Nature-Based Solutions as an Alternative Planning Option in Urban Areas

CURRENT ROLE AND FUTURE POSSIBILITIES IN THE CITY OF AMERSFOORT (NL)

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PREFACE

By completing this thesis, my time as a student comes to an end. My study years have not been as smooth as I imagined when I was younger. During the bachelor, I almost lost the connection with the field and the interest to follow through with my studies. For some time, it felt like I was stuck. Fortunately, I found the motivation to break down this mental barrier of indecisiveness and insecurity. I had a lot of catching up to do, but I eventually completed my bachelor's. After the bachelor I decided to have a fresh start at Utrecht University, by participating in the Spatial Planning Master's programme. This turned out to be a good decision. The study program, enabled me to develop myself as a planner and inspired me to find my personal interests within the field.

Writing a master's thesis was not an easy task. Finding an interesting topic and turning it into a viable research is often harder than it seems at first sight. The main problem for me is that there are too many research directions which I find interesting. Unfortunately, you cannot study all, so I had to make choices. Nonetheless, I was able to combine many interesting topics into my final thesis, which I am very glad about. In regard to the journey of finding the right topic, I need to thank my supervisor Jochen Monstadt for guiding me through the process. I would also like to express my gratitude towards Jochen for his time and devotion, that despite of his busy schedule remained undiminished. Finally, I would like to thank all interviewees for their indispensable contribution to this thesis and the overall fun and interesting conversations we had.

I sincerely hope this report will be an interesting read, regardless of whether you are a planner, policy-maker, researcher, student or have any other background. I also hope that it reflects some of my interests within the field of spatial planning. For me personally, this thesis is however not only the embodiment of the things I have learned about spatial planning, but also to a large extent a reflection of the life experience that came with it.

ABSTRACT

Recently, the concept of nature-based solutions (NBS) has been introduced as an innovative way to utilize ecosystem processes to contribute to climate change adaptation and mitigation, biodiversity or sustainable development in general. This thesis explores and explains the manifestation of NBS in urban planning policy and practice, in search for ways to more effectively promote the concept at an urban scale. The relevant institutional - and policy frameworks and key stakeholders that shape the implementation of NBS have been investigated through a qualitative case-study in the context of the city of Amersfoort, the Netherlands. Through a combination of a literature review and interviews with relevant actors, the concept was investigated in three exemplary projects as well as their urban, national and European contexts. NBS projects are often organized on the dividing line between the social system and the ecosystem and therefore concerns both urban and environmental governance. The novelty of the concept and the corresponding uncertainty and complexity of the object, process and context of NBS planning, are structural problems that lead to policies on different scale-levels, that lack substance and require non or merely voluntary action. As a result, these policies leave much room for interpretation as well as the responsibilities to act at the local scale-level. The implementation of NBS is partly done in a semi-experimental manner, where different types of solutions are being explored and shaped mostly by actors that believe they can contribute to a more sustainable future, be it socially, economically or environmentally. Different strategies can be applied in order to implement NBS-related concepts, but this depends on who are involved, what role they play and in what context they operate. In general, approaches that enable non-hierarchical collaboration between actors from different sectors and that facilitate experimentation and innovation seem to be most desirable for the development of urban NBS in a sustainable way. A structural challenge in the organization and governance of NBS however seems to be the ability to work in an integral manner, which impedes the further development of the concept. Even though the development of NBS depends on many factors, it can partly be steered and more effectively promoted to become a viable planning option for sustainable development.

Keywords: nature-based solutions, ecosystem services, urban green infrastructure, sustainable development, urban and environmental governance

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1 INTRODUCTION

In the following chapter, the topic of this thesis is introduced. Firstly, the background and problem statement are discussed in section 1.1. Secondly, the research objectives and questions are stated in section 1.2. Thirdly, the empirical case is shortly introduced in section 1.3, followed by an overview of the structure of this thesis in section 1.4.

