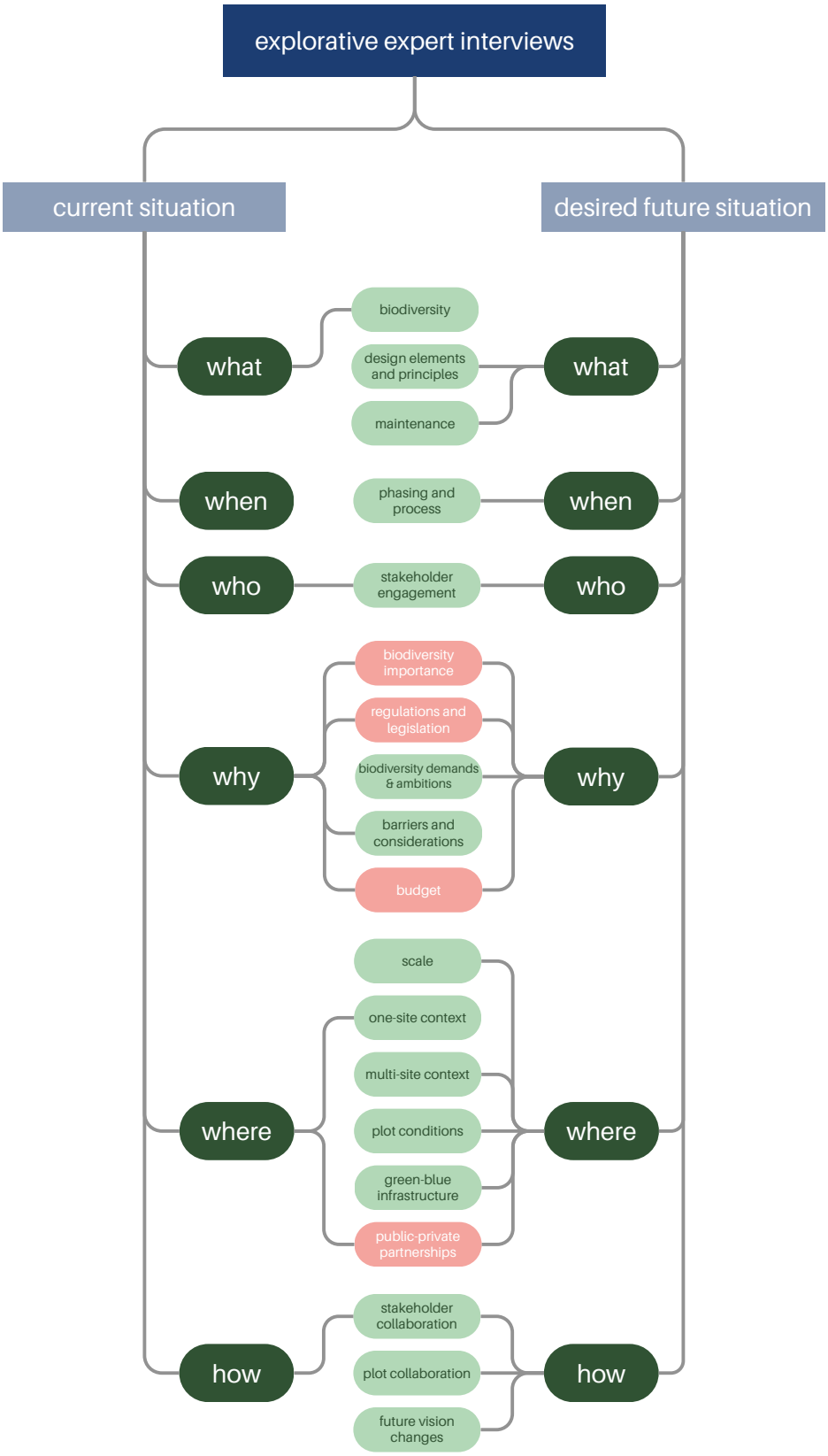

Figure 7. Expert interview data codes (source: author).

4.3 Analysis

In line with the Double Diamond framework, the main objective of the expert interviews was to discover the problem. The interviews identified current barriers and future recommendations. Following the interview protocol (*Appendix I*), the formulated questions were divided into three parts:

1. Questions regarding the experts' background and professional experience.
2. Questions about their specific involvement in biodiversity in the built environment.
3. Questions about their vision on the future of biodiversity in a multi-plot context.

In part 2 of the interviews, experts were asked for insights about the current situation of biodiversity implementation, their definition of biodiversity, and current barriers and considerations. In part 3 of the interviews, experts were asked about the guiding principles and ambitions they envision adhering to in the future, recommendations, and opportunities.

4.4 Findings

The findings and first research results are presented in this section. Within each sub-section, which are divided according to the three temporal contexts, a short conclusion is given per variable. In addition, quotes from the experts are displayed, most of the time the strongest formulation emphasising the specific variable is chosen. The experts are identified as Participant 1 – 11. This section ends with a summarising table.

4.4.1 Current situation

Biodiversity

According to the experts, biodiversity encompasses the diversity of organisms, including plants, animals, and soil life, and their interrelationships. The often-neglected subterranean component is underscored. Nature-inclusive building is recognised as a means to enhance biodiversity, contingent on environmental considerations and species-specific needs. Despite the challenges in quantifying biodiversity, the goal should be to maximise diversity within the system. The number of species of all animals in cities is underestimated, with the edges of areas being the most biodiverse, where light and dark meet and wet and dry intersect.

> *"Biodiversiteit is eigenlijk gewoon een blokkentoren. Als je maar genoeg blokjes eruit haalt van soorten in een bepaald biotoop of habitat, dan vallen bepaalde functies in dat biotoop of habitat weg, dan stort het zaakje helemaal of gedeeltelijk in elkaar. Dan zie je dat het langer droog is, of langer nat, of er zijn minder voedingsstoffen." – Participant 9*

Stakeholder engagement

The experts emphasise that the involvement and engagement of all stakeholders are essential for biodiversity implementation. While collective responsibility is highlighted, the government can and should play a leading role. Currently, biodiversity demands come mainly from project developers, the municipality, and housing associations.

> *"Biodiversiteitsimplementatie blijft vaak hangen bij goede intenties. Enerzijds omdat de mensen niet voldoende kennis hebben om dat mee te kunnen nemen, anderzijds omdat we toch ecologie te laat betrekken." – Participant 5*

Barriers and considerations

The experts highlighted several barriers that undermine biodiversity implementation in urban area development processes. These challenges include the divergent approaches of project developers, where aesthetic appeal in designs often takes precedence over biodiversity considerations. Biodiversity is often seen as merely a trade-off item. The lack of coherent policies and guidelines related to biodiversity hinders seamless implementation. The prevailing tendency of stakeholders to focus only on individual business cases and plots and the failure to make connections with the surrounding area further hamper the optimisation of biodiversity implementation.

"Als het dan uiteindelijk puntje bij paaltje komt, maakt een projectontwikkelaar toch die keuze om dat groen te schrappen en daar een huis voor te bouwen, omdat het uiteindelijk meer oplevert." – Participant 3

4.4.2 Desired future situation

Design elements and principles

Enhancing biodiversity in urban areas involves integrating green elements, as mentioned by the experts: green roofs, green façades, and drought-resistant planting. These elements also offer additional benefits such as water drainage and extended building life expectancy. Indicator species can be used to measure and enhance biodiversity. It is important to consider biodiversity already in the design process, guided by principles like the 3, 30, 300 rule and evaluations of the effectiveness of implemented measures.

"Kijk wat echt kwantitatief en kwalitatief nodig is om een bepaalde soort te huisvesten. En als je dat vroeg in het proces meebrengt, dan kun je dat tegen andere belangen schaven. Volgens mij moet je nastreven naar minimale basiskwaliteit. En dan heb je in ieder geval afgesproken, wat is de ondergrens?" – Participant 5

Maintenance

Experts cite that long-term biodiversity success in urban green areas requires strategic planning and commitment. Project developers should maintain their green areas for 5 to 10 years after construction and ensure clear communication with green space managers. Early and thoughtful planting in suitable locations simplifies maintenance. Embracing urban rewilding principles minimises interventions and enhances biodiversity by allowing natural processes to take their course. Prioritising robust design reduces the need for extensive maintenance.

"Op talloze graslanden, als je het maaien terugbrengt naar een of twee keer, heb je hetzelfde jaar nog bloemrijk grasland. En veel groenaannemers gebruiken ook nog eens de verkeerde machines." – Participant 4

Phasing and process

Integrating biodiversity and green infill into an urban area development necessitates a proactive approach from the beginning of the project, according to the experts. Greening the city should be included from the design phase, with early engagement of green space managers and ecologists. This also facilitates seamless adherence to standards and regulations.

"Ik denk dat je echt vanuit de gedachte, we gaan daar wat doen, al moet gaan denken over biodiversiteit. Dus nog voordat het gebied vastgelegd is. Alleen de eerste gedachte, waar gaan we naartoe?" – Participant 1

Stakeholder engagement

Experts contend that the central government has an exemplary role, requiring municipalities to set biodiversity conditions and a standard framework in urban area development plans. Green space managers play a strategic role in the conservation process and should be involved in urban area development from the beginning. A shared biodiversity vision should be ensured among all stakeholders involved at different stages. Essential in this process is the involvement of ecologists and energy experts, extending to the financial calculations of the plan.

"Ik denk dat de initiatiefnemer een grote verantwoordelijkheid heeft in het aanpakken van biodiversiteit en daarnaast vind ik ook dat de gemeentes ook een zekere verantwoordelijkheid hebben om dat zodanig binnen hun beleid te implementeren dat als initiatiefnemers die verantwoordelijkheid niet willen nemen, ze wel moeten." – Participant 4

Biodiversity demands and ambitions

According to the experts, more guidance and regulations are needed to encourage nature-inclusive building. Policies should be formulated, and local knowledge deployed. Conceptualise buildings as an integral part of broader ecological responsibilities that include climate, energy, and health considerations. A comprehensive biodiversity plan should be developed at the area level, encompassing all facets of the ecosystem. Nature-inclusiveness should be prioritised as an important component in the Program of Requirements.

"We willen allemaal groene steden. Of dat nou gaat om gebouwniveau, gebiedsniveau, stad of regio. Maar we zijn eigenlijk min of meer vergeten om in het hele stedenbouwkundige proces daar de voorwaarden voor te creëren." – Participant 6

Scale & multi-site context

Buildings serve as both nesting sites for animals and attractors of diverse species. Experts posit that achieving a balance between greening and densification is crucial, necessitating the connection of buildings and green space at ground level. Proactive consideration of green areas and building positioning during urban area development is vital, emphasising the need for a comprehensive approach that accommodates variety and niches for different species. The value of a building with green design elements depends on its integration with its surrounding area. However, addressing biodiversity at different scales is challenging due to divergent stakeholder interests.

"Je kijkt natuurlijk over de hele gemeente heen. De nieuwe omgevingsvisie wordt opgesteld. Daarna krijgen we de omgevingsplannen. Maar we willen ook achtertuinen verbinden naar de natuurgebieden buiten de stad. Dus het gaat eigenlijk door alle niveaus heen." – Participant 10

Plot conditions & green-blue infrastructure

During urban area development, soil life, ditches, and forests should be taken into account, and these must be protected to preserve or even enhance biodiversity. A combination of forestry and housing construction is possible, where the cost of the forest can be covered by ecosystem services. A green structure plan from the municipality is needed to ensure the right ecological connections. Holistic urban design should integrate every natural element and preserve green areas and ecology within the area. Given the diverse ecological needs, it is crucial to recognise that certain species thrive better in built-up urban areas than in the primary green structure.

> *"Soorten moeten zich kunnen verplaatsen. Je hebt allemaal losse stukjes, maar je wil juist dat die verbindingen maken, anders ga je naar een soort eiland theorie. Dus de parken in de stad wil je met elkaar verbinden en met het buitengebied. En ook met de regio." – Participant 8*

Stakeholder collaboration

The view of the experts is that collaboration among stakeholders is crucial for implementing biodiversity initiatives. This includes creating a biodiversity plan with shared ambitions and an overall image of biodiversity possibilities. Forming a multidisciplinary construction team with various experts and collaborating with universities to gather knowledge improves the ecological considerations of the project.

> *"Er zijn al voorbeelden waarbij het goed gaat. Blijkbaar kan dat dus binnen de financiële en ruimtelijke kaders. En dat heeft er vaak mee te maken dat er betrokken personen zijn, vanuit de politiek, de ontwikkelende partij, de ambtenarij, de burgers of natuurorganisaties of een combinatie van al die partijen, die samen zeggen, dit willen we." – Participant 6*

Plot collaboration

Cities play an important role as biodiversity connectivity zones, making it necessary to include the entire ecosystem in urban design, even individual buildings. A key aspect is the strategic integration of diverse elements, fostering connectivity between green areas and emphasising the collective picture rather than mandating vegetation for every building. Flexibility in the placement of green elements, both inside and outside a plot, is essential. Collaboration is key to building a residential ecosystem, emphasising cooperation between different green elements.

> *"Voor biodiversiteit moet je veel meer nadenken over de verbinding van gebouw en omgeving en meerdere gebouwen samen. Want ja, voor biodiversiteit en klimaat stopt jouw gebouw daar niet bij." – Participant 2*

Future vision changes

Experts assert that achieving specific biodiversity goals requires targeted and well-defined objectives. Strategic planning of green design elements involves careful consideration of shade, wind, and appropriate vegetation placement. Biodiversity assessments should recognise the dynamic nature of ecosystems, focusing on adaptable and self-sustaining greenery. Designing with controlled messiness enhances biodiversity, incorporating elements like herbs, shrubs, and individual trees.

Collaborative, multidisciplinary teams, including ecologists, should be involved from project initiation, establishing long-term maintenance agreements and minimal intervention strategies. Communication with end-users about green areas is crucial, emphasising the integral role of biodiversity in projects related to energy and climate. Budgeting for maintenance and strategic linkages to ecological networks strengthen biodiversity considerations in urban area development.

"Betrek het altijd op de omgeving. Een gebouw an sich met allemaal hokjes en vakjes, dat stelt nog niks voor. Het is de omgeving die bepaalt. Als er geen voedsel is, dan kan je op je gebouw gierzwaluwkasten hangen, maar dat heeft geen enkele zin. Een gebouw hoort met een omgeving verbonden te zijn." – Participant 7

4.4.3 Time independent variables

Biodiversity importance

The importance of biodiversity in urban areas is increasing. Green design elements not only benefit biodiversity but also contribute to climate adaptation, health, and well-being. Preserving and enhancing biodiversity is crucial for ecosystem maintenance and reducing pests, noise pollution, and heat stress. In addition to improving the quality of homes and the environment, biodiversity efforts contribute to a pleasant living environment, crime reduction, and improved social cohesion. Biodiversity design elements serve as means, opportunities, and obligations and align with broader sustainability goals.

"Eindelijk zien we nu in dat biodiversiteit misschien nog wel belangrijker is dan klimaat. Of in ieder geval dat dat eigenlijk de onderlegger is van het klimaatprobleem." – Participant 3

Regulations and legislation

Experts argue that nature-inclusive building requires a protocol with specific measures and collaboration with municipalities and provinces. Municipalities must take responsibility and establish concrete guidelines and criteria, while the Ministry of the Interior and Kingdom Relations (BZK) collaborates across ministries for green urban areas, examining legal and financial aspects. While the existing Building Decree (Bouwbesluit) includes regulations related to nature, there is a recognised need for expansion, particularly concerning animal habitats. Municipalities should adopt a point system for every urban area development project. The implementation of the Environment Act (Omgevingswet) on January 1, 2024, further enhances regulations for nature-inclusiveness in the built environment.

"Hoe zorg je er dan voor dat als het niet verplicht is, vanuit het bestemmingsplan of eigendomssituatie, dat toch die maatregelen genomen worden? Daar zit echt nog wel een uitdaging. En daar liggen ook wel kansen vanuit de Omgevingswet, denk ik." – Participant 8

Budget

Experts maintain that financial considerations can be a barrier to biodiversity implementation. Integrating green can enhance property value, improve energy efficiency, and manage water effectively. Early prioritisation is crucial, with a balanced approach between short-

term costs and long-term benefits. Involving the health sector and integrating biodiversity from the outset can reduce long-term costs. Biodiversity implementation should be viewed as an asset rather than a direct cost, improving overall quality and potential returns. Creating greenery in a biodiverse way can reduce costs. Experts additionally advise incorporating biodiversity implementation into the ground-related expenditure (GREX).

"Wat je nu gewoon heel vaak hebt is, mensen beslissen en sturen eigenlijk puur op geld, zeg maar, dus op hun primaire proces waarmee ze geld verdienen." – Participant 11

Public-private partnerships

Biodiversity ambitions and opportunities depend on the type of acquisition, the relationship between the public and private parties, and the plot ownership. Municipalities often have responsibility for public space but depend on project developers to realise nature-inclusive projects.

"Bij elke gemeente of elke partij, bij elke ontwikkeling kan het weer anders zijn. Afhankelijk is het eigendom, is het eigendom van de gemeente, van de ontwikkelaar? Hoe zitten die verhoudingen? Wat kan wel getest worden? Wat niet? Hoe zit je met het Bouwbesluit en de wrijving daartussen?" – Participant 8

Appendix III lists all the results of the expert interviews sorted into three tables: current situation, desired future situation, and time independent variables. Examination of the interview data reveals a distinction between two main variables: barriers and considerations, and future vision changes (as summarised in Table 7). The former concept refers to challenges inherent in biodiversity implementation, while the latter refers to opportunities, recommendations, and necessary changes for biodiversity implementation in a multi-plot context. Most of the other 17 variables are mentioned in these two concepts. The convergence of these two concepts is necessary for the transition to the next methodological stage, the focus group workshop (Figure 8).

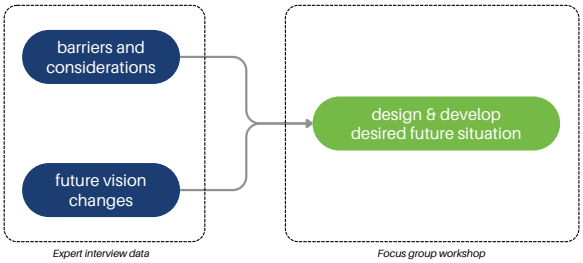

Figure 8. Transition expert interview data to focus group workshop (source: author).

Table 7 presents a comprehensive synthesis of the data from the expert interviews, delineating the insights of these two concepts. The table articulates which variables indicate barriers and/or recommendations, displayed with quotes. It further designates the impact of the statement on design elements and principles, stakeholder engagement, financial prerequisites, and phasing, visualised in green. White boxes delineate 'not applicable'.

Table 7. Expert interviews data (source: author).