1.1 BACKGROUND AND PROBLEM STATEMENT

Many cities struggle with complex urban issues, such as water management, food security, resource depletion, energy security and public health (Faivre et al, 2017). Policy-makers and urban planners traditionally turn to enhancements of the so-called 'grey infrastructure' to address these urban issues (Davies & Lafortezza, 2019). Grey infrastructures are *'manmade improvements that support and improve human settlement such as roads, power lines, water systems, schools and hospitals'* (EEA, 2011:16). These infrastructures usually involve 'hard' poorly permeable surfaces (e.g. concrete, stone, asphalt), which often comprise a substantial part of cities' surfaces (Gartland, 2012; Matthews, Lo & Byrne, 2015). Solutions regarding grey infrastructure are often sufficient to solve a particular problem, however they might ignore the (long-term) environmental, social and economic impact they could induce. The importance of this impact has nonetheless become more notable, mainly because of the prominence of two environmental processes: climate change and urbanization. Climate change is likely to, for example aggravate the urban heat island effect and increase flood events in many cities (Field et al, 2012; Lo, 2013; Matthews, Lo & Byrne, 2015). Urbanization could lead to an increase of hard poorly permeable surfaces, which in turn could further amplify the impacts caused by increases in the frequency and intensity of climate extremes (Field et al, 2012; Gartland, 2012; Matthews, Lo & Byrne, 2015). Combined, the processes of urbanization and climate change are likely to pose new challenges for policy-makers and urban planners in addressing urban issues (Green et al, 2016).

Both in research and policy, many directions towards a more sustainable urban development are being explored. The use of natural components and their alleged multifunctionality is an example of such a direction, which has been increasingly studied and promoted to address urban challenges (European Commission, 2015). This ecologically-oriented approach towards urban development is based on the potential of nature in providing ecosystem services (ESS) such as food, water, carbon sequestration, urban cooling, and recreation in providing benefits to urban populations. The delivery of ESS highly depends on the way ecosystems are spatially structured (Alberti, 2005; Kaczorowska et al, 2016). This spatial structure is partly represented in the concept of urban green infrastructure (UGI), which is shaped by landscape architecture and spatial planning (Pauleit et al, 2017). The concept focusses on strategically planned green spaces, such as parks, gardens, waterbodies and other green structures (Connop et al, 2016) with respect to their corresponding ecosystem services at multiple scales (Benedict & McMahon, 2012; Pauleit et al, 2017). UGI incorporates natural components as a means to ease the impact of urban stresses such as urban heat, floods and pollution. Especially when looking at the prospects of climate change and urbanization, these kinds of properties are highly desirable (Davies & Lafortezza, 2019).

Even though the appreciation of ecologically-oriented concepts such as ESS and UGI has grown, their use in practice is not self-evident. For ESS the focus of research has mainly been on describing ecosystems and their services to human life, often ignoring the importance of decision-making, policy implementation and governance (Primmer, 2015). The concept of UGI is also believed to lack the focus and immediacy that policy-makers and urban planners desire when addressing urban issues (Davies &

Lafortezza, 2019). In more general terms, the mainstreaming of climate adaptation in policy and practice has proven to be a complicated issue (Uittenbroek, 2016). This is especially the case when climate adaptation and objectives of different policy departments (e.g. spatial planning, water management and public health) need to be linked, after which they need to be translated into practice. Even when there is consensus and support on a certain policy implementation, the reallocation of resources and the reorganization of practices is often difficult (Uittenbroek et al, 2014).

Recently, the term nature-based solutions (NBS) has been introduced as a way to make natural ecosystems an integral part of sustainable development. As the name suggests, NBS aims to address a certain problem by looking at solutions that are in some way inspired, copied or supported by nature (van den Bosch & Sang, 2017). NBS can also be seen as an 'umbrella' concept, overarching ecologically-oriented approaches to sustainable urban development such as ESS and UGI (EC, 2015). This relatively 'new' concept has strong ties with these earlier concepts, however focuses more on finding 'real-world' solutions while acquiring co-benefits for the environmental, economic and social realm. In this way, the concept of NBS distinguishes itself as a more integrated and practice-oriented approach in contrast to ESS and UGI. This perspective is believed to be a strength, as it could sometimes be a more effective and cost-efficient development approach than traditional approaches (Lafortezza et al, 2018). Conceptually speaking, NBS might have the potential to compete with, replace or merge with existing grey infrastructures. A challenge however lies in the actual transition from 'grey' to 'green' problem-solving (Davies & Lafortezza, 2019).

In order to promote this transition many studies have been conducted, focusing on the value of (re) introducing 'biodiversity', 'ecosystems', 'green infrastructure', or 'nature-based solutions' into the urban realm. Knowledge on actual transitions and how to initiate and consolidate sustainable transitions is, however, limited. Even though NBS seem to hold potential in propelling this transition, there are still uncertainties surrounding the concept. Creating knowledge on the way NBS are defined and used in practice could be a useful step to deal with uncertainties. Furthermore, understanding of how NBS are socially-produced within urban communities and how actors associate with the enabling and restricting factors for the uptake, scaling or mainstreaming of NBS, could be helpful in closing this knowledge gap.

1.2 Research objectives and questions

The main challenge that will be addressed in this research is the challenge of local actors (e.g. planners, policy-makers, developers) to apply a comprehensive ecologically-oriented approach that strategically enhances ecosystem services (e.g. by planning a city-wide green infrastructural system), through local interventions that promote nature-based solutions (e.g. green roofs or pocket parks). It is likely that the 'real world' would benefit from the integration of grey and green infrastructure (Maes et al, 2015), in a way that nature-based solutions work in combination with existing approaches (Davies & Lafortezza, 2019). The main goal in overcoming this challenge is that nature-based solutions are seen as 'one of the options' for planners, policy-makers and other actors to choose from, so they could compete with, replace or merge with existing approaches (Potschin-Young et al, 2018). There are however many barriers that could prevent the implementation and up-scaling of nature-based solutions, which complicates this mainstreaming (Connop et al, 2016).

The research objective is to explore and explain how nature-based solutions are addressed in urban planning policy and practice and how they could be more effectively promoted at an urban scale. More specifically, the sub-goals of this research are:

1. To describe and explore the emergence, use and promotion of NBS and to explain NBS through the institutional - and policy frameworks and key stakeholders that shape their implementation.
2. To explain the enabling and restricting factors underlying the development of NBS.
3. To analyze the urban governance of NBS and to inform governance approaches to effectively promote NBS in a sustainable way.

The research objective could be translated into the following main research questions:

How are nature-based solutions addressed in urban planning policy and practice and how could they be more effectively promoted at an urban scale?

Empirically, this research will focus on the city of Amersfoort in the Netherlands. To approach the main research question, the following sub-questions could be asked as intermediate steps:

i. To what extent and in what way is the concept of NBS being used and promoted in planning policy and practice in Europe, the Netherlands and Amersfoort?
ii. What enabling and restricting factors to the implementation of NBS could be identified and how do they shape the development and integration of the NBS concept into policy and practice in Amersfoort?
iii. What institutions and actors are relevant to the implementation of NBS and what governance approaches would be beneficial for developing NBS in a sustainable way?

1.3 EMPIRICAL CASE

The city of Amersfoort (NL) has been the stage for the empirical part of this thesis. Within the city, three NBS-related projects were selected to be studied. The term 'NBS-related' is used because projects in Amersfoort were not clearly designated to specifically implement the NBS concept. In other (mostly bigger) European cities, projects could be found that were more clearly related to the NBS concept, for example because they are connected to a European research project. The city of Amersfoort however, is a middle-sized city that is not tied to such research projects and therefore offered a less studied area, yet to be explored. The three projects within the case of Amersfoort show different strategies in the way NBS-related content was brought forward. Studying these projects, could therefore help to understand how NBS-related concepts are manifested in the case of Amersfoort and how they could be promoted more effectively.

1.4 THESIS STRUCTURE

The thesis is structured as follows:

Chapter 1 Introduction: In this chapter the topic of the thesis is introduced, by discussing the topic's background and problem statement. Following from this, the research objectives and questions as well as the empirical case are discussed.