Theme	1st order construct	Extracts from the interviews	Impact on component			
		Barriers and considerations, as wel as recommendations	Design elements and principles	Stakeholder engagement	Financial prerequisites	Phasing
what	Design elements & principles	*'...dat we ook afmoeten van het netheidscomplex...' - P3*	Impact			
		'Maar eigenlijk is rommeligheid een beetje het nieuwe duurzaamheid hè. Want rommelig is vanuit biodiversiteit eigenlijk heel interessant.' - P5	Impact			
		'Maar om te kunnen bepalen of het past en om te kunnen bepalen of het een bijdrage levert moet het op eindgrootte worden ontworpen.' - P4	Impact			
		'Bijvoorbeeld ook de bodembiodiversiteit is een hele belangrijke, die vaak niet heel erg tastbaar is, dus we vergeten dat vaak.' - P3	Impact			
		'Wij zijn altijd gewend om te meten in de absolute waarden wat iets heeft, maar natuur verandert.' - P2	Impact			
		'Er is een onderzoek geweest naar de bomen die in 2022 zijn gepland in Nederland. 70% zijn de verkeerde.' - P4	Impact		Impact	
		'We willen het liefst een afvinklijstje, of een lijstje met maatregelen wat we kunnen doen en dan gaan we afstrepen. Oh ja, we hebben dit gedaan. Zonder eigenlijk te kijken naar het effect wat je gaat bereiken, dus we moeten veel meer gaan sturen op het bereiken van een bepaald effect.' - P3	Impact		Impact	Impact
		'Doordat je eerst op het hoogste niveau die groene structuur hebt neergelegd. Alleen zou dan dat ook ecologisch ingevuld moeten worden. En de consequenties daarvan op een lager niveau, mochten we dan een groene gevel of dak maken, welke soorten kan je dan gebruiken? Als iedereen dat dan doet, dan krijgen we iets.' - P4	Impact	Impact		Impact
		'En natuur-inclusief vraagt eigenlijk wat van een gebouw, maar niet alleen esthetiek, maar ook functioneel, voor klimaatadaptatie, biodiversiteit. Dat hij daar voldoende bijdrage aan levert, en dan kan het wel ten koste gaan aan esthetiek.' - P5	Impact		Impact	
		'We hebben nu bijvoorbeeld een lijst met indicatorsoorten opgesteld van, die soorten die zeggen iets over hoe je je gebied zou kunnen inrichten en als die soort er komt, nou ja, dan weet je dat het op een bepaalde manier in orde is.' - P10	Impact			Impact
		'Als je ervoor zorgt dat die struik over de stoep gaat groeien, ja, dan moet je er elk jaar aan gaan knippen. Maar als je die struik zo neerzet dat die gewoon niet over de stoep heen groeit, dan hoef je die nooit, nou ja, incidenteel te knippen.' - P4	Impact		Impact	
		'Maar nu is het geaccepteerd, snap je. Omdat het in design gegoten is. En dat kan heel subtiel zijn hè.' - P9	Impact			
	Maintenance	*'Maar wij gaan van 22 keer maaien, van gazongras op heel veel plekken. Nadat we het hebben getransformeerd in een kruidenrijk grasland, naar 1,4 keer maaien. Dat is 20,6 keer minder maaien. Enorme CO2 uitstoot scheelt dat. Maar ja, ook heel veel werk.' - P4*	Impact	Impact	Impact	
		'Dat er langdurige afspraken worden gemaakt met degene die het groen onderhoud doet. Daar gaat het namelijk ook nog heel vaak op mis. Dan heb je bijvoorbeeld een inschrijving en de goedkoopste die wordt het dan. En die zet dan iets niet robuust neer of die denkt ja na mij, wat maakt het uit? En dan na een jaar krijgt iemand anders het onderhoud. Terwijl als jij dus langdurige contracten van 10 of zelfs 20 jaar, dan zorgt iemand die dat groen gaat onderhouden sowieso voor heel goed plantmateriaal of bijvoorbeeld juist dat het al heel snel dichtgroeit. Dat is dan een investering in het begin, maar het ziet er al snel beter uit. Je hebt minder onderhoud op de lange duur, je hebt al meer biodiversiteit of je zorgt al voor grotere bomen.' - P2	Impact	Impact	Impact	Impact
		'Die worden 16 keer per jaar gemaaid, moet dat allemaal 16 keer per jaar gemaaid worden? Of kan je daar bloemrijk grasland van maken?' - P10	Impact		Impact	
		'Het concept urban rewilding. Dat gaat eigenlijk over dat je een bepaalde uitgangspositie aanbrengt en dat kan bijvoorbeeld op een dak zijn of een gevel, maar dat je dan vervolgens eigenlijk de natuur zijn gang laat gaan en alleen gaat het sturen, alleen gaat ingrijpen als het echt nodig is.' - P3	Impact		Impact	
		'Alle grote groenaannemers in Nederland hebben de verkeerde machines.' - P4	Impact	Impact	Impact	
when	Phasing & process	*'Dus op het moment van het stedenbouwkundig plan. Dus op het moment dat je aan het nadenken bent over waar komen de gebouwen? Waar komen de wegen? Dat moment is het al zo dat je die ecoloog betrokken moet hebben en die moet dan beginnen met zijn analyses doen, welke soorten, welke bodems, welke biotopen.' - P4*	Impact	Impact		Impact
		'Dat was gewoon kavels verkopen, gebouwen neerzetten en dan denk je, oh wacht, ik moet ook nog een leuke leefruimte hebben, dus dat zag je wel altijd, het was altijd een sluitpost.' - P9	Impact		Impact	Impact
		'Dus we merken eigenlijk, dan komt het daarna weer terug op het moment dat je meer in een voorlopig ontwerp bepaalde onderdelen verder gaat uitwerken. Maar dan heb je eigenlijk een kans gemist. A, om het in die prioritering bovenaan te zetten of in ieder geval zo goed mogelijk. En B, om het ruimtelijk zo in te delen dat het uiteindelijk ook, dat het gaat renderen, dat het ook echt gaat werken.' - P6	Impact			Impact
		'Maar ecologie zou je gewoon moeten meenemen in je opbrengsten, je verwachte opbrengsten. En daarvoor zou jij in het begin van een project eigenlijk een studie willen doen, van hoe verhoudt groen en grijs zich, en welke opbrengsten zijn dan redelijk te verwachten.' - P5	Impact		Impact	Impact
		'En als je te laat bezig bent, ja, dan heb je alleen maar vertraging bij projecten.' - P8				Impact
who	Stakeholder engagement	*'En zeker als je gaat kijken naar, vanuit het ontwikkelaars perspectief, ja dan zie je dat daar nog wel echt stukje kennis ontbreekt.' - P3*		Impact		
		Want ik merkte dat, enerzijds heb je ecologen, die kennis hebben en anderzijds heb je ontwerpers vaak, die de pen of stift hanteren. Ergens in die communicatie zit daar toch een drempel of een afstand tussen." - P5		Impact		
		'Maar bij bewoners is het ook sterk afhankelijk welk soort mensen je hebt, hoe gemotiveerd ze zijn, want lang niet iedereen heeft de motivatie om hier de waarde van in te zien. Hoewel wel bijna iedereen in een groene omgeving wil wonen.' - P1		Impact	Impact	
		'Wij hebben zelf met diverse projecten steeds samenwerking gezocht met de Wageningen Universiteit om kennis uit te breiden, want van een hele hoop dingen weten we onvoldoende.' - P1		Impact		Impact
		'...omdat we toch ecologie ook te laat betrekken.' - P5		Impact		Impact
		'De gezondheidssector is niet aangehaakt bij de financiering van het groen. Dus als we het hebben over biodiversiteit in de stad, dan kom je eigenlijk uit op multifunctioneel groen in de stad, wat ook klimaat en gezondheid aan doet. Als je dan kijkt naar hoe we dat waarderen, monetariseren, er zit heel veel impact aan de kant van gezondheid, en daar zit ook aardig budget. En dat is niet gelinkt." - P6		Impact	Impact	
		'We moeten ook kijken naar de belangen van de verschillende partijen. Iedere partij heeft zijn eigen belang en dat eigenbelang, dat kan op het gebied van biodiversiteit parallel lopen, maar dat hoeft het niet.' - P1	Impact	Impact	Impact	
		'Wat dan wel belangrijk is, is om de bewoners te informeren en voorbeelden te laten zien, want ja, ze hebben vaak niet altijd een idee van de mogelijkheden.' - P2		Impact		
why	Biodiversity importance	*'Biodiversiteit is essentieel voor ons willen wij als soort mens kunnen blijven voortbestaan en leven. Dus de betekenis van biodiversiteit daarin is gewoon cruciaal. En dat betekent dat je dus alles in het vermogen moet stellen om zoveel mogelijk biodiversiteit te creëren, te handhaven en te stimuleren, dat het ook gebeurt.' - P7*	Impact		Impact	
		'Men was bang voor natuur. Want ja, als ergens natuur komt, dan mag je niks meer. Als je het nou goed doet, dan is het natuurlijk helemaal geen belemmering. Het is een belemmering omdat we het te weinig doen.' - P8	Impact	Impact		
	Regulations and legislation	*'Ik denk dat wat enorm gaat helpen is een norm. Omdat een norm een stok achter de deur is waardoor niet alleen de kopgroep, maar ook het peloton, hier iets mee moet.' - P6*	Impact			
		'Maar eigenlijk om zo'n transitie te maken zou je ook in het beleid iets moeten veranderen.' - P2	Impact			
		'En nu moeten we in één keer, straks ook met de komst van de Omgevingswet, ja, moeten we integraal gaan denken, moeten we met elkaar een oplossing gaan vinden.' - P3	Impact	Impact		
	Biodiversity demands & ambitions	*'Het gebouw is onderdeel van die hele gebiedsopgave. En hoe ga je er dan voor zorgen dat je zeg maar, zowel voldoet aan de biodiversiteitsopgave, als de klimaatopgave, als de energieopgave, maar ook een stukje gezondheid, hoe gaan mensen daar uiteindelijk gezond wonen, verblijven, werken? Dat je dat eigenlijk van tevoren allemaal al meeneemt en dat je dat meeneemt in je afweging voor een bepaalde keuze.' - P3*	Impact	Impact	Impact	Impact
		'En dat komt omdat in die fase waarin je in een schetsontwerp zit, waarin je het Programma van Eisen formuleert, waar je eigenlijk bezig bent te verkennen, hoe je de wensen die je hebt met het gebied en de ruimtelijke indeling, probeert daar het eerste zicht op te krijgen, waarin ook vaak een grondexploitatie wordt gemaakt om gevoel te krijgen. Dan wordt het eigenlijk niet gezien of onvoldoende gezien.' - P6	Impact	Impact	Impact	Impact
		'Omdat er vaak hele hoge ambities zijn aan de voorkant, mensen zijn welwillend, maar vervolgens verliezen we het in het proces.' - P5	Impact	Impact	Impact	Impact
		'Ik denk dat een hele belangrijke taak ligt voor onder andere de gemeenten. Dat zij bij de uitvraag al een helder kader hebben waarbinnen gewerkt kan worden en dat biodiversiteit daarin een vast onderdeel is waar ook KPI's voor worden gesteld, dat x procent van een gebied efficiënt moet worden ingericht voor biodiversiteit.' - P3	Impact	Impact		Impact
		'We gaan dan eigenlijk nu meer kijken van, welke kant willen we op? Basiskwaliteit natuur, dat is ook een van de dingen die we gaan opstellen. Van, wat voor natuur willen we minimaal hebben en waar willen we die minimaal hebben?' - P10	Impact	Impact		
		'Als je ergens in een gebied komt, ben je toch afhankelijk van de lokale kennis.' - P5	Impact	Impact		
		'Iedereen heeft zijn eigen hokje, de ontwikkelaar heeft dat hokje waar die mag bouwen en de gemeente heeft dat hokje waar toevallig iemand gezegd heeft, dat is gemeentegrens. Maar dat heeft niks te maken met hoe de natuur zijn gang gaat.' - P1	Impact	Impact		
	Budget	*'En dat is toch iets wat bijvoorbeeld in de grondexploitatie van een gebiedsontwikkeling, als een kostenpost wordt benaderd en niet als iets wat geld oplevert.' - P6*			Impact	
		'Dat is een heel lastig geven en nemen systeem, want een ontwikkelaar wil geld verdienen, daar is ook niks mis mee. Dat mag. Maar er zijn grenzen. Dus je zit in het proces van daar waar je misschien wat minder huizen kunt bouwen, maar je kunt de kwaliteit van de huizen en de omgeving verhogen door de natuur meer naar binnen te halen, waardoor de opbrengst toch hoger kan zijn.' - P1	Impact	Impact	Impact	Impact
		'Want wat je nu gewoon heel vaak hebt is, mensen beslissen en sturen eigenlijk puur op geld, zeg maar, dus op hun primaire proces waarmee ze geld verdienen.' - P11		Impact	Impact	
		'...dat je ziet dat de baten van het groen, ook voor biodiversiteit, maar ook voor die andere zaken, op de lange termijn zijn. Terwijl aan de voorkant natuurlijk in die 2, 3, 5 jaar dat er wordt ontwikkeld, worden kosten gemaakt. Die kosten voor het gebouw die krijg je terug op moment dat je het gebouw verkoopt. Die baten die het groen oplevert, de komende 3/4 eeuw of langer.' - P6			Impact	Impact
		'...dat degene die misschien profijt ergens van heeft, niet eens de eigenaar is.' - P2		Impact	Impact	
where	Scale & multi-site context	*'Maar de ontwikkeling om echt gewoon iedere boom of iedere groep van struiken of ieder slootje wat er aanwezig is, om dat ook in te passen, ... dat hoort wel bij een stedenbouwkundige ontwerp.' - P1*	Impact			
		'...van welke soorten komen daar voor, kunnen daar voorkomen en waar zien we dan de barrières om het op te lossen. En op die manier weet je ook van, als er dan ontwikkelingen plaatswinden, voor welke soorten zou je dan welke voorzieningen op gebouwniveau moeten nemen. Dus je gaat van groot naar steeds kleiner toe.' - P8	Impact			Impact
		'Het blijft toch wel heel beperkt en dan is het inderdaad vaak van nou kijk, we hebben inderdaad ook een gebouwtje met een groen dak. Of hé, we hebben een paar groene gevels aangelegd en dat is dan duurzaam, of dat is dan biodiversiteit.' - P3	Impact			
		'...waar zal ik de biodiversiteit kunnen ondersteunen die er nu al aanwezig is en van daaruit kijken naar de verdere inrichting om dat te stimuleren.' - P7	Impact			
	Plot conditions & green-blue infrastructure	*'...je moet eigenlijk, die verbindingen bieden. En bepaalde soorten zijn ook gebonden aan bepaalde oppervlaktes, aan een leefmilieu, die kunnen niet eens voorkomen in een klein leefmilieu.' - P9*	Impact			
		'En de volgende stap is nu om dat systeemniveau op te pakken. Maar goed, daar kun je als ontwikkelaar, snap ik dat je alleen een paar kavels hebt, maar ook al heb je een paar, dan kun je wel zeggen, hoe sluit dat aan op de rest van het systeem?' - P9	Impact	Impact		
		'Misschien moet je op een grotere gebiedsschaal beginnen om de ecologische infrastructuur in te tekenen. En aan te geven, zo willen wij het groen hebben en wat er overblijft, daar kunnen we nadenken over huizen of wat dan ook.' - P4	Impact			Impact
		'Hoe stedelijker de centra worden, hoe groter de versnippering eigenlijk van de groene stukken en eigenlijk voor een ecosysteem is het heel erg belangrijk dat er veel binding blijft tussen alle soorten habitas zeg maar die er zijn.' - P11	Impact			
	Public-private partnerships	*'...met wel de clausule dat bij elke gemeente of elke partij, bij elke ontwikkeling weer anders kan zijn.' - P8*		Impact		
		'Eigenlijk moet je onderscheid maken tussen, ben je met een stedelijk gebied bezig, ben je aan het inbreien, of aan het renoveren, dat is een ander proces dan wanneer je aan het uitbreiden bent. Dat is heel simpel omdat je, je hebt in het stedelijk gebied inbreien en renoveren, heb je grotere beperkingen.' - P1	Impact	Impact	Impact	Impact
		'En afhankelijk is het eigendom, is het eigendom van de gemeente, is het eigendom van de ontwikkelaar? Hoe zitten die verhoudingen? Wat kan wel getest worden? Wat niet?' - P8	Impact	Impact	Impact	Impact
how	Stakeholder collaboration	*'Het is een gemiste kans als je met 5 projectontwikkelaars een gebied moet invullen en je gaat niet allemaal op dezelfde manier het punt biodiversiteit aan. Er kan verschil in de uitwerking zitten. Dat is prima, want niet iedereen hoeft een begroend gebouw te hebben en niet iedereen hoeft een groen dak te hebben, zijn heel veel andere opties, maar dat totale beeld moet je met elkaar maken.' - P1*	Impact	Impact		Impact
		'De architect gaat over het gebouw en de gemeente gaat over de openbare ruimte en dan waait het uit, dus als je dan niet met elkaar een gezamenlijk standpunt hebt ingenomen van tevoren, dan ga je het ook niet meer redden, dan ben je toch weer die details aan het invullen.' - P5	Impact	Impact		Impact
		'En vervolgens gaat iedere partij binnen zijn eigen business case bedenken hoe die de punten haalt. En daar komt een soort verzameling aan natuur-inclusieve projecten uit, het een meer en het andere minder. Ja, die eigenlijk min of meer eilandjes op zichzelf zijn, die ongetwijfeld, ecologie is vrij flexibel, onderling mogelijk gaan interacteren, maar geen optimalisatie is vanuit de natuur. Dus op de ene plek heb je een woontoren waar vooral nestkasten in zitten voor huismussen, en het gebouw 20 m verderop heeft een heel groot groen dak. Vanuit de huismus geredeneerd moet daar het voedsel voor de mus zelf en de jongeren te halen zijn, en dan wiegt hij op en neer. Ja, die partij die dat groendak maakt, die is helemaal niet bezig met die huismussen van die toren ernaast, als ze al weten dat er überhaupt een toren komt, dat er een nestkast voor zo'n huismus komt. - P6	Impact	Impact		
	Plot collaboration	*'Je wil eigenlijk dat al die groene stukken van het land toch verbonden worden en dat een stad ook meerdere verbindingszones heeft. En dat je als wijk ook bewust daarop aansluit.' - P11*	Impact			
		'...op klein kavelniveau, maar daar zijn de mogelijkheden gewoon minder of heb je een andere verhouding tot elkaar, zeg maar. Dus het mooiste is is als er samenspel is tussen openbare ruimte en kavels.' - P5	Impact			
		'Als je dat niet in een binnentuin kwijt kan of een openbare ruimte, misschien wel in de berm net buiten het plangebied.' - P5	Impact	Impact		
		'Dus we moeten afkomen van die losse postzegels en dat je het als een systeem gaat zien en dat jouw postzegel een puzzelstukje is in het grote systeem. Ook al is dat systeem er nog niet, dan kun je wel dat allereerste stukje leggen.' - P9	Impact	Impact		

4.5 Conclusion

In conclusion, the findings from the expert interviews reveal important considerations and challenges in seeking to enhance biodiversity within urban area development. The identified barriers encompass a range of factors, including divergent approaches of project developers who prioritise aesthetic appeal over biodiversity, the lack of coherent policies that prevent seamless integration, and the prevailing tendency to focus on individual business cases rather than the broader ecological context. Additionally, financial considerations, such as the high cost of biodiversity implementation and the need for early prioritisation, emerge as major barriers.

To address these challenges, the experts emphasise the crucial role of stakeholder engagement and the need for collective responsibility and government guidance. The establishment of clear guidelines and criteria by municipalities, especially in collaboration with provinces, is considered essential to close regulatory gaps. The implementation of the Environment Act (Omgevingswet) is expected to strengthen regulations related to nature-inclusiveness in the built environment.

Furthermore, integrating biodiversity from the beginning of urban area development projects, guided by strategic planning and commitment, is highlighted as a crucial factor for long-term success. This involves early collaboration with green space managers and ecologists. The strategic positioning of biodiversity design elements, both inside and outside plots, is emphasised as essential for enhancing biodiversity connectivity and achieving a collective, rather than isolated, impact.

The importance of considering biodiversity as an asset rather than a direct cost is stressed, with financial considerations seen as potential barriers that can be mitigated through measures such as including biodiversity implementation in the budget of land costs and revenues.

Given this study's delineation of four components, it is important to examine the impact of the expert interview data on these components. The results in Table 7 illustrate a predominant influence on ‘design elements and principles’, with a substantial 80% of the statements contributing to this facet. ‘Stakeholder engagement’ emerges as the next significant domain, evidencing impact in 52% of the statements, followed by ‘financial prerequisites’ at 38%, and ‘phasing’ at 35%. This synthesis highlights the different emphases within the experts' discourse and provides valuable insights into the varying degrees of impact assigned to the components. While stakeholder engagement is significant, it suggests areas for focused attention, and the impact on financial prerequisites and phasing highlights their contextual relevance.