Chapter 2 Theoretical framework: In this chapter the main theoretical perspectives, that are needed to approach the research objectives and questions are discussed. Firstly, ecologically-oriented concepts relevant to NBS are being explored, explained and compared, after which an overview is given on the state of research and relevant knowledge gaps. Secondly, the governance of NBS is explored, including theories and concepts helpful for the empirical investigation of governance in NBS-related projects. Lastly, the enabling and restricting factors relevant to the implementation and promotion NBS are explored.

Chapter 3 Conceptual framework: In this chapter a conceptual model is constructed. This framework is based on the theories, concepts and frameworks explored in the theoretical framework and used to guide the empirical study. The framework is established by first explaining the analytical structure of the thesis, after which the conceptual approach for the investigation of NBS projects is explained in more detail. By combining the analytical structure and the conceptual approach, the conceptual model is established.

Chapter 4 Methodology: In this chapter the main methods for the empirical research are discussed. This chapter contains a discussion of the case-study research design and the methods for data collection and processing.

Chapter 5 Results: In this chapter the main findings are presented. These results are structured following the conceptual model.

Chapter 6 Discussion: In this chapter the results from the investigated projects are compared and critically reflected. Furthermore, the results are linked to earlier discussions on the use of NBS-related concepts on city, national and EU scale.

Chapter 7 Conclusion and Recommendations: In this chapter an approach is made to answer the research questions by utilizing the main findings. Subsequently, policy recommendations are presented for people dealing with NBS at different scale-levels. Finally, recommendations for further research are presented.

2 THEORETICAL FRAMEWORK

The following chapter contains a report of the theoretical explorations done as a basis for this thesis. This theoretical framework consists of 3 sections, each covering the theoretical underpinnings needed to approach the research objectives and questions. The different sections are however not isolated but meant to be viewed as interconnected pieces. The sections are rather building upon one another, cumulatively forming a whole.

Firstly (section 2.1), the relevant concepts of NBS are discussed in order to build familiarity with the concept and its origins. The section concludes with a discussion on the state of research and relevant knowledge gaps, which functions as a setup for the following section. This section corresponds mostly with research question [1] and objective [i]. The second section (section 2.2) discusses the theoretical underpinnings of the governance of NBS to address the challenge of 'operationalizing' the concept of NBS, as identified in the first section. This section corresponds mostly with research question 1 and 3 and objective [iii]. Lastly (section 2.3), the enabling and restricting factors for the 'operationalization' of NBS are discussed. Many of these factors (enabling as well as restricting) could be found within the dimensions and characteristics discussed in the second section, which emphasizes the connection between the sections. This section corresponds mostly with research question 2 and objective [ii].

2.1 CONCEPTS OF NBS

In this research project, most emphasis will be put on the following three 'green' concepts as part of the ecologically-oriented approach; ecosystem services (ESS), urban green infrastructure (UGI) and nature-based solutions (NBS). There are some other concepts connected to ecologically-oriented development and NBS, such as natural systems agriculture (Jackson, 2002), natural solutions (Dudley et al, 2010), ecosystem-based approach (Cowan et al, 2010), urban forestry (Salbitano et al, 2016) and ecological engineering (Borsje et al, 2011). In line with the goals of this research project and because of the available time and comprehensibility, the concepts used in this report are however limited to ESS, UGI and NBS. The concept of NBS, as discussed in chapter 1, could be seen as an 'umbrella concept' (EC, 2015) and therefore receives the most attention in this research project. However, because of the relative novelty of NBS, the term might be still unknown in practice or at least be less known than the concepts of ESS or UGI. When investigating the use of ecologically-oriented approaches, it is therefore important to take into account the other concepts, as they might be more established among local professionals, policy-makers, urban planners, landscape architects, academic scholars, etcetera. To understand the connection between societal actors and ecologically-oriented approaches, the city is viewed as a social ecological system. In this chapter, this overarching approach will be discussed (section 2.1.1). Further, the ecologically-oriented concepts (ESS, UGI and NBS) will be discussed separately (section 2.1.2 – 2.1.4) and in relation to each other and their context (section 2.1.5). This chapter aims to characterize each of these concepts, so that they could be better understood in terms of how they differ, overlap or complement each other. In addition, the current state of NBS research as well as the main knowledge gaps are discussed in section 2.1.6.

2.1.1 The city as social ecological system

The three concepts described in the previous section all have a different focus, they however also share many ideas. In order to make sense of how these concepts relate to each other and to understand their potential effect on a city, the city could be viewed as a social ecological system (SES). The concept of SES is characterized by relationships between people and nature on different scales, as shown in figure 1. The main proposition of the concept is that the social and ecological systems are

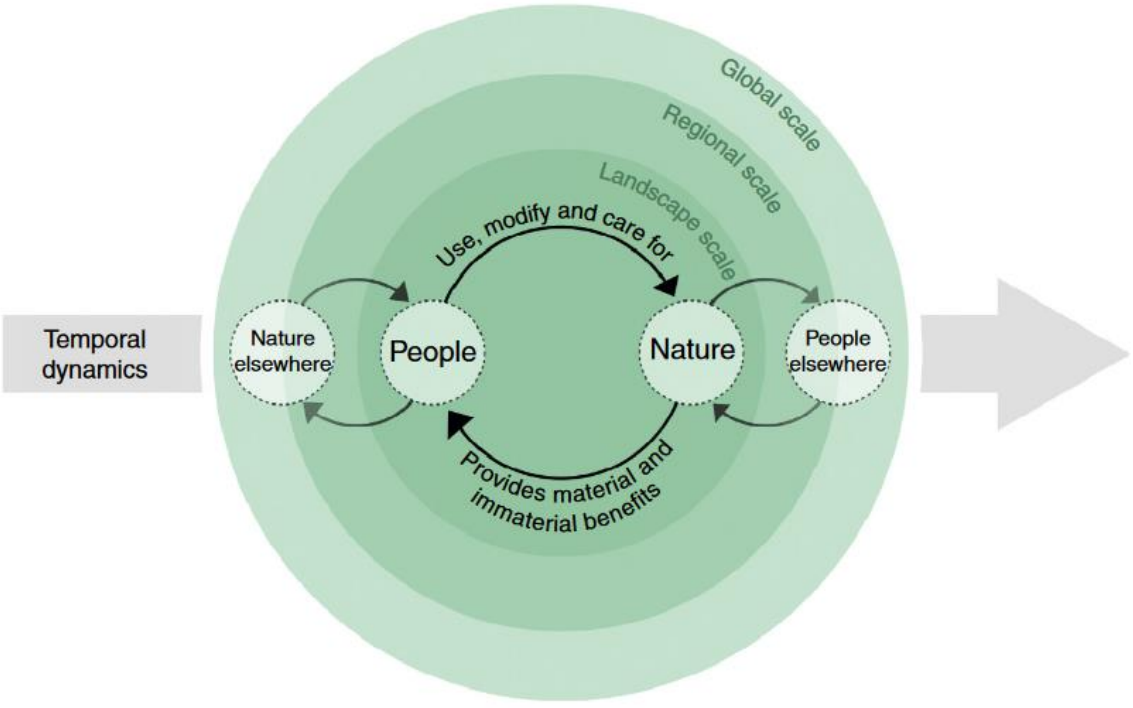


Figure 1 The concept of SES through different scales. Source: Fischer et al (2015)

interlinked and interdependent. This presumes that humans are part of ecosystems and partly shape them, while at the same time being dependent on the ecosystem's capacity to provide material and non-material services for the development of society (Fischer et al, 2015). Even though figure 1 shows interactions between global, regional and landscape scale, the spatial or functional limits of a SES could be demarcated by a specific ecosystem and problem context (Glaser et al, 2012). Different types of aspects become apparent, according to the scale that is zoomed-in to. In the case of this thesis, most focus is on the development of NBS on a city-scale. Therefore, without discarding the influence on – and of other scale-levels, this thesis views the city as a SES.