In essence, this nuanced analysis reveals challenges and opportunities in biodiversity implementation. This calls for strategic interventions in future urban area development, emphasising a holistic, collaborative approach and a shared vision among stakeholders at different levels.

5 Empirical study II: Focus group workshop

As already described, a workshop will be organised to validate the expert interview findings and gain additional opinions and insights. For the workshop, a focus group is gathered. This chapter presents the different stages of the focus group workshop: the pre-design phase, the design phase (the workshop itself), and the post-design phase. The pre-design phase consists of the composition of the focus group, which will be briefly discussed, and the set-up and preparation of the workshop, including the case outline, process phasing, and the main statement. During the design phase, discussions with the participants are held on various concerns and assertions, a process is designed together, and a main statement is discussed and evaluated. In the post-design phase, the data from the workshop is analysed. The results are presented in the Findings section.

5.1 Focus group

The focus group consists of five participants. Invitations were sent to previously interviewed ecologists, and project developers, sustainability consultants, municipal officials, and one green space manager. The final focus group consisting of four different disciplines is shown in Table 8. Each discipline is given its own colour post-it, to facilitate easy distinguishing of the individual participants and their contributions during the data analysis.

Participant	Discipline	Colour of post-it
A	Project developer	Pink
B	Project developer	Pink
C	Ecologist and consultant at project development company	Blue
D	Landscape architect	Purple
E	Green space manager	Green

Table 8. Focus group participants (source: author).

5.2 Workshop set-up

The two goals of the workshop are articulated as follows: first, to elicit different perspectives from various stakeholders, and second, to develop a process that delineates the critical junctures for biodiversity enhancement and implementation. The presentation of the workshop is appended in Appendix IV. The workshop presentation initiates with an overview of the research, encompassing identified issues, research frameworks, primary objectives, and the main research question. Subsequently, a delineation of the workshop is provided, comprising four themes: '*who*,' '*why*,' '*when*,' and '*how*.'

A situation outline is given within which the discussion will take place. This ensures that participants do not give answers like 'it depends on the project', because the project specifications are given. These comprise:

- Urban area development, development of mixed-use buildings.
- Developer A owns one plot and surrounding plots are being developed by other developers.
- The municipality has a facilitating role.
- The municipality has biodiversity ambitions and wants to incorporate them into an anterior agreement.
- The zoning plan is outdated, there is no anterior agreement yet.
- Developer A is responsible for hiring the architect, subcontractors, and utility partners.

The structuring of the '*who*,' '*why*,' and '*when'* themes adhere to the same format. First, one or two barriers and one or two recommendations, as mentioned by the interviewed experts, will be examined. The focus group is asked to assess their perspectives based on the assertions put forward. The participants are then prompted to affix tasks and responsibilities on the process poster using post-its. If there is enough time, the content of these notes will be deliberated. The participants are encouraged to refine the specified tasks to align with the SMART criteria: specific, measurable, acceptable, realistic, and time-bound. In the *'how'* section, the focus revolves around a specific statement: *All stakeholders should establish a joint ambition on biodiversity at the start of a project*. This statement undergoes a stepwise analysis, starting with an exploration of the constituents of '*all stakeholders'*. The subsequent discussion involves the temporal parameter *'at the start of a project*.' The final aspect entails a discussion on the nature of '*a joint ambition on biodiversity*,' clarifying the required components of such a collective effort. If there is still time afterward, additional advice may be given by the participants.

The basis for the process that will be designed during the workshop is shown in Figure 9. This process is based on the urban area development process outlined in *Chapter 2: Theoretical Background*. The representation includes six different disciplines, which were identified by the experts during the interviews as having the greatest importance for biodiversity responsibility and associated tasks. It is intended that a representative from each discipline will participate in the workshop, thus promoting a multidisciplinary perspective. Participants are encouraged to transcend the boundaries of their individual disciplines to encourage holistic considerations during the workshop discussions.

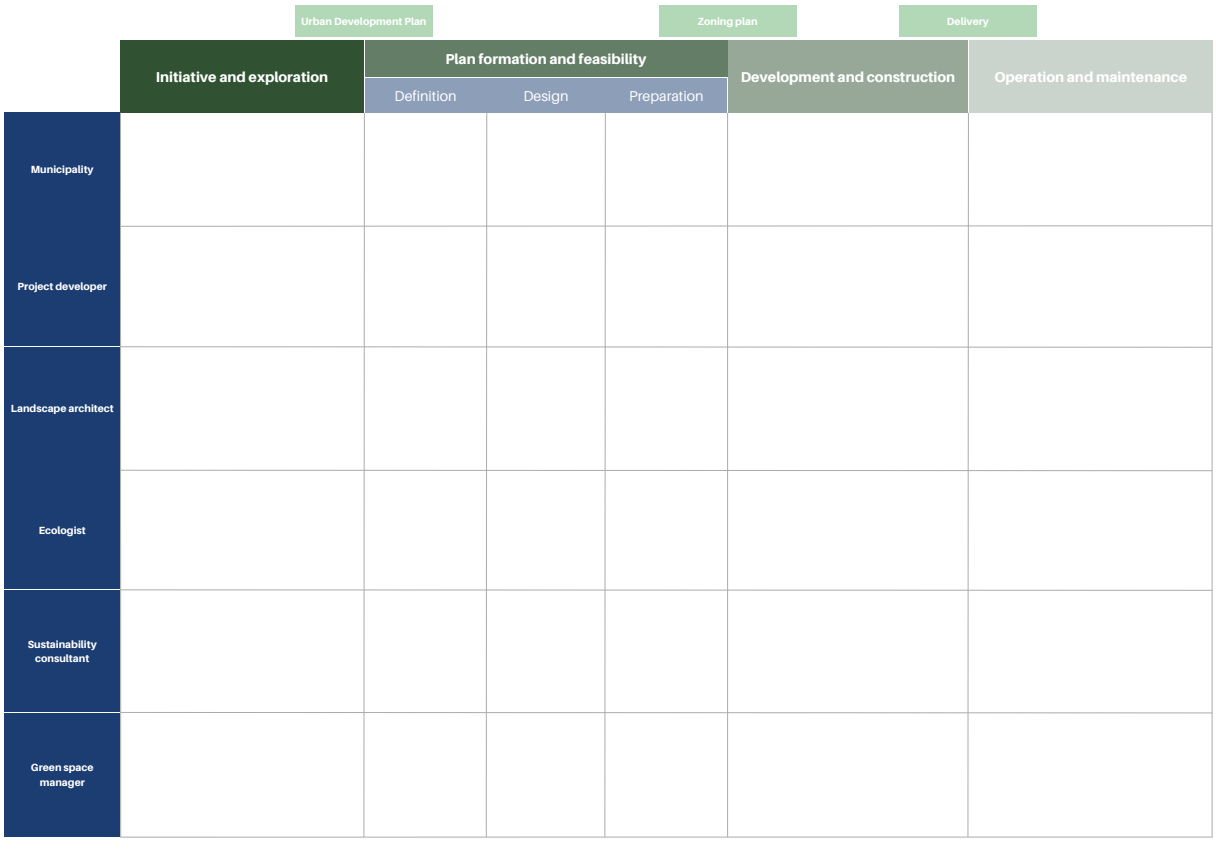

Figure 9. Workshop process (source: author).

5.3 Findings

The results of the focus group workshop are described in this section, organised according to the thematic structure used during the workshop. Starting with the '*who'* theme, this subsection presents the findings regarding the roles of the stakeholders, sequentially followed by the '*why'* and '*when'* themes. The outcomes of the process design are shown graphically in Figure 10, in which the contributions of each participant are colour coded. In addition, Table 9 shows the content of the assertions on the post-it notes attributed to their respective participants. For nuanced understanding, quotes from participants, denoted as Participant A - E, are included alongside brief conclusions per theme. An abbreviated summary and conclusion are then provided for the theme '*how'*, which includes the discussion and evaluation of the statement.

5.3.1 Who

Barriers and recommendations given by interviewed experts

- Stakeholders often focus only on their own interests, contributions, and plot(s).
- Ecologists should be involved from the beginning of a project.

Discussion

The participants offered nuanced perspectives on the two assertions under consideration. Regarding the assertion that stakeholders often focus only on their own interests, contributions, and plots, the discourse emphasised the importance of collaboration and shared goals within urban area development. Participants underscored the need for inclusive teamwork, where diverse stakeholders, including ecologists, architects, and project developers, contribute to a common vision. While recognising the inherent tension between individual interests and collective goals, participants stressed the need to transcend individual 'bubbles' for successful urban area development.

> *"Ik denk, over de grote lijn, denk je wel aan je eigen, maar je moet anderen ook wel meenemen, want uiteindelijk moet je het ook samen doen en ik denk, als echt alleen maar iedereen in zijn eigen coconnetje blijft, dan ga je de gemeente ook niet overtuigen dat het plan dat je voor ogen hebt, dat dat er gaat komen." – Participant A*

Addressing the statement advocating early involvement of ecologists in projects, the participants highlighted the significance of timing within the development process. Some emphasised team spirit and collective effort during the early stages of a project. The discussion highlighted the potential for divergent interests among stakeholders, especially those not directly involved in the project team. Participants underscored the challenges of maintaining integrated biodiversity-focused ambitions throughout the entire project life cycle.

> *"Maar wat je wel vaak ziet, daarbuiten, partijen die niet direct onderdeel zijn van die gebiedsontwikkeling, maar er wel mee te maken hebben, dus stakeholders. Die denken wel meer vanuit hun eigen straatje, hè. Dus een beheerder zal alleen zeggen, van ja, maar hoe is dat met het beheer geregeld? En die wil dan dat het beheer zo laag mogelijk is. De gemeente die zal zeggen, past het wel binnen het beleid, dus die is alleen maar met elkaar nadenken over het eigen beleid, dus ik zie daar in de praktijk in ieder geval wel een groot verschil in." – Participant D*

The discussion further explored the role of different stakeholders, such as project developers, architects, and municipal authorities, in shaping the ecological narrative within urban area development. Participants acknowledged the evolving nature of ambitions and cited cases where initial comprehensive biodiversity goals can diminish as projects progress. They stressed the importance of continuous involvement of ecologists and other advisors throughout the process to avoid this. In addition, participants discussed the possible influence of external factors, such as municipal policies and instruments like area labels, on steering biodiversity implementation.

> *"De ecoloog moet ook betrokken blijven. Want het probleem wat ik net aanstipte heeft er ook mee te maken met dat de kennis en ambitie ook persoonsafhankelijk is. En ja, als personen zeg maar op 1/3 van het proces uit dat proces verdwijnen, dan verdwijnt ook zeg maar die kennis en ambitie die erbij horen. En dan is er eigenlijk niemand meer om te checken of de daadwerkelijke ambities wel gerealiseerd worden." – Participant D*

In summary, the discussion revealed a nuanced understanding of the challenges and opportunities associated with stakeholder collaboration and ecological considerations in urban area development. Participants stressed the need for proactive, inclusive approaches, early involvement of diverse experts, and setting clear, sustainable ambitions to enhance biodiversity in projects.

> *"Ik denk toch het tot stand komen van een gezamenlijk uitgangspunt. Als je die in een vroege fase met elkaar afstemt, met je projectteam maar ook met de gemeente, met je directie, dus eigenlijk vanuit verschillende actoren, je draagvlak hebt, en dat je die zo door de verschillende fases heen kan brengen. Dus eigenlijk telkens dat er iets is, of een vinklijst of alleen je uitgangspunten, waar je op terug kan vallen, dat je zegt, dit is de basis, hier moeten we iedere fase doorheen gaan." – Participant A*

5.3.2 Why

Barriers and recommendations given by interviewed experts

- Biodiversity is often seen as something unimportant on a checklist, without looking at the effect that should be achieved.
- Project developers often focus only on profit maximisation and therefore often prefer more houses over greenery.
- Biodiversity should be seen as something that generates money rather than as a cost and should therefore be included in the expected returns.

Discussion

The discussion on the '*why*' theme illuminated additional key challenges and perspectives. Participants acknowledged that biodiversity is often treated as a mere checkbox item in projects and emphasised the need to shift the focus to a deeper understanding of ecological impact. A recurring theme was the prevalence of 'greenwashing', in which biodiversity is used as a marketing tool without genuine commitment to its tangible effects. This practice was identified as a major obstacle

in daily work, where green visuals and ecological symbols in brochures overshadow the actual ecological value of proposed developments.

The conversation touched on the contextual variations in attitudes towards biodiversity, with a distinction between urban and rural developments. While green initiatives and design elements may be more readily accepted in rural areas, challenges arise in densely populated urban environments where the perceived need for biodiversity is questioned by residents.

"En in de stad hebben ze (ontwikkelaars) zoiets, ja maar we zijn in de stad. Dus daar hebben ze ook niet het gevoel van, waarom het belangrijk is op die plek om iets aan biodiversiteit te doen. Maar het verschilt ook per persoon." – Participant C

Participants expressed concern about project developers prioritising profit maximisation over green areas. The tension between financial considerations and ecological sustainability was evident. There were different opinions on whether biodiversity's intrinsic value should be quantified in monetary terms. Some argued against reducing biodiversity to a financial metric and emphasised the fundamental role it plays in sustaining life. Others, however, suggested that assigning a financial value could enhance its implementation into projects. The focus group discussed the difficulty of measuring the financial returns of biodiversity, especially over a longer period of time. The challenge lies in quantifying intangible benefits such as improved well-being, reduced healthcare costs, and improved quality of life associated with biodiversity.

"Nou volgens mij moet je daar juist wegblijven, bij die hele financiële paragraaf en dat het biodiversiteit geld oplevert. En waarom? Biodiversiteit is iets wat ons bestaan waarborgt. Als je dat financieel gaat uitdrukken, dan ben je volgens mij helemaal op de verkeerde tour aan het gaan, dat je het weer langs het financiële lat leggen en het daarmee dus ook meer of minder mate belangrijk maakt." – Participant E

"Ik denk dat het wel heel goed is om te bedenken, wat kost het groen precies? En dan heb je het niet alleen over kwantiteit, gewoon hoeveel procent van je kavel wordt groen, maar ook over de kwaliteit die je daar kan realiseren en wat nog niet zo makkelijk is, is voor elke kavel een soort vuistregel te bepalen met hoeveel groen is genoeg. Want die norm die bestaat nog niet." – Participant C

"En tegelijkertijd zitten daar opbrengsten aan vast, maar die ja, hoe kan je die uitdrukken als het zo ongelooflijk moeilijk te meten is en ook over een lange tijd meetbaar moet zijn, hè." – Participant D

In conclusion, the discussion emphasised the difficulty of further cost reduction without compromising the essential elements of biodiversity initiatives. The participants underscored the need to explore alternative funding sources rather than relying solely on budget cuts. The metaphor of a 'sledgehammer' approach illustrated the harsh impact of excessive budget constraints on green areas. Despite the perceived low costs, there was recognition of undervaluing the importance of biodiversity. The overall conclusion is the need for a nuanced approach that considers both financial constraints and environmental sustainability in urban area development.

5.3.3 When

Barriers and recommendations given by interviewed experts

- Focusing on biodiversity too late can increase costs, delays, and ineffective results.
- At the beginning of the project, do an area analysis of the species, soils, and biotopes present to make a connection with the surrounding area.
- Think about maintenance during the design phase.

Discussion

During the '*when'* discussion, the participants emphasised the importance of early consideration for biodiversity in urban area development for better adaptations. They acknowledged that there are opportunities to make positive changes during the urban planning of public spaces. Participants recognised the significance of a green design plan in steering projects toward biodiversity goals. Additionally, the discussion focused on the necessity of ongoing monitoring and evaluation to assess the impact of biodiversity implementation. The need for collaboration between landscape architects and ecologists was highlighted, to ensure full understanding of the environment and implementation. The conversation also covered challenges related to soil conditions, the unique characteristics of urban areas, and the importance of involving relevant stakeholders, such as municipalities, early in the design phase to avoid complications.

"Naja hoe vroeger je begint, hoe beter je kan bijsturen natuurlijk." – Participant A

"Maar ik denk wel dat je, stel dat je er toch te laat bij bent, dat je met een inrichtingsplan van de openbare ruimte best wel wat kan bijsturen." – Participant C

"Ik denk dat de gemeente sowieso participant is, want die vogel ziet echt niet waar de gemeentegrens stopt en de projectontwikkelaar begint, dus ik denk dat je dat ook heel breed moet zien en vanuit de hele leefgebieden van verschillende soorten waar je naar kijkt." – Participant E

After each theme discussion, participants were asked to stick their opinions and perspectives on the process with post-its. The notes taken can be seen in Figure 10. This figure is based on the tangible result of the discussions, consisting of affixed post-its, as presented on the physical poster. Table 9 presents what exactly was written on the post-its. This is indicated by numbers, which can be found in Figure 10. The exact poster and Dutch assertions can be found in Appendix V.

Figure 10. Workshop process design with colour-coding (source: author, from workshop).

Number	Note
1	Firm KPI from local government (steering mechanism)
2	Defining policies thus capturing impacts of biodiversity
3	Ecological vision map/ ambition book
4	Policy municipality + organisation = key
5	Starting early and sticking to it
6	Set a biodiversity ambition with different levels: 1) basic; 2) better; 3) excellent
7	Embracing and implementing sustainability ambition
8	Engage a 'design ecologist' (there aren't too many of those)
9	Set ambitious internal policy on biodiversity
10	Deploy tool (NL Gebieds/Terreinlabel)
11	Project developer ≠ area developer; integrator of interests
12	Engage benefit holders of green areas as partners
13	Joint consensus from different actors (developer, design team, board, municipality) on concept, leading to biodiversity principles
14	Include social benefits in the business case and hand the bill to municipalities, insurance, etc.
15	Management buy-in
16	Determine spatial claim of ecology
17	Engage ecological knowledge
18	Identify ecological opportunities
19	Establish ecological framework
20	Define ecological context

21	Maintenance input capture = controlling costs
22	Define green standard (m^2 per inhabitant) or something similar
23	Stay out of financial profits as long as you can, biodiversity is the basis of our existence
24	Opportunity map in broader context (vertical + horizontal)
25	Establish ecological vision for development
26	Quickscan environment
27	Space claim retention and multiple deployment biodiversity/climate adaptation/playground etc.
28	Monitor space claim greenery at ground level
29	Always integrate design + maintenance
30	€ in construction are 'limited' compared to total, benefits high
31	Have municipal green management review design
32	Check plans against stated ambitions when transferring phases
33	Prevent biodiversity cuts through long-term review and engagement
34	Keep the landscape architect involved until the end: construction and monitoring
35	Project monitoring also on KPIs sustainability
36	Make biodiversity quantifiable (instrument)
37	Design ecologist
38	Develop a database of (the effects of) ecological area developments
39	Ex-post monitoring on effectiveness of measures
40	Convince need for biodiversity (not just reduce to €€)
41	Education & awareness > everyone
42	Monitor long-term eco-effects and compare with other projects
43	Maintenance certainly does not have to cost more

Table 9. Workshop participant notes (source: author, from workshop).

5.3.4 How

Because the statement on the '*how*' theme underwent a systematic analysis in collaboration with the focus group, three short discussions followed. Consequently, this section aims to provide concise summaries of each discussion.

Statement

All stakeholders should establish a joint ambition on biodiversity at the start of a project.

Discussion 1: 'all stakeholders'

The discussion highlighted the importance of engaging various stakeholders, including municipal green managers, policymakers, project developers, and landowners. The participants emphasised the effectiveness of collaboration, necessary for successful implementation of biodiversity goals in urban area development projects, citing examples of ongoing projects where multiple project developers and the municipality worked together on sustainability issues. The project developer, together with substantive knowledge of other stakeholders, should take the lead in shaping a joint ambition. This does depend on the collaboration model between the municipality and the project developer.

> *"Dus als ze gezamenlijk risico dragen, dan moeten ze daar gezamenlijk uitspraak over doen, in dit geval is het zo dat de gemeente met name faciliteert, dan kan het nog steeds dat ze zeggen ja we faciliteren wel, maar we trekken wel degelijk de regie naar ons toe." – Participant B*

Discussion 2: ‘at the start of a project’

The discussion on when to establish the ambition for biodiversity highlighted again the need for collaboration between the municipality and project developers, especially in the early stages of the project. The focus group pointed towards initiating the ambition-setting process during the broader urban planning phase, either driven by the municipality's existing green structure plans or initiated by project developers when identifying and acquiring land. The key takeaway is that it is important to integrate biodiversity goals into the overall urban area development vision from the outset of the project.

“Ja vanaf het begin van het project. Ja, dat is inderdaad op het moment dat er een plan op de grotere schaal voor de langere termijn gemaakt wordt.” – Participant D

Discussion 3: ‘a joint ambition on biodiversity’

Finally, the third discussion revealed several important considerations for formulating such an ambition. The importance of understanding the existing conditions and context of a project was emphasised, suggesting that the ambition should be tailored to the specific characteristics of the site. All participants agreed that more focus on multi-plot contexts is necessary in the future. This includes not only designing biodiversity initiatives for the building itself but also for the surrounding buildings and areas. In addition, the participants discussed the need to define clear criteria for biodiversity, to make the ambition more pragmatic and measurable. They also stressed the importance of aligning the ambition with desired effects.

“En de ambitie hangt ook af van wat de ontwikkelaar op eigen kavel moet oplossen. Het staat in aanvulling op wat er in OR gebeurt. Moet die eigenlijk ook de openbare ruimte realiseren? Ja dat bepaalt wel of je je alleen maar moet bezighouden met het nestkastje met de haag die erbij hoort, of ook met een plek voor wilde bijen.” – Participant C

5.4 Conclusion

Examining the designed process illustrated in Figure 10 provides clear insights into the individual contributions of the different disciplines. Tasks and responsibilities are mainly given to the project developer, which is also evident from the discussions. Notably, both the project developers (Participant A and B) and the landscape architect (Participant D) delineated roles and responsibilities over the entire development process, while the ecology consultant (Participant C) and the green space manager (Participant E) concentrated mainly on the first two phases of urban area development. Moreover, a noteworthy observation emerges regarding the division of roles and responsibilities among the disciplines, showing an interdisciplinary division, except from the landscape architect, who aligned tasks and responsibilities predominantly to the project developer. Furthermore, there is proportionality in the number of notes per discipline.

The final phase of the workshop is the post-design phase. For this purpose, a comprehensive synthesis of the notes from all participants is summarised in Figure 11. This schematic outline illustrates how the future is seen by the participants and what it might look like in an ideal world.

	Urban Development Plan			Zoning plan	Delivery	
	Initiative and exploration	Plan formation and feasibility			Development and construction	Operation and maintenance
		Definition	Design	Preparation		
Municipality	• Define biodiversity policy including KPIs and ambitions	• Define green standard	• Review design			• Develop database of ecological area developments • Monitor on effectiveness
Project developer	• Set sustainability ambition including biodiversity with designteam, board and municipality • Engage (design) ecologist, green space manager and greenery benefit holders • Deploy biodiversity tool • Include social benefits in business case • Management commitment	• Stay out of financial profit discussions	• Monitor greenery space claim and multiple deployment	• Check plans against ambitions when transferring phases	• Prevent biodiversity cuts through long-term review and engagement • Monitor on sustainability KPIs • Make biodiversity quantifiable with an instrument	• Monitor on effectiveness and compare with other projects
Landscape architect	• Determine spatial claim of ecology and engage ecological knowledge		• Integrate design and maintenance		• Stay involved during construction and monitoring	
Ecologist	• Identify and establish ecological framework	• Do a quickscan of the environment • Establish ecological opportunity map				
Sustainability consultant			• Focus on benefits and not on financial barriers			
Green space manager	• Gather maintenance input		• Have municipal green management review design			• Remember that maintenance does not have to cost more

Figure 11. Workshop process design summary (source: author).

It is visible that biodiversity is considered important throughout every phase of an urban area development project. The extensive discussions addressed versatile aspects of stakeholder collaboration, phasing, financial prerequisites, and joint ambitions associated with biodiversity implementation in urban area development projects. On stakeholder responsibilities, there was a consensus on the need for proactive engagement of various stakeholders, including (design) ecologists, (landscape) architects, project developers, and municipal authorities. In particular, the project developer was seen as a pivotal figure in steering joint ambitions and fostering collaboration. One notable post-it statement, although not explicitly included in Figure 11, has considerable significance, as unanimously recognised by all participants. It highlights the need for each stakeholder to make proactive efforts at every stage to educate and convince all other stakeholders of the importance of biodiversity.

The discussion on phasing highlighted the importance of early involvement in the life cycle of a project. The need for a proactive approach during the broader urban planning phase was underscored, with primarily collaboration between the municipality and project developers. Starting the ambition-setting process at an early stage was considered essential to seamlessly integrate biodiversity goals into the overarching urban area development vision.

The financial discussions elucidated the complexities of quantifying biodiversity's intrinsic value, highlighting the need for a nuanced approach. Participants emphasised the exploration of alternative funding sources to avoid excessive budget constraints that could compromise essential elements. In addition, management commitment is necessary, or even management buy-in.

Many barriers remain, not all of which are likely to be overcome in the near future. ‘Greenwashing’ practices, contextual variations in attitudes toward biodiversity, and the

prioritisation of profit over green areas were identified as major obstacles. The need for a deeper understanding of ecological impact, clear criteria for biodiversity, ongoing monitoring and evaluation, and collaboration between landscape architects and ecologists were stressed as strategies to navigate these challenges. The discussions essentially boiled down to a call for proactive collaboration, early integration of biodiversity goals, a nuanced approach to financial prerequisites, and strategic measures to overcome barriers. The collective insights presented a roadmap for biodiverse urban area development.

Regarding the distinction between one-plot contexts and multi-plot contexts, additional conclusions can be drawn. Figure 11 delineates participants' statements specifically on the emphasis of multi-plot contexts, indicated in blue. Consensus among participants underscores the need for more attention to multi-plot contexts in future urban area development. However, the recommendations derived from the expert interviews predominantly underlined the importance of the multi-plot context, thus providing an overarching emphasis on this facet throughout the workshop, rather than the comparative exploration of one-plot versus multi-plot contexts.

6 Discussion

The discussion of this research encompasses an examination of the results, explains methodologies employed, and describes the overall study conduct. This is done first for the literature review and established hypotheses, and secondly for the empirical research, consisting of the expert interviews and the focus group workshop. The chapter finalises by addressing the limitations of the study and offering recommendations for future research.

This thesis investigated the relationship between 'stakeholder collaboration and co-development', and 'biodiversity across multiple plots'. The research broadly focused on four components: stakeholder engagement, phasing, design elements and principles, and financial prerequisites. The study aimed to examine how private project developers can co-develop with other stakeholders to enhance biodiversity across multiple plots in an area.

6.1 Literature review

The literature review systematically explored the relationship between biodiversity implementation and urban area development, covering the four key components identified in the conceptual framework. Additionally, an inquiry into biodiversity regulations and legislation was conducted, validating the problem statement of limited regulations and supervision, and identifying potential barriers that can be addressed through this research. The overarching aim of the literature review was to review existing research to gain foundational knowledge needed to answer the four sub-questions.

The literature review defines key terms such as urban area development and biodiversity in the built environment and clarifies their interrelationships. Urban area development is defined as a complex, long-term process of physical adaptation of a specific location to meet socio-economic and spatial needs through the collaboration of diverse stakeholders using various tools. The study outlines complex relationships between concepts, such as biodiversity and scale, biodiversity and building collaboration, and between stakeholder collaboration and biodiversity enhancement. The literature review concentrated mainly on clarifying the concepts and their interrelationships, without explicit examination of the difference between a one-plot context and a multi-plot context.

The literature review emphasises the importance of collaboration between green design elements on buildings, infrastructure, and stakeholders to enhance biodiversity in urban areas. Design elements and principles, financial prerequisites, and regulations and legislation are identified as influential factors. The conclusion outlines hypotheses for each component, highlighting the need for stakeholder engagement, appropriate design principles, and financial planning to achieve successful biodiversity implementation in urban area development projects.

Drawing upon the literature review, six themes were delineated as the basis for the empirical research: what, when, who, why, where, and how. The first four themes form the core of the research and embody the key components, while the last two focus on solutions, incorporated in the workshop and subsequently into the proposed implementation framework. The themes describe the complex relationship between the two main concepts and serve as analytical frameworks for both analysing the expert interview data and structuring the workshop.

6.2 Empirical research

The empirical research consisted of explorative interviews with experts and a workshop. The knowledge and insights gained from both the literature review and the expert interviews formed the foundation for the workshop. The comprehensive research provides valuable insights into the complex interplay of factors influencing successful biodiversity implementation. The literature review, expert interviews, and the workshop together offer a multifaceted understanding of challenges and opportunities in enhancing biodiversity across multiple plots in urban areas.

The expert interviews validate and enrich the findings from the literature review, emphasising the barriers such as divergent project developer priorities and financial constraints. The synthesis of the experts' opinions highlights the prominent role of 'design elements and principles' and sheds light on the diverse impacts attributed to each component.

The literature underscores the need for engagement with a diverse range of stakeholders, while expert interviews emphasise its central role in overcoming barriers and achieving a collective vision. The workshop further reinforces the importance of proactive collaboration and identifies the project developer as a key figure in steering joint ambitions and fostering collaboration among various stakeholders. The Environment Act in 2024 is poised to play a significant role in strengthening regulations and promoting a collaborative approach.

The findings stress the importance of strategic planning from the outset of urban area development projects. Early involvement of critical stakeholders, such as ecologists and green space managers, especially during the urban planning phase, is considered essential for seamlessly integrating biodiversity goals into the overarching vision. Financial prerequisites emerge as a critical aspect, with the need for a nuanced approach to quantify biodiversity's intrinsic value. The experts advocated for viewing biodiversity as an asset rather than a cost, while the focus group emphasised the potential role of alternative funding sources and management commitment in overcoming financial barriers.

The workshop revealed an interdisciplinary division of roles between project developers, landscape architects, ecologists, and green space managers. The discussions produced a comprehensive synthesis, outlining a collective vision for biodiverse urban area development. While acknowledging persistent barriers, such as 'greenwashing' initiatives and varying attitudes toward biodiversity, the participants presented a roadmap for the future: proactive collaboration, early integration of quantified biodiversity goals, a nuanced approach to financial prerequisites, and strategic measures to overcome obstacles.

Concerning the distinction between a one-plot and a multi-plot context, the interviews and the workshop had a different format, but mostly comparable outcomes. During the interviews, the experts were questioned first on their perspective of the current one-plot context and then of the future multi-plot context. This created a difference between the contexts through the order of the questions. Conversely, the workshop, taking place in the scope of urban area development, naturally tended towards focussing on a multi-plot context. In both cases, the participants themselves highlighted the importance of focussing on multi-plot contexts in the future. Additional noteworthy differences between the methods include the experts’ emphasis on governmental and municipal tasks and roles, whereas the focus group participants concentrated their responses on the responsibilities of project developers. Furthermore, the interview responses were exclusively provided by ecologists and similar disciplines, making the outcomes one-dimensional, while the various disciplines in the focus group workshop contributed to a multidimensional understanding.

6.3 Limitations

While this study provides important insights into the challenges and opportunities of integrating biodiversity in multi-plot contexts and urban area development projects, it is essential to acknowledge certain limitations. The research consists of a literature review, expert interviews, and a workshop, each with its inherent biases and perspectives. While the emphasis on expert opinions during the interviews is valuable for capturing real-world insights, it can also introduce a degree of subjectivity. Furthermore, the interviews and subsequent data analysis were conducted by the same researcher, creating the potential for inherent bias. Consequently, consistent interpretation across different researchers cannot be guaranteed. Nevertheless, subjectivity and inherent biases are overarching limitations arising in qualitative research and thus intrinsic to this methodological approach. Given that outcomes are occasionally dependent on the interpretation of the data, it is relevant to clarify the process by which transcripts are transformed into conclusions. This aspect deserves careful consideration, acknowledging the potential influence of the researcher's subjective lens on the analysis process and emphasising the need for transparency in the transition from raw data to interpretive outcomes.

The workshop, while providing a rich interdisciplinary perspective, represents a specific context due to the situation outline, and its findings may not be universally applicable. Furthermore, the research primarily examines the perceptions and experiences of professionals involved in urban area development, and the inclusion of different community perspectives can provide a more holistic understanding. The absence of representatives from municipal or central government agencies during the workshop implies a possible limitation, as this perspective remains unrepresented, possibly leading to incomplete findings. In addition, to better align this research with biodiversity implementations in practice and enhance practical relevance, it is recommended that future research examine case studies involving project developers or other entities involved in development initiatives.

Despite these limitations, the study provides a solid foundation for further research and highlights the need for ongoing interdisciplinary studies to refine strategies for implementing biodiversity in diverse urban areas.

6.4 Further research

Building on the insights gained from this study, several avenues emerge for further exploration. The result of this research is advice on biodiversity implementation in urban area development projects. This advice results in an implementation framework. Follow-up research should be carried out to determine whether this advice can be applied in the near future. Moreover, as urban area development continues to evolve, the findings emphasise the need for a holistic and collaborative approach, aligning with the collective insights presented in the workshop. Studies tracking the implementation of biodiversity strategies in urban area development projects over time can provide valuable insights into the evolution of practices and the effectiveness of regulations and legislation.

A deeper analysis of the identified components, such as 'financial prerequisites,' through targeted empirical research, can provide a nuanced understanding of its specific impact. Moreover, future research could conduct a comparative analysis of different cases with biodiversity implementation strategies and their effectiveness in different contexts. Furthermore, given the dynamic nature of environmental policies, ongoing assessments following the implementation of

the Environment Act in 2024 can provide valuable feedback on its impact. Lastly, interdisciplinary research that examines the relationships between biodiversity, urban planning, and economics can contribute to holistic strategies that balance ecological sustainability with economic viability in urban area development projects.

This research not only identifies current challenges, but also sets the stage for future efforts. These recommendations are intended to deepen our understanding and develop practical strategies for enhancing biodiversity in future urban area development projects. Future research further can build on the findings of this study by addressing the gaps and limitations.

7 Conclusion

This thesis examined the influence of stakeholder collaboration and co-development on the implementation of biodiversity across multiple plots. Based on explorative and qualitative research, the relationships between these two main concepts and stakeholder engagement, design elements and principles, phasing, and financial prerequisites were investigated. This master thesis focused on implementing biodiversity within new construction projects in urban areas through co-development between different stakeholders and across different plots. By combining all the gained knowledge and insights, it is now possible to answer the main research question. First, the four sub-questions will be answered and subsequently, the main research question.

SQ1. Which design elements and principles enhance biodiversity across multiple plots?

In response to this sub-question, urban nature-based solutions and other design elements and principles have been researched. This research did not exhaustively explore all possible design elements for biodiversity enhancement but rather focused on elucidating the underlying principles that guide the selection and integration of such design elements. Urban nature-based solutions, guided by integrated principles emphasising systemic understanding and mutual benefits, emerge as key instruments for addressing societal challenges while enhancing biodiversity and human well-being. Recognising the impact of scale, the research underscores the need for collaborative efforts across multiple plots to enhance urban biodiversity. Biodiversity thrives at broader spatial scales where interconnected networks of green areas can support larger populations and facilitate species movement. Urban nature-based solutions, if strategically integrated into building designs, not only enhance ecological connectivity but also have other contributions, such as mitigating the urban heat island effect. Ecosystem services highlight these diverse benefits.

The value of a building with green design elements depends on its integration with its surrounding area. To ensure integration of the building and plot with its surrounding area, a comprehensive analysis of the area, including a soil survey which is often neglected, is necessary during the initial phase of the project. Subsequently, strategic positioning of buildings is imperative to contribute to the creation of interconnected pathways, thereby enhancing ecological connectivity.

Diversity prevails over quantity, stating that one starling and one sparrow exceed the ecological value of two sparrows. While quantifying biodiversity remains a complex task, the overarching goal is to maximise diversity. Enhanced diversity can be achieved by creating a broad variety of habitats. This can be done by placing buildings with varying heights, so different species with different nesting preferences can nest at different heights.

Current biodiversity strategies, design elements and principles, for example the selection of native plants, play a crucial role in shaping urban biodiversity. Especially in cities, it is important to preserve native vegetation with indigenous plant and animal species. Guidelines proposed in the literature emphasise exploring existing biodiversity before urban area development and designing, for reduced ecological impact. Another valuable guideline involves the use of indicator species, as their presence attracts other species. Additionally, indicator species can be used to measure biodiversity.

Insights from the literature deepen the understanding of how design elements like green roofs, green walls, and permeable pavements enhance biodiversity, offering knowledge of species richness and habitat effectiveness. Furthermore, the data establishes a coherent link between

biodiversity design elements and maintenance. Prioritising robust and low-maintenance designs and urban renewal reduces the need for extensive maintenance and enhances biodiversity.

The research concludes by exploring the formulation of a joint ambition between co-developing parties on biodiversity, emphasising the need for contextual understanding through area analyses, clear criteria, and alignment with desired effects as crucial considerations. The need for pragmatism and measurability to guide the ambition effectively is stressed. In essence, this research provides a comprehensive understanding of the relationship between design elements and principles and collaborative efforts across multiple plots, paving the way for informed decision-making and strategic planning in future urban area development projects. This will further guide the integration of design elements to enhance biodiversity in a multi-plot context.

SQ2. Which stakeholders are important for biodiversity implementation and what are their roles?

The research on stakeholder engagement has elucidated the roles of various stakeholders in biodiversity implementation within urban area development projects. The identified stakeholders include private parties (investors, financiers, construction companies, project developers, residents, and business owners), public parties (central government, provinces, regions, and municipalities), and citizens and civil society organisations. The roles and commitments of these stakeholders vary, encompassing initiation, permitting, partnership, investment, and ownership. The key stakeholders are the municipality, project developer, landscape architect, ecologist, and green space manager. The relationship between the project developer and the municipality is seen as the most important, underscoring the necessity for establishing public-private partnerships. While the expert interviews focused mainly on the role of the government, the workshop discussions emphasised the role of the project developer, highlighting an observable tension between these stakeholders that necessitates collaborative alignment within the multi-plot context.

Four approaches to addressing fragmented land ownership in a multi-plot context encompass plot development, organic development, developing apart together, and aggregation of ownership. Given the relationship between stakeholder collaboration and biodiversity enhancement, the latter two approaches contribute most to biodiversity enhancement. These approaches include more shared visions and contractual agreements.

The research findings underscore the significance of stakeholder engagement, and it contributes valuable insights into the motivations and factors influencing stakeholders in the context of biodiversity practice. Biodiversity implementation requires collective responsibility, with the government and project developer playing leading roles. However, this is more recalcitrant in practice. Achieving biodiversity ambitions depends on the intrinsic motivation of individuals and their ability to convince other stakeholders. This dependence on individual commitment is independent of ties to a specific party. The ability of a particular party to establish and pursue biodiversity goals further depends on the nature and extent of the public-private partnership. The informal steering of ambitions and encouragement of stakeholders are separate from formal control mechanisms. The responsibility to sustain biodiversity-focused ambitions throughout the entire project life cycle lies with each stakeholder. The more ambitions there are for biodiversity enhancement, the more complex stakeholder engagement becomes, due to the intricate coordination required among diverse stakeholders with potentially conflicting interests and priorities. Early involvement of ecologists and sustainability experts is essential, given the changing nature of biodiversity ambitions throughout the project.

SQ3. What are the financial prerequisites of biodiversity implementation within the scope of an urban area development project?

The exploration of financial prerequisites associated with biodiversity design elements and green and blue infrastructure reveals a range of benefits, including reductions in urban heat island effects, energy savings, long-term employment opportunities, improved indoor environmental quality, and lower operational costs. Research recognises the indirect financial benefits of biodiversity enhancement and highlights the variable nature of financial considerations in urban area development projects. The financial returns of biodiversity implementation remain difficult to measure, especially over a longer period. Quantifying intangible benefits continues to be a challenge.

Financial prerequisites are recognised as potential barriers to biodiversity implementation, with experts advocating for early prioritisation and an integrated approach. By incorporating financial considerations from the beginning of the project, it is possible to mitigate the financial barriers. Biodiversity must be incorporated into ground-related expenditure (GREX). The formulation and implementation of ambitious biodiversity measures requires financial allocations, as it is proving difficult to accurately quantify the return on such investments. Biodiversity measures therefore represent a short-term financial expenditure within the current fiscal framework. The discussion on budgetary aspects further reveals concerns about contextual variations in attitudes towards biodiversity, especially in urban versus rural developments.

Cost reduction of biodiversity implementation is difficult, as cost-saving measures can jeopardise the essential elements of biodiversity initiatives. However, a feasible approach involves the implementation of biodiversity design elements in a way that simultaneously reduces management costs. Transforming lawns, for example, into biodiverse ecosystems, can lead to significant reductions in management costs. This transition not only enhances biodiversity but also reduces the necessity for frequent mowing, thereby contributing to more cost-effective maintenance.

The tension between financial considerations and environmental sustainability is clear, with discussions about quantifying the intrinsic value of biodiversity in monetary terms. Stakeholders have varying perspectives on the financial considerations associated with biodiversity implementation. While some oppose reducing biodiversity to a financial metric and emphasise the intrinsic role biodiversity plays in sustaining life, others advocate assigning a monetary value, arguing it can enhance its implementation in projects. Moreover, alternative funding sources must be explored during projects and the importance of biodiversity should be recognised by all stakeholders beyond direct financial measures. The research highlights the need for a strategic, collaborative, and balanced perspective to ensure a successful and sustainable implementation of biodiversity initiatives in urban area development projects.

SQ4. How should an urban area development process be designed for biodiversity implementation?

The phasing and processes involved in biodiversity implementation have been examined during the expert interviews and the workshop, using the basic process of urban area development consisting of four phases: initiative and exploration, plan formation and feasibility, development and construction, and operation and maintenance. Tasks and actions were determined across the four phases, specifying responsibilities for each stakeholder in the pursuit of biodiversity implementation. The process to be followed and the degree of collaboration between stakeholders depends on their level of ambition, which will be discussed in the *Recommendations* chapter in more detail.

The research produced a series of recommendations for implementation of biodiversity in urban area development. The main findings highlight a proactive integration of biodiversity from the beginning of the project, by involving green space managers and ecologists during the initiative and exploration phase. This approach ensures seamless adherence to standards, regulations, and legislation.

Highlighted directives are ongoing monitoring and evaluation throughout the project life cycle to assess the impact of biodiversity implementation. However, it is imperative to establish goals at the start of the project, so evaluative measures can be taken to assess whether these objectives have been achieved and to effectively steer the project towards its biodiversity goals. The formulation of such an objective can be done by a joint ambition document. Collaboration between the project developer and the municipality is particularly important to establish this. The articulation of shared biodiversity ambitions for the area, achieved through a mutual agreement between the project developer and the municipality, serves to give the project clarity. These agreements, which depend on the cooperation model between the project developer and the municipality, are ideally initiated during the broader urban planning phase, either driven by the municipality's existing green structure plans or initiated by project developers when acquiring land.

Besides the aforementioned form of collaboration, the synergy between two other stakeholders is of paramount significance for biodiversity implementation and enhancement. Collaboration between landscape architects and ecologists has been underscored as necessary, to ensure a comprehensive understanding of the environment. Furthermore, the involvement of various relevant stakeholders is important in addressing challenges related to urban characteristics and plot conditions. These stakeholders may include consultants and municipal authorities, contributing to a multi-faceted approach to the complexity of biodiversity initiatives.

Main research question:
How can private project developers co-develop with others to enhance biodiversity across multiple plots in an area?

In conclusion, this research provides strong guidance for private project developers aiming to enhance biodiversity across multiple plots in an urban area. The designed process and the implementation framework provide the most support. Collaboration between stakeholders and between plots has been proven as an important and recurrent concept, necessary for integration of design elements and principles, collective responsibility, and to challenge the tension between financial considerations and environmental sustainability. Collaboration is imperative between the co-developing parties and the municipality through public-private partnerships, but should extend to include landscape architects, ecologists, green space managers, and relevant consultants. Roles, responsibilities and priorities of stakeholders vary per urban area development project and biodiversity ambitions, which makes biodiversity enhancement complex. Greater biodiversity ambitions are accompanied by more complexities in integrating design elements and principles, stakeholder engagement, financial prerequisites, and phasing.

Project developers and the government continue to be identified by various stakeholders as leaders on the road to biodiverse urban areas. With the new laws and regulations established this January, hopefully the government and municipalities will provide more direction for parties who do not consider biodiversity important from their perspective. Until then, it is important for all

stakeholders involved in urban area development projects to understand the intrinsic value of biodiversity and to establish joint ambitions and agreements on biodiversity implementation at the beginning of projects. This requires intrinsic motivation from individuals, because control does not always lie with the stakeholder whose primary goal is to enhance biodiversity. Establishing such an ambition starts with an assessment of the environment and existing local biodiversity. Subsequently, it involves ensuring the integration of the building or plot with the existing ecosystems in the surrounding area. Central to this approach is the recognition that biodiversity thrives at broader spatial scales, necessitating collaborative efforts across multiple plots to support larger populations and facilitate species movement. To maximise biodiversity, diversity is preferred over quantity, which implies deliberate consideration of varied building heights and strategic building placement to create interconnected pathways. Having established these ambitions, a rigorous regime of monitoring and evaluation at each stage of the development process is necessary.

Financial prerequisites remain potential barriers. Early prioritisation and an integrated approach of biodiversity implementation in the project budget are seen as measures to balance short-term costs with long-term benefits. Pursuing high biodiversity ambitions entails immediate financial considerations and requires the allocation of dedicated budgetary resources. Early and high priority is important to secure and maintain these financial prerequisites. Financial considerations in the context studied show a nuanced complexity, characterised by a tension between financial considerations and environmental sustainability. The more ambitious the biodiversity goals within a project aimed at greater biodiversity enhancement, the more complex the financial prerequisites.

The main focus of this research was on the comparative analysis between one-plot contexts and multi-plot contexts, a central theme that has emerged as an important consideration. Enhanced collaboration among stakeholders and across plots facilitates a more nuanced examination of multi-plot contexts and broader spatial scales within projects. The main recommendations are to initiate an area analysis at the beginning of the project, along with the establishment of a joint ambition based on this evaluative study. Conducting such an analysis and setting such an ambition requires stakeholder collaboration to ensure consistency and coordination among the various stakeholders.

8 Recommendations

8.1 Advice

This research primarily addresses to project developers. Although the findings are also relevant to other stakeholders, including municipalities, landscape architects, and ecologists, the target group of this thesis is project developers. Intriguingly, the study revealed an emphasis among the experts interviewed on the municipality, occasionally attributing it to perceived shortcomings in providing adequate guidance to other stakeholders for biodiversity implementation. Some of the experts are employed by a municipality. However, project developers were also recognised as important leaders in biodiversity implementation. The workshop focused mainly on project developers, with three out of the five participants being employed by a project development company.

This chapter provides advice directed towards project developers, preceded by a brief recommendation addressed to the government. Municipalities play a pivotal role in enhancing biodiversity in urban areas. Therefore, it is imperative that municipalities proactively establish guidelines and principles for biodiversity enhancement for future development areas. The formulation and implementation of a green structure plan is indispensable to ensure the right ecological connections. Introducing a standardised point system to evaluate each urban area development project can encourage nature-inclusive building practices. Municipalities are advised to encourage collaboration with project developers through public-private partnerships. Inclusive collaboration involving various stakeholders should be emphasised and initiatives should be taken to establish collective ambitions. These ambitions should be formulated during the initiative and exploration phase. Because of the scarcity of urban ecologists, municipalities should make efforts to increase the presence of ecologists and urban ecologists to assist other stakeholders in urban area development projects. Moreover, it is of utmost importance for municipalities to be open to initiatives from other stakeholders aimed at enhancing biodiversity.

Based on the extensive findings and insights derived from this study, private project developers are advised to adopt a strategic and collaborative approach when striving to enhance biodiversity across multiple plots in an area. The following recommendations for biodiversity implementation are given, structured by theme:

- *What?*

  Implement urban nature-based solutions and biodiversity considerations from the initiation phase of the project, such as green roofs, green walls, and permeable pavements and focus on native vegetation, herbs, and shrubs. Investigate which elements best fit the project by looking at the effect to be achieved, using indicator species and area analyses. Connect to biodiversity on land, in water, and in soil. Ensure the elements are strategically integrated into building designs, emphasising systemic understanding and mutual benefits. Quantify your goals and ensure that the enhancement or change is measurable. Connect design elements to vegetation in the surrounding area and place them strategically. Use biodiversity implementation to achieve additional benefits from vegetation. Prioritise robust and low-maintenance designs. Focus on area scale and diversity, as opposed to one-plot contexts and quantity.

- *When?*
  Implement ongoing monitoring and evaluation of biodiversity enhancements throughout all phases of the urban area development process. This ensures that the goals set during the initial phases are continuously assessed, and adjustments can be made when needed. Recognise the evolving nature of biodiversity ambitions over the project's life cycle. Be prepared to adapt strategies and interventions based on the changing dynamics of the development phases. Keep relevant stakeholders involved throughout all phases.
- *Who?*
  Recognise the different roles and commitments of stakeholders and engage ecologists, sustainability experts, and the municipality early. Emphasise collaboration, inclusive teamwork, shared goals, collective ambitions, and a balance of individual interests to address challenges related to urban characteristics and plot conditions, ensuring a comprehensive and informed approach to biodiversity. Maintain clear communication with all stakeholders regarding the importance of biodiversity at each phase of the project. Create awareness about the long-term benefits and ecological value.
- *Why?*
  Acknowledge the intrinsic value of biodiversity beyond immediate financial metrics and financial benefits. Do not quantify the financial returns but focus on environmental benefits. Emphasise early financial prioritisation, integration into ground-related expenditure (GREX), and exploration of alternative funding sources. Implement biodiversity design elements in a way that reduces maintenance costs. Highlight compliance with standards, regulations, and legislation related to biodiversity. Include biodiversity in the early stages of the project to align with legal requirements, instruments and tools, and environmental standards.
- *Where?*
  Analyse the surrounding area and the species, soils, and biotopes present as early in the project as possible. Address the challenges associated with urban characteristics. Match biodiversity strategies to the unique conditions of the urban area and connect green elements to the green and blue infrastructure. Promote collaboration and interactions between plots and design areas through the strategic placement of buildings and varying building heights. Focusing on connecting an area’s biodiversity with the main ecological structure is more tangible and less complex than biodiversity enhancement. The emphasis on establishing these connections inherently results in more biodiversity enhancement.
- *How?*
  Embrace collaboration between stakeholders, including private parties and public entities, and especially between a landscape architect and ecologist and between the municipality and the project developer. Encourage collective responsibility for increasing biodiversity. Establish a joint ambition and contractual agreements on biodiversity at the outset of a project together with the municipality and other relevant stakeholders, based on the municipalities’ green structure plans. Conduct comprehensive area analyses in collaboration with stakeholders to ensure contextual understanding, clear criteria, and alignment with desired effects. Ensure the seamless integration of biodiversity goals into the overall vision from the start of a project. Involve relevant stakeholders like consultants, contributing to a multi-faceted approach to the complexity of biodiversity implementation.

In conclusion, private project developers are encouraged to use these recommendations as a comprehensive guide for biodiversity implementation across multiple plots in urban area development projects. The collaborative, proactive, and strategic approach described herein is designed not only to enhance biodiversity, but also to contribute to sustainable and ecologically resilient urban areas.

8.2 Biodiversity implementation framework

Based on the findings of this study, it is possible to indicate four gradations, ambition levels, of biodiversity enhancement in urban area development. These gradations serve as categorical benchmarks to clarify how project developers and other stakeholders can address biodiversity considerations within urban area development projects (Figure 12). The use of these gradations should be studied and validated by examining case studies involving project developers or other developing parties. Figure 12 shows that biodiversity in urban areas can only be enhanced to a certain level. The illustration is a conceptual thinking framework and does not include specific measurements. Figure 13 presents the tasks, phasing, and stakeholder engagement of the four gradations.

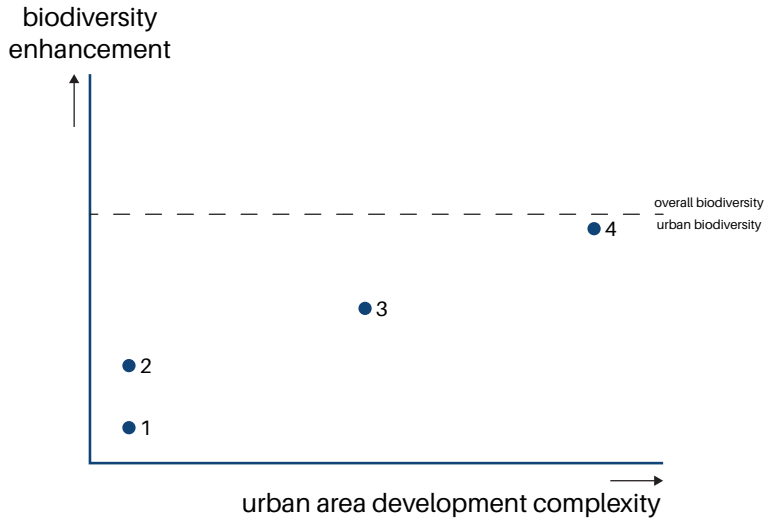

Figure 12. Four gradations: biodiversity enhancement versus complexity (source: author).

The four gradations are delineated as follows:

1. Solely legally required biodiversity measures are implemented, with a primary focus on conservation and protection of existing biodiversity. This approach can be considered a basic standard, encompassing the minimum requirements for biodiversity implementation. The gradation is characterised by a focus on a single plot and a minimal level of complexity, with limited financial prerequisites, minimal stakeholder engagement necessities, few complex tasks, straightforward phasing, and an absence of complex design elements and principles.

2. Similar to the approach in gradation 1, the emphasis remains on a one-plot context and the level of complexity remains the same. However, this gradation includes a heightened incorporation of biodiversity enhancement measures. The start of the project includes a

comprehensive analysis of the area and its biodiversity potential, culminating in the formulation of an ambition document with the active engagement of relevant stakeholders. While the urban area development remains focused on a one-plot scale, a significant increase in biodiversity enhancement is achieved compared to gradation 1.

3. Focus on a multi-plot context. Formulate a joint ambition with an integral area concept endorsed by all co-developing stakeholders. In the absence of explicit municipal guidelines, it is necessary to establish a partnership between the project developer and the municipality, facilitating the joint formulation of agreements on biodiversity objectives. This gradation manifests itself in increased complexity of design elements, stakeholder engagement, phasing, and financial prerequisites. Establishing connections between plots results in significantly greater biodiversity enhancement compared to gradations 1 and 2. Ensure seamless integration of biodiversity objectives into the overarching vision of the project, coupled with the implementation of ongoing monitoring and evaluation of biodiversity enhancements across all phases.

4. Connection to main ecological structure and green-blue infrastructure of the municipality. The emphasis on establishing these connections inherently results in more biodiversity enhancement. Collaboration with a landscape architect and an ecologist becomes even more important and phasing and financial prerequisites become more complex. This ambition level cannot always be pursued, because it depends on the location and potential of the area, relative to the green-blue infrastructure of the city. A more exhaustive area analysis at the project outset is warranted for this gradation, emphasising the increased importance of the municipality's role.

Figure 13 presents the course of each urban area development phase within each gradation. The figure is based on the four gradations and the findings of the focus group workshop. Each subsequent gradation builds upon its predecessors, with gradation 4 encompassing the tasks and responsibilities delineated in gradations 1, 2, 3, and 4. Each gradation is characterised by an escalation in biodiversity ambitions, manifested in increased complexity of design elements, stakeholder engagement, phasing, and financial prerequisites. The increase in complexity of design elements corresponds to an increased focus on broader spatial contexts as higher biodiversity goals are pursued. Gradation 1 only considers biodiversity conservation in a one-plot context. In gradation 2, biodiversity measures are implemented for biodiversity enhancement. Gradation 3 expands its scope to a multi-plot context, while gradation 4 extends to the ecological structure of the municipality. The increase in the complexity of stakeholder engagement does not necessarily mean an increase in the number of stakeholders; rather, it means a refinement of relationships, roles, and responsibilities. More complexity in phasing and financial prerequisites is a direct result of the higher ambitions and increased complexity of stakeholder engagement.

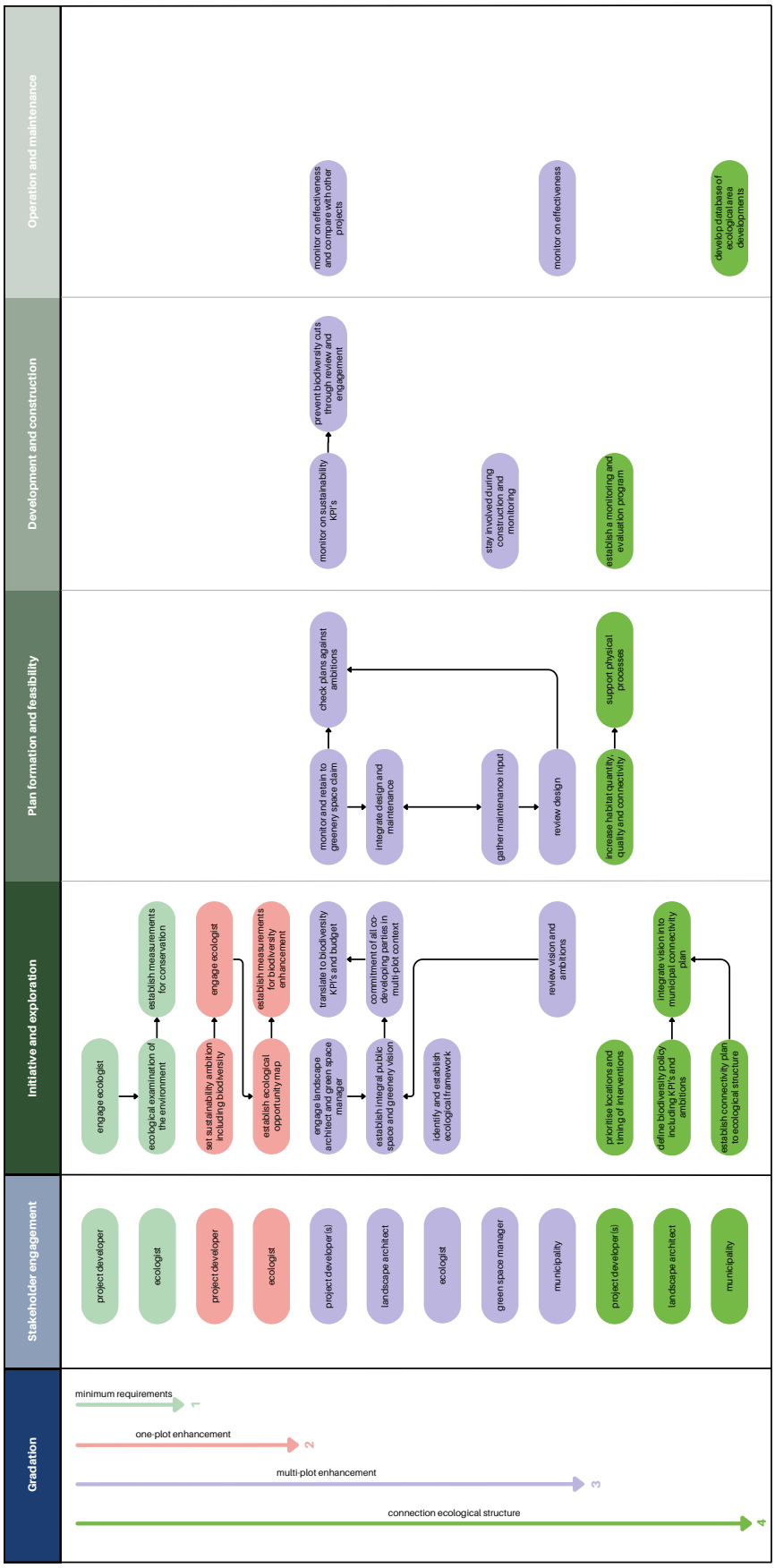

Figure 13. Process of four gradations including stakeholder engagement (source: author).

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Appendix I: Interview protocol

Datum:
Interviewee:

Benodigdheden:

- Toestemmingsformulier
- Interviewprotocol inclusief vragen
- Telefoon of audio-opnameapparaat
- Laptop
- Notitieblok + pen
- Opladers voor alle apparaten

Introductie

Bedankt voor uw deelname aan dit interview.
Dit interview is voor mijn masterscriptie, waarin ik onderzoek doe naar de invloed van samenwerking tussen belanghebbenden op de implementatie van biodiversiteit op meerdere gebouwen. Dit interview heeft als doel om inzicht en kennis te verwerven over relevante belanghebbenden tijdens de implementatie van biodiversiteit in projectontwikkelingsprojecten.

Om het interview soepel te laten verlopen en het onderzoek efficiënt te laten verlopen, vraag ik graag uw toestemming om het interview op te nemen. De opnames worden getranscribeerd en geanonimiseerd. Na afloop van het onderzoek worden de opnames en de tekst verwijderd. Als u akkoord gaat met de opname, wil ik u vragen het toestemmingsformulier in te vullen.

Ik zal u wat meer achtergrondinformatie geven over mijn scriptie. Dit onderzoek doe ik vanuit het perspectief van de projectontwikkelaar. Door onderzoek te doen naar biodiversiteit en te praten over waar VORM, mijn afstudeerbedrijf, tegenaan loopt als het gaat om biodiversiteitsimplementatie, kwam ik erachter dat projectontwikkelaars een toolbox missen die hen kan ondersteunen bij het implementeren van biodiversiteit in hun projecten, inclusief samenwerking met andere relevante belanghebbenden en omliggende gebouwen. Zo'n toolbox zou ook positieve effecten hebben op de stad, op andere belanghebbenden en op eindgebruikers. Ik richt me alleen op nieuwbouwprojecten van meerdere gebouwen.
Tijdens deze masterscriptie zal ik deze onderzoeksvraag beantwoorden: *Hoe kunnen particuliere projectontwikkelaars samenwerken met andere belanghebbenden om de biodiversiteit over meerdere gebouwen in een gebied te vergroten?*

Dit interview bestaat uit 3 delen. Deel 1 is 'Wie bent u?', uw functie, achtergrond en werkervaring. Deel 2 gaat over uw ervaring met biodiversiteit, en dan specifiek biodiversiteit op gebouwen. Deel 3 is uw toekomstvisie.

Vragen

1. Wie bent u?
    a. Kunt u wat meer vertellen over uw achtergrond?
    b. Wat is uw huidige functie?
    c. Bij wat voor bedrijf werkt u?
    d. Hoeveel jaar ervaring heeft u?

2. Uw ervaring met biodiversiteit
    a. Wat is uw betekenis van biodiversiteit?
    b. Wat is uw ervaring/kennis met/van biodiversiteit op gebouwen?
        i. Wanneer wordt er gekeken naar biodiversiteit op een gebouw?
        ii. Waarom is biodiversiteit op gebouwen belangrijk volgens u?
        iii. Wie kijkt er naar biodiversiteit op gebouwen?
        iv. Met wie werken zij samen om biodiversiteit op een gebouw te implementeren?
    c. In uw ervaring, geldt dit voor één gebouw/of één project of voor meerdere gebouwen/projecten?
    d. Is deze ervaring op het professionele vlak of persoonlijk?
    e. Bent u betrokken geweest bij een project waarin biodiversiteit op gebouwen geïmplementeerd werd?
        i. Welke overwegingen voor biodiversiteit op gebouwen hebben daarin meegespeeld en waarom?
    f. Wat moet er volgens u anders of veranderen als het gaat om biodiversiteit op een gebouw?
        i. Kunt u hierbij een voorbeeld geven?

Voordat we verdergaan naar het volgende deel van dit interview, zal ik u wat meer vertellen over mijn onderzoek. In mijn onderzoek kijk ik naar het verschil tussen biodiversiteit op één gebouw en biodiversiteit op meerdere gebouwen. Mijn onderzoek focust zich op dit verschil dat beïnvloed wordt door samenwerking tussen verschillende belanghebbenden. Ik zal u dezelfde vragen stellen, maar dan met de focus op biodiversiteit op meerdere gebouwen en niet op één gebouw. We hebben het net gehad over uw ervaring, nu zal ik uw mening vragen over een mogelijk toekomstbeeld.

3. Het verschil met meerdere gebouwen
    a. Als we kijken naar meerdere gebouwen, ziet u zaken die verbeterd of veranderd zouden moeten worden?
        i. Wanneer moet er gekeken worden naar biodiversiteit op meerdere gebouwen?
        ii. Waarom moet er gekeken worden naar biodiversiteit op meerdere gebouwen?
        iii. Wie (welke belanghebbenden) moet(en) betrokken zijn bij biodiversiteit op meerdere gebouwen?
        iv. Met wie moet deze partij of partijen samenwerken om biodiversiteit op meerdere gebouwen te verhogen?

Appendix II: Informed consent form

U wordt uitgenodigd om deel te nemen aan een onderzoek genaamd Biodiversiteit in gebiedsontwikkeling: vanuit het perspectief van de projectontwikkelaar. Dit onderzoek wordt uitgevoerd door Ravelijn van Laar van de TU Delft en projectontwikkelaar VORM voor de masterthesis van de master Management in the Built Environment aan de Faculteit Bouwkunde.

Het onderzoek focust zich op de invloed van samenwerking tussen belanghebbenden op de implementatie van biodiversiteit op meerdere kavels. Dit interview heeft als doel om inzicht en kennis te verwerven over relevante belanghebbenden tijdens de implementatie van biodiversiteit in gebiedsontwikkelingsprojecten. Dit interview zal ongeveer 60 minuten in beslag nemen. De data zullen alleen gebruikt worden voor dit onderzoek. De resultaten van het onderzoek zullen gepubliceerd worden. Antwoorden van de interviews zullen anoniem gebruikt worden in de publicatie. U wordt gevraagd om antwoord te geven op vragen over uw ervaring met biodiversiteit.

Zoals bij elke online activiteit is het risico van een databreuk aanwezig. Ik doe mijn best om uw antwoorden vertrouwelijk te houden. Ik minimaliseer de risico's door persoonlijke data te archiveren na het onderzoek, de verzamelde data veilig te bewaren op een met wachtwoord-beschermde computer en de antwoorden te anonimiseren tijdens het transcriberen.

Uw deelname aan dit onderzoek is volledig vrijwillig, en u kunt zich elk moment terugtrekken zonder reden op te geven. U bent vrij om vragen niet te beantwoorden. De data zullen nadat het onderzoek is afgerond verwijderd worden.

Mocht u later nog vragen hebben, kunt u contact opnemen met:
Ravelijn Yvette Sophie van Laar
0683324207
ravelijnvanlaar@gmail.com
R.Y.S.vanlaar@student.tudelft.nl

Dit onderzoek wordt begeleid door Paul Chan.
P.W.C.Chan@tudelft.nl

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. Ik heb de informatie over het onderzoek gedateerd 06-07-2023 gelezen en begrepen, of deze is aan mij voorgelezen. Ik heb de mogelijkheid gehad om vragen te stellen over het onderzoek en mijn vragen zijn naar tevredenheid beantwoord.	☐	☐
2. Ik doe vrijwillig mee aan dit onderzoek, en ik begrijp dat ik kan weigeren vragen te beantwoorden en mij op elk moment kan terugtrekken uit de studie, zonder een reden op te hoeven geven.	☐	☐
3. Ik begrijp dat mijn deelname aan het onderzoek de volgende punten betekent: • Het interview zal worden opgenomen. Alleen de audio zal worden gebruikt. • De antwoorden van het interview zullen worden geanalyseerd in Atlas-TI. • De opnames van het interview zullen na afronding van het onderzoek worden verwijderd.	☐	☐
4. Ik begrijp dat de studie op 1 februari 2024 eindigt.	☐	☐
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
5. Ik begrijp dat mijn deelname betekent dat er persoonlijke identificeerbare informatie en onderzoeksdata worden verzameld, met het risico dat ik hieruit geïdentificeerd kan worden.	☐	☐
6. Ik begrijp dat de volgende stappen worden ondernomen om het risico van een databreuk te minimaliseren, en dat mijn identiteit op de volgende manieren wordt beschermd in het geval van een databreuk: • De data wordt bewaard op een met wachtwoord beschermde computer. • De data wordt gedurende het onderzoek opgeslagen op een aparte schijf. • De data wordt geanonimiseerd, de persoonlijke gegevens zoals uw naam worden verwijderd. • De audio opname van het interview zal niet worden gepubliceerd en verwijderd worden na afronding van het onderzoek.	☐	☐
7. Ik begrijp dat de persoonlijke informatie die over mij verzameld wordt en mij kan identificeren, zoals mijn naam, niet gedeeld worden buiten het studieteam.	☐	☐
8. Ik begrijp dat de persoonlijke data die over mij verzameld wordt, vernietigd wordt op 1 februari 2024.	☐	☐
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
9. Ik begrijp dat na het onderzoek de geanonimiseerde informatie gebruikt zal worden voor de publicatie van de masterscriptie op de website van de TU Delft.	☐	☐
10. Ik geef toestemming om mijn antwoorden, ideeën of andere bijdrages anoniem te quoten in resulterende producten.	☐	☐
D: (LONGTERM) DATA STORAGE, ACCESS, AND REUSE		
11. Ik geef toestemming om de geanonimiseerde data (de antwoorden van het interview) die over mij verzameld worden gearchiveerd worden in de database van de TU Delft opdat deze gebruikt kunnen worden voor toekomstig onderzoek en onderwijs.	☐	☐

Signatures

_____ _____ _____

Naam deelnemer Handtekening Datum

Ik, **de wettelijke vertegenwoordiger**, verklaar dat de informatie en het instemmingsformulier aan de potentiële deelnemer correct zijn voorgelezen, en dat hij/zij de kans heeft gekregen om vragen te stellen. Ik verklaar dat de potentiële deelnemer zijn/haar instemming vrijwillig heeft gegeven.

_____ _____ _____

Naam wettelijke vertegenwoordiger Handtekening Datum

Ik, **de onderzoeker**, verklaar dat ik de informatie en het instemmingsformulier correct aan de potentiële deelnemer heb voorgelezen en, naar het beste van mijn vermogen, heb verzekerd dat de deelnemer begrijpt waar hij/zij vrijwillig mee instemt.

Ravelijn van Laar  12-09-2023

Naam onderzoeker Handtekening Datum

Contactgegevens van de onderzoeker voor verdere informatie:

Naam: Ravelijn van Laar

Emailadres: R.Y.S.vanlaar@student.tudelft.nl

Appendix III: Expert interviews results

Theme	1st order construct	Data item	Specifications from answers
what	biodiversity	Definition of biodiversity	Het gaat over het leven, al het leven, dus de diversiteit in soorten, maar ook diversiteit in genen, dus de genetische biodiversiteit.
			Organismen en de samenhang van de organismen en de relatie met een bepaalde plek. De organismen sluiten samen kringlopen.
			Het is een totaalsysteem waar wij als mens een onderdeel van uitmaken.
			Biodiversiteit is de variatie tussen verschillende soorten, planten, dieren, schimmels, maar ook binnen een bepaalde soort, zodat je ook weerbaar bent bij veranderingen.
			Het integrale geheel van biodiversiteit betekent dat bij elk planten-ecosysteem een dierlijk ecosysteem hoort.
			Een ecosysteem heeft een bepaalde balans. Het systeem zal altijd weer proberen in balans terug te komen. Dat heen en weer gaan leidt tot onevenwichtigheden.
			De interactie tussen flora en fauna met de omgeving.
		Definition of nature-inclusivity	Je betrekt de gebouwen in de omgeving zodanig dat je maximaal natuur en biodiversiteit faciliteert.
			Natuur-inclusiviteit betekent dat je in het hele proces met de natuur en biodiversiteit rekening houdt, al vanaf het allereerste begin.
			Het gaat over de biologische diversiteit zoveel mogelijk proberen na te streven en daarin de conditie te scheppen om die zoveel mogelijk te voldoen aan die diversiteit om het systeem op orde te brengen.
		Biodiversity in cities	Biodiversiteit boven de grond is net zo belangrijk als dat onder de grond is.
			Zoveel soorten als dat je in de stad vindt, zoveel vind je in het buitengebied niet. Je mag blij zijn als je dat in een natuurterrein bij elkaar telt. Het aantal soorten in de stad wordt onderschat.
			Soms worden gebouwen spontaan bewoond door soorten waarvan je het eigenlijk niet of nog niet verwacht had.
			Randen van gebieden zijn het meest biodivers. Daar waar licht en donker elkaar ontmoeten, nat en droog, dat zijn de plekken met de meeste biodiversiteit. Hoe meer randen je kunt creëren, hoe meer je doet voor de biodiversiteit, maar dat geldt niet voor alles.
		Measure biodiversity	Je moet een systematiek bedenken die voldoende beeld geeft van de biodiversiteit, of waarvan je weet dat als bepaalde elementen aanwezig zijn en een bepaalde structuur of kenmerken hebben, dat daar dan ook meer soorten op afkomen. Of je moet een groep kiezen die een goede referentie geeft voor de biodiversiteit.
who	stakeholder engagement	Biodiversity demand from...	Projectontwikkelaars
			Gemeente
			Woningbouwvereniging/woningcorporatie
why	barriers and considerations	WHAT Design elements & principles	Netheidssyndroom. Er wordt ontworpen vanuit het idee, dat staat mooi en netjes of dat ruikt lekker, in plaats vanuit een biodiversiteitsgedachte.
			Vaak worden de verkeerde boom- of plantsoorten geplant, of op de verkeerde plek.
			Bodembiodiversiteit wordt vaak vergeten, omdat die niet heel erg tastbaar is.
			Groene elementen zo planten dat ze elkaar niet in de weg zitten.
			Er wordt vaak niet op eindgrootte ontworpen.
			Architecten vinden vaak dat biodiversiteit ten koste gaat van esthetiek.
		WHAT Maintenance	Vaak wordt er te veel onderhoud gepleegd, wat biodiversiteit juist tegenhoudt.
			Vaak wordt het beheer na een jaar aan een andere partij overgedragen, die het niet op de juiste manier onderhoudt.
		WHEN Phasing & process	Biodiversiteit wordt gezien als sluitpost.
			De juiste kennis vanuit ecologen wordt te laat betrokken.
			Als het te laat wordt opgepakt, zal de uitwerking niet optimaal gaan renderen en echt gaan werken.
			Als het te laat wordt opgepakt, zorgt dat uiteindelijk voor meer kosten.
			Te laat een focus op biodiversiteit leggen zorgt uiteindelijk voor vertraging.
		WHO Stakeholder engagement	Er ontbreekt kennis over biodiversiteit bij de mensen die het stedenbouwkundig ontwerp maken en bij projectontwikkelaars.
			De verschillende betrokken partijen focussen zich vaak alleen op hun eigen belang en eigen bijdrage.
			Landschapsarchitect heeft vaak niet genoeg kennis over natuur, ecologie, biodiversiteit. Bewustwording dat het een specifieke expertise is die bij hen vaak beperkt aanwezig is.
		WHY Biodiversity importance	Biodiversiteit wordt niet als iets belangrijks gezien, soms zelfs als obstakel.
		WHY Regulations and legislation	Er ontbreekt sturing en randvoorwaarden vanuit beleid over biodiversiteit.
		WHY Biodiversity demands & ambitions	Biodiversiteit wordt vaak niet aangepakt samen met andere opgaves, zoals de klimaatopgave, de energieopgave en gezondheid.
			Biodiversiteit wordt vaak gezien als een afvinklijstje, zonder dat er gekeken wordt naar het effect wat wordt bereikt.
			Vaak zijn er hoge ambities aan de voorkant, die vervolgens verloren raken in het proces.
			Projectontwikkelaars zien hun eigen project als iets wat niet heel veel verschil zal maken.
		WHY Budget	Biodiversiteit/groen wordt gezien als iets duurs, als een kostenpost en niet als iets wat geld oplevert.
			Projectontwikkelaars focussen zich vaak alleen maar op winstmaximalisatie en verkiezen daardoor vaak meer huizen boven groen.
			De partij die betaalt is vaak niet de partij voor wie het kwalitatief wat oplevert.
		WHERE One-site context	Partijen kijken alleen naar hun eigen business case, hun eigen kavel, waardoor er geen optimalisatie voor de natuur wordt gevormd. Zo ontstaat een postzegel-effect.
			Vaak wordt er geen verbinding met de omgeving gemaakt, waardoor de natuur of biodiversiteit niet goed werkt.
			Er wordt vaak alleen gekeken naar biodiversiteit op kavelniveau of gebouwniveau.
			Eén biodiversiteitselement zoals een groen dak of groene gevel wordt gezien als duurzaam en een biodiversiteitsverbetering.
			Als je kijkt op een lager niveau, kijk dan bij elk biodiversiteitselement zoals groene gevel of groen dak, welke soorten je kan gebruiken en aantrekken.
		WHERE Plot conditions	Bij inbreiden en renoveren zijn veel beperkingen op biodiversiteit.
		HOW Stakeholder collaboration	Iedere projectontwikkelaar gaat op zijn eigen manier biodiversiteit aan.
			De verschillende betrokken partijen hebben vaak geen gezamenlijke ambitie.

Table A.III. 1. Current situation (source: author).

Theme	1st order construct	Data item	Specifications from answers
what	design elements and principles	Biodiversity elements to incorporate in a project	Groene gevel
			Struiken
			Groen dak
			(Nest)kasten
			Bloemrijk grasland
			Natuurdak
			Wadi's: functioneren beter met een grote variatie van verschillende wortelstelsels, penwortels.
			Sloten
			Sedumdak
			Waterdak
			Faunapassage
			Polderdak
			Biodiversiteitsdak
			Ecosysteem dak
			Blauwgroendak
			Kooiconstructies gevuld met restmateriaal en nestgelegenheid.
			Takkenril
		Green roof characteristics and advantages	Combinatie groen en zonnepanelen zorgt voor veiligere zonnepanelen, vliegen minder in de fik. Zonnecollectoren op pergola met daaronder kruidenrijke vegetaties werken beter door verkoeling. Vegetaties doen het beter door de pergola.
			Met de juiste voorwaarden en het juiste materiaal is het mogelijk om het bodemleven op een groen dak terug te brengen. Dikte en materiaal spelen een grote rol. In een dun matje is het lastiger om in te overleven.
			Gaan langer mee dan een normaal dak.
			Slimme daken zijn gekoppeld aan de weersverwachting. Vangen water op voor grijswatercircuit, binnen/buiten-beplanting.
		Green façade characteristics	Verschillende soorten planten te kiezen, verschillende invloed op biodiversiteit.
			Grondgebonden gevels zijn beter voor waterafvoer en doorworteling in de grond.
		Principles to incorporate in a project	Weten welke soorten je wil aantrekken of specifieke soorten aantrekken. Ontwerp met de gedachte, wat hebben planten en dieren nodig en hoe verplaatsen ze zich. Het gaat om het scheppen van de juiste condities dat de soort die je wil aantrekken ook komt. En hoe soorten met elkaar samenhangen.
			Stapel zoveel mogelijk verschillende functies.
			Zoveel mogelijk inheemse beplanting laten groeien.
			Zorg dat je meerdere biotopen in een gebied hebt.
			Streef naar de 3, 30, 300 regel.
			Uitzicht op groen.
			Maak vanuit een groene façade een verbinding met de grond voor hogere biodiversiteit.
			Bij het planten van bomen op daken, gebruik meerstammige bomen met een dieper zwaartepunt in de kluit, deze vangen minder wind. Kluiten worden voorgekweekt zodat ze sterk geworteld zijn, minder grond op het dak nodig hebben en minder draagkracht.
			Ontwerp met waardplanten en gidssoorten.
			Positioneren op zon oriëntatie.
			Droogte-resistente beplanting laten groeien.
			Beter streven naar iets ambitieus dan laag inzetten.
			Bij een soort vegetatie hoort een soort substraat.
			Ontwerp de tuinen bij de huizen, zodat in het ontwerp al veel groen aangebracht wordt.
			Neem de natuurlijke dynamiek mee in de ontwerpen.
			Ontwerp met het doel om een kringloop te laten ontstaan.
		Insects, animals and plants to attract in an area	Vogels
			Vlinders
			Insecten
			Bijen
			(Huis)mus
			(Gier)zwaluw
			Vleermuizen
			Egels
			Gebouw-bewonende soorten
			(Slecht)valk
			Spreeuw
			Hommels
			Wormpjes
			Schimmels/paddenstoelen
			Grondgebonden soorten
			Roodstaart
	maintenance	Maintenance principles	Het is belangrijk hoe gebouwen gebruikt worden op de lange termijn voor de verhoging van biodiversiteit.
			Projectontwikkelaars moeten het beheer na oplevering 5 tot 10 jaar zelf doen.
			Duidelijke communicatie met beheerders over het beeld en het uitleggen van de bewustgemaakte keuzes.
			Als vergroening eerder en op de juiste plek worden geplant, is het makkelijker om het te beheren.
			Urban rewilding: een bepaalde uitgangspositie aanbrengen en vervolgens de natuur en de natuurlijke processen zijn gang laten gaan en alleen ingrijpen als het echt nodig is, alleen bepaalde ingrepen doen om die bepaalde kwaliteit voor de biodiversiteit en de natuur in stand te houden. Minimaliseer beheer.
			Minder beheer is beter voor de biodiversiteit. Er is over het algemeen ook minder beheer nodig dan momenteel ingezet wordt. Ontwerp iets robuusts.
		Biodiversity elements with little maintenance	Bloemrijk of kruidenrijk grasland.
			Takkenril
when	phasing and process	Focus on biodiversity during process	Vanaf de initiatieffase, voordat de eerste tekeningen gemaakt worden.
			Tijdens stedenbouwkundig ontwerp/plan.
			Tijdens de visievorming.
			Gedurende het gehele proces in de loop van het project.
			In het schetsontwerp.
			Bij het doen van een gebiedsanalyse.
			(Als het eigen grond is) vanaf de grondexploitatie.
		Phasing and process principles	Als vanaf het begin biodiversiteit wordt meegenomen in het ontwerp, is het makkelijker om aan normen en regels te voldoen.
			Gebruik het gebiedslabel als afwegingskader gedurende het proces, van initiatief tot realisatie en beheer, en check constant of je alle thema's hebt ingevuld.

who	stakeholder engagement	Responsible stakeholder	Gemeente (vanuit beleid en organisatie)
			Projectontwikkelaar
			Rijksoverheid
			Eigenaar van het gebouw/de kavel
			Architect
			Waterschap
			Initiatiefnemer
			Woningbouwvereniging/woningcorporatie
			Bouwer/uitvoerder
		Stakeholders to engage in biodiversity implementation	(Stads)ecoloog/adviseur
			Bewoners (afhankelijk van motivatie)
			Landschapsarchitect
			Beheerders
			Hovenier/groen professional
			Kennisinstituten en verenigingen: WUR, Vogelbescherming, IVN, Vlinderstichting, Zoogdiervereniging, Reptielen- en amfibieën Vereniging.
			Stedenbouwkundige
			Bodemkundige
			Architect
			Gezondheidssector: grote impact van groen op gezondheid, veel budget bij gezondheidssector. Link dit aan elkaar.
		Roles and tasks	Rijksoverheid: voorbeeldfunctie
			Gemeente: voorwaarden scheppen bij eerste plannen. Standaardkader opstellen.
			Op bewonersavonden voorbeelden laten zien, bewoners meer voorlichting geven over groen.
			Gemeente: intern meer samenwerken.
			Vanaf het begin de beheerders betrekken, een strategische beheerder input laten geven aan de voorkant, voorkomen dat hij zich niet erkend voelt.
			Zorg dat de verschillende partijen die in verschillende fases betrokken zijn, qua biodiversiteit een gezamenlijke visie hebben.
			Betrek de ecoloog bij de financiële doorrekening van het plan.
why	biodiversity demands & ambitions	Ambition to adhere to in a project	Het gebouw is onderdeel van de hele gebiedsopgave, inclusief biodiversiteitsopgave, klimaatopgave, energieopgave en gezondheid. Stel een overkoepelend biodiversiteitsplan op (op gebiedsniveau) waarbij alle onderdelen van het ecosysteem zijn bedacht.
			Stel een norm op om de basiskwaliteit van de biodiversiteit op orde te hebben.
			Stel aan het begin op dat x procent van een gebied efficiënt moet worden ingericht voor biodiversiteit.
			Urban rewilding: een bepaalde uitgangspositie aanbrengen en vervolgens de natuur en de natuurlijke processen zijn gang laten gaan en alleen ingrijpen als het echt nodig is, alleen bepaalde ingrepen doen om die bepaalde kwaliteit voor de biodiversiteit en de natuur in stand te houden.
			Gebruik lokale kennis van een plek om te kijken wat daar ingepast kan worden.
			Natuur-inclusiviteit moet een belangrijk onderdeel zijn in het Programma van Eisen.
			Beschouw alle groene onderdelen als waardevolle elementen.
			Zorg dat de biodiversiteit na afloop hoger is dan ervoor.
			Streef naar Gebiedslabel A.
			Ontwerp altijd met verdichten en vergroenen in balans.
where	scale	At what scale level we should implement biodiversity	'Grote schaal'
			Gebiedsschaal
			Provinciaal niveau
			Stadsschaal
	multi-site context	Principles of a larger scale	Kijk naar de omgeving van het gebouw en de verbinding tussen gebouw en omgeving. Waar kun je de biodiversiteit vandaan halen om in het gebouw te verwerken? Kijk naar de aanwezige soorten, bodems en biotopen.
			Begin op een grote gebiedsschaal om de ecologische infrastructuur in te tekenen, kijk daarna naar waar je huizen wilt intekenen.
			Zorg dat het gebouw aansluit op het ecosysteem.
		Advantages of a larger scale	Biodiversiteit werkt beter als het een geheel vormt. Als er samenwerking is tussen openbare ruimte en kavels, zijn er veel meer mogelijkheden voor biodiversiteit.
	plot conditions	Principles in a project about plot conditions	Voordat je begint met de eerste tekeningen van het plan, moet je kijken naar de aanwezige natuur en biodiversiteit, inclusief bodemleven, biotopen, zon-oriëntatie, wind, schaduw, temperatuur, luchtvochtigheid.
			Pas elk aanwezig natuurelement in in je stedenbouwkundige ontwerp. Behoudt het groen en de ecologie in het gebied zelf.
			Zet de juiste natuurelementen (zoals bomen) op de juiste plek, die in dat gebied al voorkomen en bij de bodem passen. Wat wil je op die plek bereiken en welke onderdelen van het ecosysteem horen daarbij?
			Stel je keuzecriteria in op de kavelomstandigheden, bijvoorbeeld met een quickscan flora en fauna.
			Ontwerp met gidssoorten/indicatorsoorten/icoonsoorten. Je kiest een soort die garant staat voor een bepaalde kwaliteit van je leefomgeving die je nastreeft. Kenmerkende soorten naar gelang het landschap.
			Er is veel ruimte op groen op plekken waar je het niet verwacht. Eerst kijken waar groen kan en is, dan verder kijken.
			Laat de bomen in je gebied staan.
	green-blue infrastructure	Principles in a project about plot conditions	Er zijn soorten die niet in de hoofdgroenstructuur kunnen leven en wel in het bebouwde deel van de stad.
			Er moet 37.000 hectare bos bij in NL, en een miljoen woningen. Ontwikkel een woonwijk in combinatie met een bos.

how	stakeholder collaboration	Collaboration between stakeholders	Een stad zonder stadsecoloog moet terecht kunnen bij een stad in de buurt met een stadsecoloog.
			Bouwers en projectontwikkelaars moeten een ecoloog in dienst nemen.
	plot collaboration	Plot collaboration principles	Als elke kavel een postzegel is, werkt de biodiversiteit niet optimaal. Zorg dat de kavel onderdeel is van een corridor. Niet ieder gebouw hoeft begroeid te zijn, als het maar een totaalbeeld vormt.
			Als je voorzieningen toevoegt, moet je ook je groen daarop aanpassen.
			Als je een bepaalde voorziening wilt toevoegen, maar die kan niet terecht in jouw kavel, kijk dan of die net buiten je plangebied kan.
			Bouw een woonecosysteem met samenwerking tussen de verschillende groen- en natuurelementen.
	future vision changes	WHAT Design elements & principles	Stuur op het bereiken van een bepaald effect, met een bepaalde doelstelling.
			Maak niet zomaar alles groen, het juiste groen moet op de juiste plaats. Rekening houden met schaduwen van andere gebouwen en wind.
			Biodiversiteit moet niet gemeten worden als absolute getallen, omdat de natuur constant verandert.
			Ontwerp met een soort rommeligheid, laat de beplanting wat meer zijn gang gaan. Dat is beter voor biodiversiteit.
			Reken voor bomen 1 m3 ondergrondse ruimte per levensjaar. Hou hier rekening mee in het ontwerp.
			Maak nettere vegetaties. Ontwerp biodiversiteitselementen vanuit design. Dan wordt het eerder door mensen geaccepteerd.
			Plant kruidenrijke vegetaties, geen vaste planten maar: kruiden, struiken, struwelen, individuele bomen en boomgroepen.
		WHAT Maintenance	Maak langdurige afspraken van 10 of zelfs 20 jaar over het groen onderhoud.
			Minimaliseer beheer en focus op groen wat zichzelf kan onderhouden.
			Gebruik de juiste (maai)machine voor het juiste grasland.
		WHEN Phasing & process	Zet in het begin van het proces al goed de hoofdlijnen neer met wat er belangrijk is vanuit de ecologie. Ga zo vroeg mogelijk in gesprek met een ecoloog. Bekijk biodiversiteit vanuit het systeem, het watersysteem, hittestress systeem. Daarna kijken naar de habitats. Daarna kijken naar de soorten.
			Doe aan het begin van het project een analyse van de aanwezige soorten, bodems en biotopen.
			Denk tijdens het ontwerpen al na over onderhoud.
			Alle partijen die betrokken zijn bij het project moeten vanaf het begin aan tafel zitten en hun onderzoek en adviezen uitbrengen en van gedachten wisselen over hoe dingen goed op elkaar afgestemd kunnen worden. Alles is met elkaar verbonden en moet gelijktijdig opgaan. Stel een gezamenlijke ambitie op. Inclusief ecoloog, beheerders, mensen van kabels en leidingen, bouwer, opdrachtgever, opdrachtnemer, architect, projectontwikkelaar.
			Vanaf het begin kijken naar de gidssoorten/indicatorsoorten/icoonsoorten in de omgeving.
			Stel van tevoren het budget voor beheer vast.
			Neem biodiversiteitsmaatregelen vroeg mee in de verwachte opbrengsten.
		WHO Stakeholder engagement	Ecologen moeten vanaf het begin betrokken worden bij een project.
			Er moet meer communicatie en voorlichting plaatsvinden met bewoners over het groen en de biodiversiteit.
		WHY Biodiversity demands & ambitions	We moeten biodiversiteit integraler in onze projecten verwerken en meer linken aan andere thema's zoals energie, klimaat en gezondheid.
			We moeten natuur-inclusiviteit zien als norm.
		WHERE Plot conditions	Voordat je aan een project begint, moet je onderzoeken hoe het gebied of de kavel kan aansluiten op de ecologische hoofdstructuur, om daar corridors naar toe te maken.
		HOW Stakeholder collaboration	Samenwerking tussen partijen is nodig om een totaalbeeld voor biodiversiteit te maken.
			Stel aan het begin samen met alle betrokken partijen een gezamenlijke ambitie op voor biodiversiteit.
			Stel een multidisciplinair bouwteam op met verschillende experts, zoveel mogelijk partijen met kennis van natuur en milieu.

Table A.III. 2. Desired future situation (source: author).

Theme	1st order construct	Data item	Specifications from answers
why	biodiversity importance	Reason for biodiversity implementation	Voor de gezondheid en welzijn van de mens.
			Voor klimaat, klimaatbeheersing en klimaatadaptatie.
			De wereld willen verbeteren, investeren in de toekomst.
			Om een prettige leefomgeving te creëren, inclusief minder criminaliteit.
			Groene elementen zijn een nut, een middel, een kans en een verplichting.
			Waterretentie en waterberging.
			Om de kwaliteit van de huizen en de omgeving te verhogen.
			Beleving van groen voor bewoners en passanten.
			Voor koeling van het binnen- en buitenklimaat.
			Voor integraliteit met andere duurzame thema's, zoals energie.
			Om ontmoetingsplekken te creëren en bij te dragen aan de sociale cohesie.
			Om de prijsvraag/tender te winnen.
			Als bijdrage tegen geluidshinder.
			Tegen hittestress.
			Luchtkwaliteit verbetering.
			Fijnstof afvangst.
	regulations and legislation	Directives and norms containing biodiversity	Natuurregels in Bouwbesluit, o.a. over dierverblijven.
			Regel van Konijnendijk, 3-30-300 regel. Uitzicht op 3 bomen, 30% van de wijk valt in de schaduw van een boom, vanuit elke woning op 300 meter afstand een park.
			Omgevingswet
			Puntensysteem
			Bestemmingsplan
			CSRD-richtlijn verplicht bedrijven om te rapporteren over hun impact op mens en milieu.
			Natuurbeschermingswet
	budget	Financial considerations	Als biodiversiteitsimplementaties tijdig worden meegenomen kan dat schelen in kosten. Het kan een investering zijn in het begin, maar is op de lange termijn goedkoper, door o.a. minder beheerkosten.
			Je moet biodiversiteitsimplementaties zien als baten, niet als kosten. De baten van groen en biodiversiteit zijn op de lange termijn.
			Door biodiversiteitsimplementaties kan het zijn dat er minder huizen gebouwd kunnen worden, maar de kwaliteit van de huizen en de omgeving wordt wel erg verhoogd door de natuur meer naar binnen te halen, waardoor de opbrengst toch hoger kan zijn.
			Biodiversiteitsimplementaties zijn in vergelijking met een geheel programma helemaal niet duur.
			Als je biodiversiteitselementen slim en efficiënt inricht, hoeft het niet meer te kosten.
			Verwerk biodiversiteitsimplementatie in de GREX, grond-exploitatiekosten.
			Onderhoudskosten gaan omhoog door meer biodiversiteitsmaatregelen.
			Onderhoudskosten gaan omlaag door meer biodiversiteitsmaatregelen.
			Een groendak is financieel voordelig, doordat het langer meegaat.
			De gezondheidssector moet aanhaken bij de financiering van het groen. Groen en biodiversiteit hebben veel impact op klimaat en gezondheid en in de gezondheidssector zit een groot budget.
where	public-private partnerships	Acquisition type	De biodiversiteitsambities en -mogelijkheden hangen heel erg af van de soort aankoop, de relatie tussen de publieke en private partijen en wie de eigenaar van de kavel is.
			Inbreiden (renoveren) of uitbreiden. Bij inbreiden/renoveren zijn meer beperkingen en mogelijkheden.

Table A.III. 3. Time independent variables (source: author).

Appendix IV: Workshop presentation

Introductie

Problemen

- Gebouwen als op zichzelf staande projecten
- Biodiversiteit als bijzaak of laatste toevoeging
- Biodiversiteitsimplementatie is complex
- Relatief weinig wet- en regelgeving
- Moeite met beleid omzetten in concrete acties en regelgeving
- Onduidelijke verantwoordelijkheden, rollen en risico's van belanghebbenden

Kaders

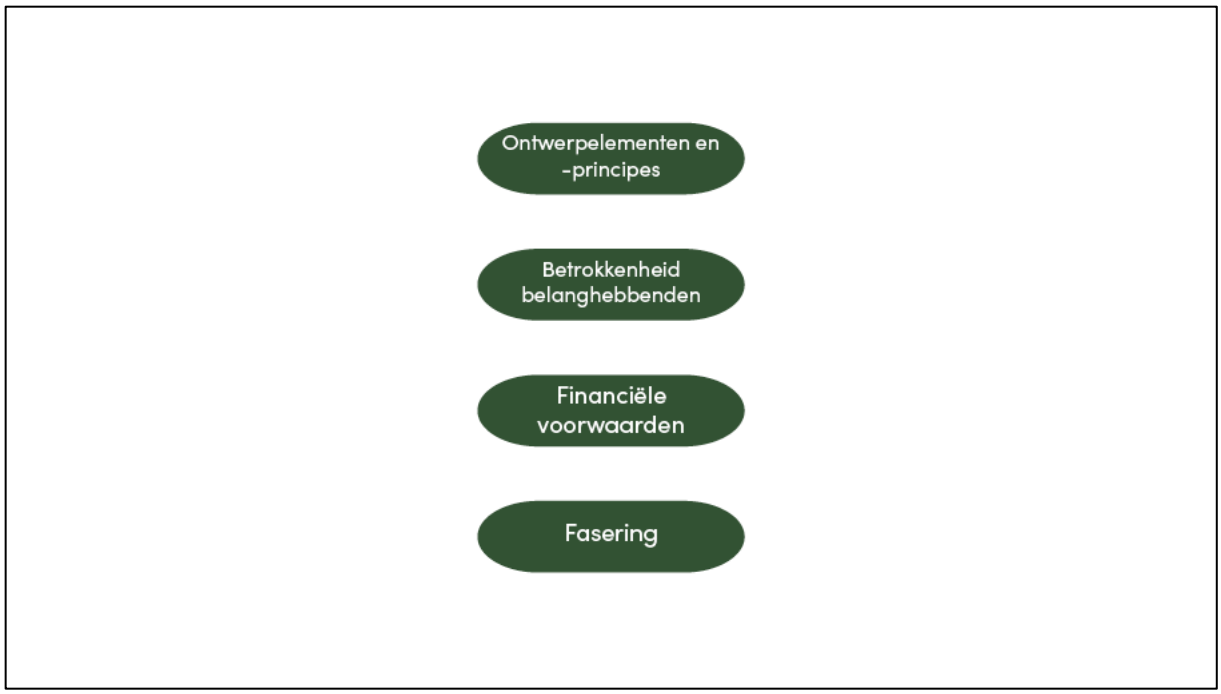
- Gebiedsontwikkeling
- Integraal versus individueel
- 2 concepten

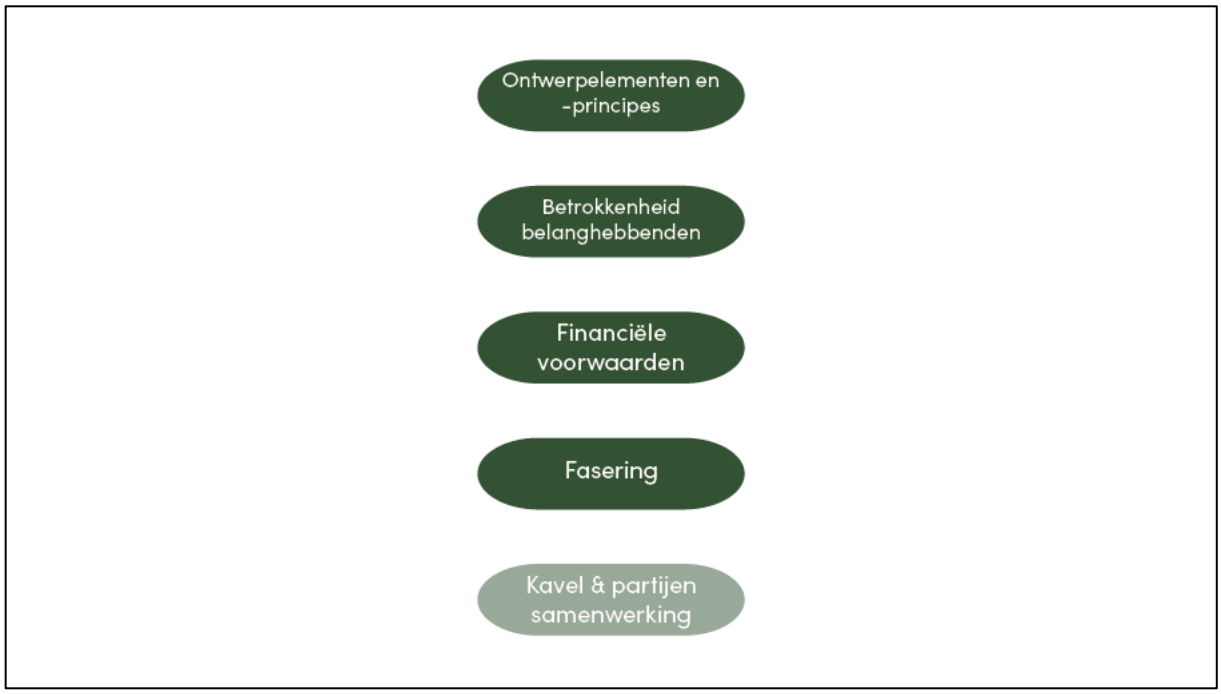
Hoofddoel

Het ontwikkelen van een toolbox waarmee project ontwikkelaars biodiversiteit kunnen implementeren binnen nieuwbouwprojecten in stedelijke gebieden, door middel van samenwerking tussen verschillende belanghebbenden en over verschillende kavels.

Onderzoeksvraag

Hoe kunnen projectontwikkelaars met anderen samenwerken om de biodiversiteit over meerdere gebouwen in een gebied te verbeteren?


Ontwerpelementen en -principes
Betrokkenheid belanghebbenden
Financiële voorwaarden
Fasering


Ontwerpelementen en -principes
Betrokkenheid belanghebbenden
Financiële voorwaarden
Fasering
Kavel & partijen samenwerking

Verloop workshop

Situatieschets

Uitleg proces

1. WIE
- Uitspraken experts
- Consequenties op proces

2. WAAROM
- Uitspraken experts
- Consequenties op proces

3. WANNEER
- Uitspraken experts
- Consequenties op proces

4. HOE
- Stelling en invulling

Situatieschets

- Binnenstedelijke gebiedsontwikkeling
- Grond is van projectontwikkelaar: projectontwikkelaar A heeft 1 kavel en omliggende kavels worden ontwikkeld door andere projectontwikkelaars.
- Gemeente heeft faciliterende rol
- De gemeente heeft biodiversiteitsambities en wil deze verwerken in een anterieure overeenkomst.
- Bestemmingsplan is verouderd, er is nog geen anterieure overeenkomst.
- Mixed-use gebouwen
- Projectontwikkelaar A is verantwoordelijk voor het aannemen van architect, onderaannemers en nutspartijen.

Gebiedsontwikkeling proces

	Initiatief en verkenning	Planvorming en haalbaarheid			Ontwikkeling en realisatie	Exploitatie en beheer
		Definitie	Ontwerp	Voorbereiding		
Gemeente						
Project ontwikkelaar						
Landschapsarchitect						
Ecoloog						
Duurzaamheids-adviseur						
Groen beheerder						

WIE

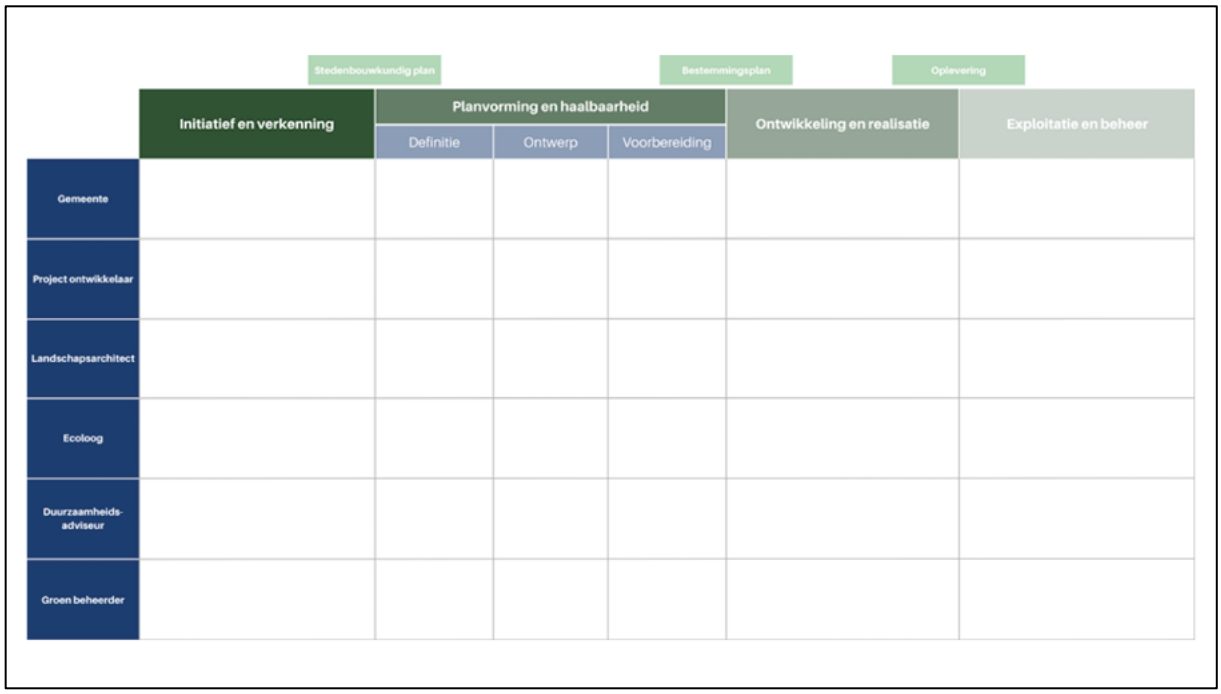
Barrière

- De verschillende belanghebbenden focussen zich vaak alleen op hun eigen belangen, bijdragen en kavel(s).

Aanbeveling

- Ecologen moeten vanaf het begin van een project betrokken worden.

Consequenties op proces



WAAROM

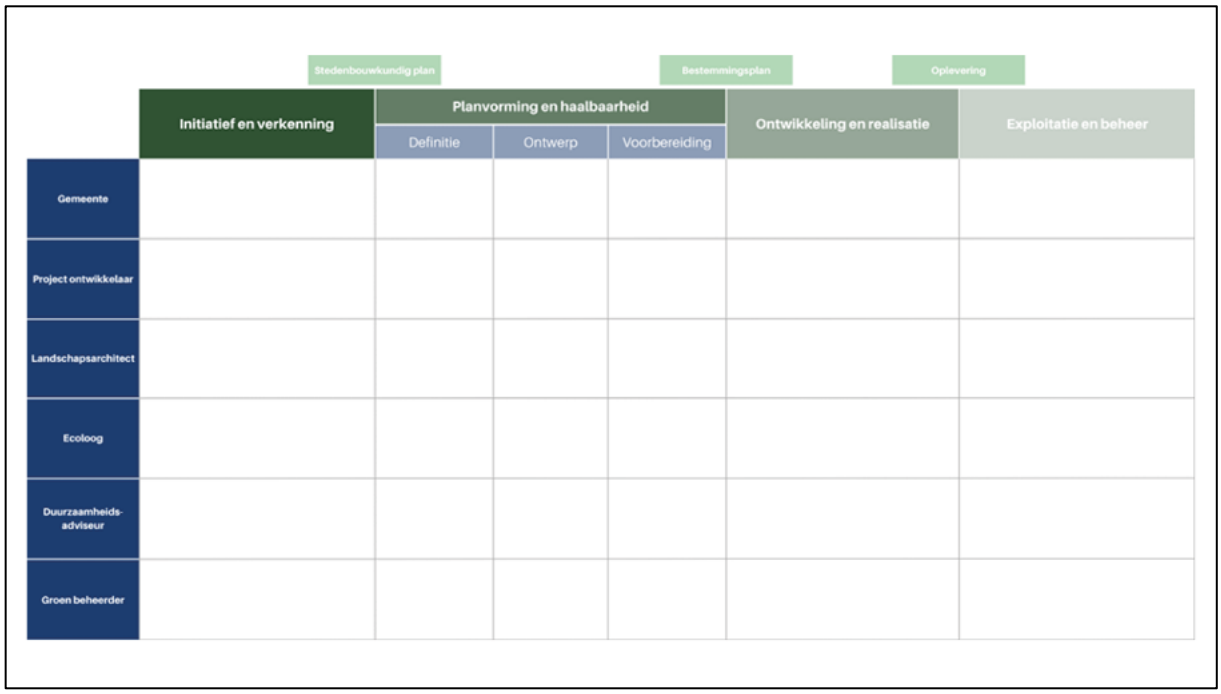
Barrières

- Biodiversiteit wordt vaak gezien als iets onbelangrijks op een afvinklijstje, zonder dat er gekeken wordt naar het effect wat wordt bereikt.
- Projectontwikkelaars focussen zich vaak alleen maar op winstmaximalisatie en verkiezen daardoor vaak meer huizen boven groen.

Aanbeveling

- Biodiversiteit moet worden gezien als iets wat geld oplevert in plaats van als kostenpost en moet dus meegenomen worden in de verwachte opbrengsten.

Consequenties op proces



WANNEER

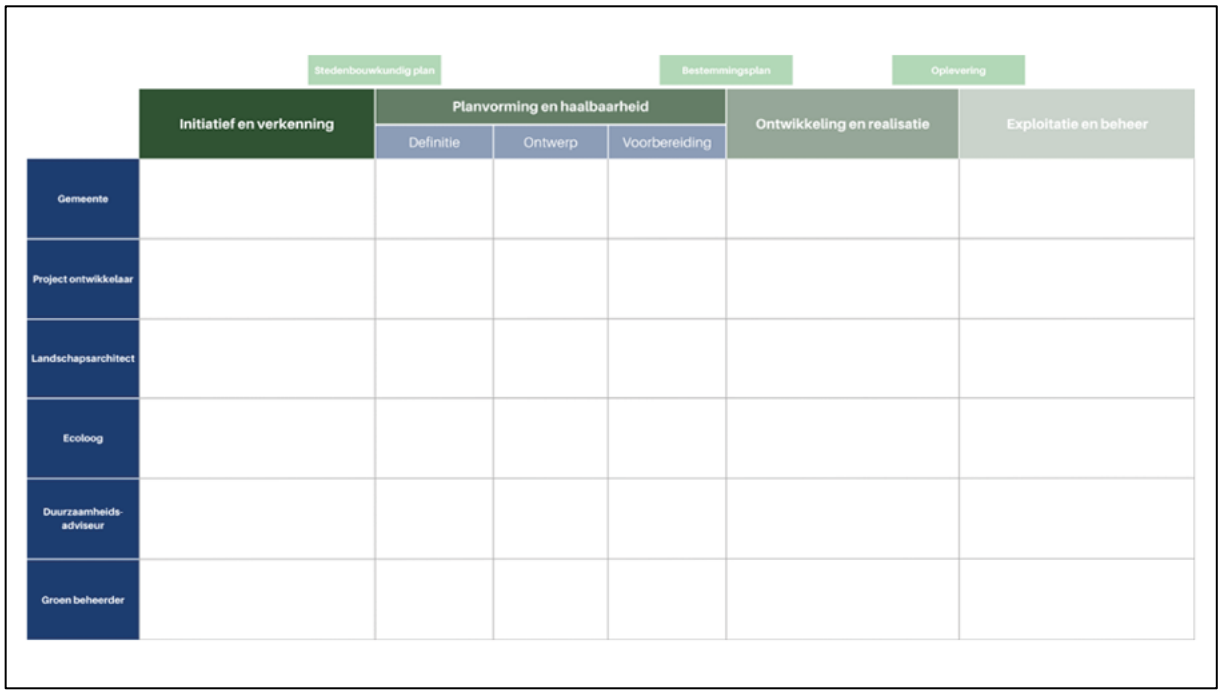
Barrière

- Te laat een focus op biodiversiteit leggen kan zorgen voor meer kosten, vertraging en ineffectief resultaat.

Aanbevelingen

- Doe aan het begin van het project een analyse van de aanwezige soorten, bodems en biotopen, om een verbinding met de omgeving te kunnen maken.
- Denk tijdens het ontwerpen al na over onderhoud.

Consequenties op proces



HOE

Stelling:

Alle betrokken partijen moeten bij het begin van een project een gezamenlijke ambitie over biodiversiteit opstellen.

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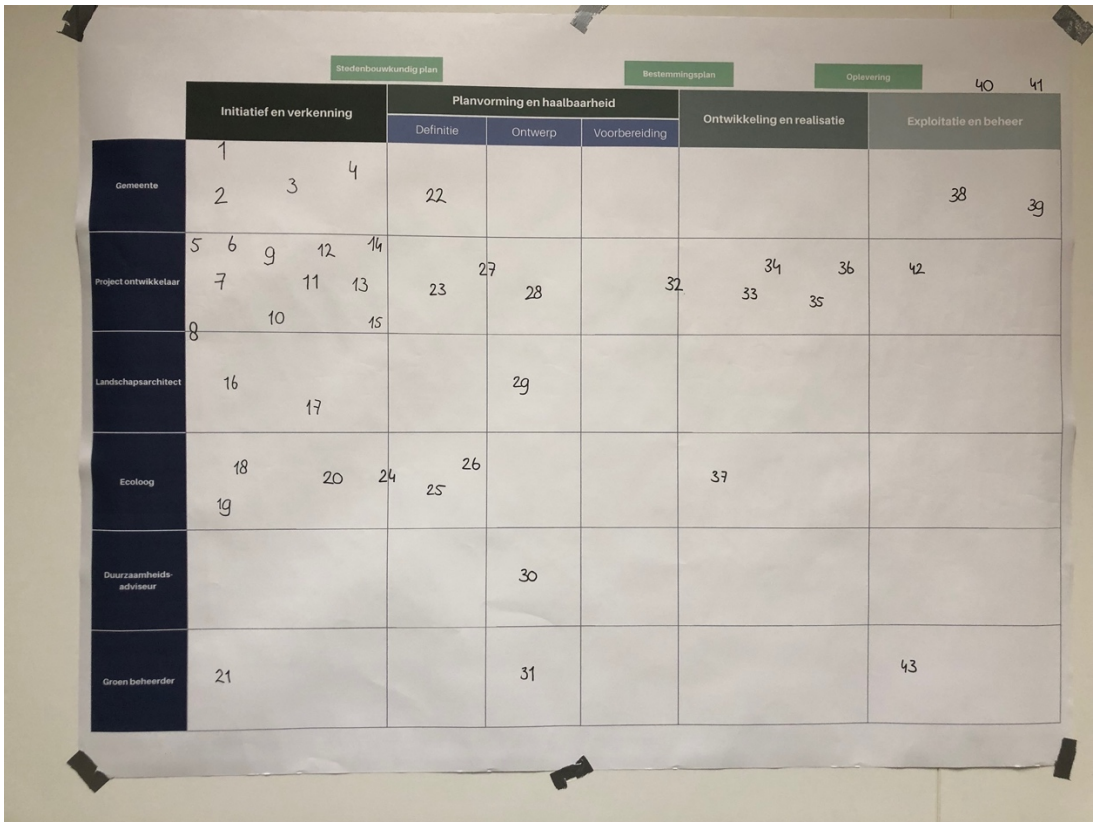
Conclusies
Hoe kunnen we handvatten geven voor biodiversiteitsverbetering in gebiedsontwikkeling?

Appendix V: Workshop poster and notes



Number	Note
1	Harde KPI vanuit locale overheid (sturingsmechanisme)
2	Beleid definiëren dus effecten van biodiversiteit vastleggen
3	Ecologische visiekaart/ ambitieboek
4	Beleid gemeente + organisatie = key
5	Vroeg beginnen en vasthouden
6	Stel zelf en biodiversiteitsambitie op met verschillende niveaus: 1) basis; 2) beter; 3) excellent
7	Duurzaamheidsambitie omarmen en uitvoeren
8	Schakel een 'ontwerpend ecoloog' in (daar zijn er niet zoveel van)
9	Stel ambitious intern beleid op m.b.t. biodiversiteit
10	Tool (NL Gebieds/Terreinlabel) inzetten
11	Projectontwikkelaar ≠ gebiedsontwikkelaar; integrator van belangen
12	Baathouders van groen betrekken als partner
13	Gezamenlijk draagvlak vanuit verschillende actoren (ontwikkelaar, ontwerpteam, directie, gemeente) op concept, wat leidt tot biodiversiteitsuitgangspunten
14	Neem in de business case de maatschappelijke baten mee en leg de rekening bij gemeentes, verzekering, etc.
15	Management buy-in
16	Ruimtelijke claim van ecologie bepalen
17	Schakel ecologische kennis in
18	Ecologische kansen aangeven
19	Ecologisch kader vaststellen
20	Ecologische context definiëren
21	Beheer input vastleggen = kosten beheersen
22	Groennorm definiëren (m^2 per inwoner) o.i.d.
23	Blijf uit de financiële baten zolang je kan, biodiversiteit is de basis van ons bestaan
24	Kansenkaart in bredere context (verticaal + horizontaal)
25	Ecologische visie op ontwikkeling vaststellen
26	QS omgeving
27	Ruimteclaim vasthouden en meervoudig inzetten biodiversiteit/klimaat-adaptatie/spelen etc.
28	Ruimteclaim groen op maaiveld bewaken
29	Ontwerp + beheer altijd integreren
30	€ in aanleg zijn 'beperkt' t.o.v. total, baten hoog
31	Gemeente-groenbeheer ontwerp laten toetsen
32	Toets de plannen op de gestelde ambities bij overdracht van fases
33	Voorkom bezuiniging op biodiversiteit door middel van toetsing en betrokkenheid op lange termijn
34	Blijf de landschapper betrekken tot het eind: aanleg en monitoring
35	Projectmonitoring ook op KPI's duurzaamheid
36	Biodiversiteit kwantificeerbaar maken (instrument)
37	Ontwerpend ecoloog
38	Ontwikkel een database met (de effecten van) ecologische gebiedsontwikkelingen
39	Monitoring achteraf op effectiviteit maatregelen
40	Overtuigen noodzaak biodiversiteit (niet alleen terug te brengen tot €€)
41	Educatie & voorlichting > iedereen
42	Monitor de eco-effecten op lange termijn en vergelijk die met andere projecten
43	Onderhoud hoeft zeker niet meer te kosten