The main idea behind viewing the city as a SES is, that the influence of services provided by biophysical processes to society should not be seen as isolated and independent processes. The influence of these services is rather seen as being intertwined in social and political processes (Ernstson, 2013). Framing the city as such helps to understand the way that societies, their physical environment and policies are interconnected in a way that incorporates resilience and the development of sustainable approaches (Vandergert et al, 2016). This interconnectedness is at the basis of this research project, as the aim is to investigate how (new) ecologically-oriented policies influence the physical environment and therefore society and vice versa.

Figure 2 illustrates the interactions between the societal, social and environmental sub-systems that could be found within cities. The figure gives a simplified view of reality, as the social and environmental entities interact in numerous different ways and are constantly changing (Gallopin et al, 1997).

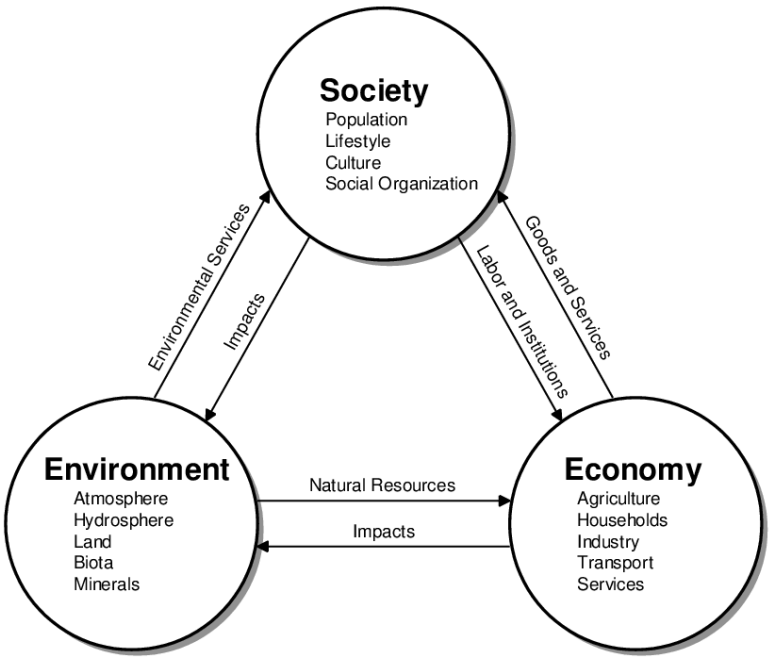


Figure 2 SES sub-systems and their interactions. Source: Raskin et al (1996)

2.1.2 Ecosystem services

Among other things, nature is essential for the production of clean water, food and fresh air. Natural components such as plants, trees and other vegetation can filter out air pollutants and reduce flood risk trough runoff retention and infiltration. Besides that, nature has notable influence on human life in the form of restoration, education, inspiration and creativity. This idea, that nature provides certain services to human life, is the basis of the ESS concept (Pauleit et al, 2017).

The concept originates from at least the 1970s, however it became more popular in the scientific community in the 1990s. The more widespread use of the concept was initiated by the Millennium Ecosystem Assessment (MEA) (De Groot et al, 2010). This resulted in attempts to put the concept in to practice, however not without much debate about how to define the distinction between ecosystem functions and ecosystem services and on how to classify and quantify ecosystems services. Assessing the value of nature for human life has proven to be complicated to express in conventional economic terms (Goméz-Baggethun et al, 2010, Lele et al, 2013). The systematic assessment of demand and supply of natural services as part of the concept of ESS, could be seen as an attempt to connect a societal value to ecosystems. Regarding this perspective, the following definition of ESS is most popular (Pauleit et al, 2017): "the functions and products of ecosystems that benefit humans, or yield welfare to society" (MEA, 2005). Ecosystem services can generally be distributed over four general categories, namely provisioning services, regulatory services, cultural services and supporting services (MEA, 2005). Table 1 describes what kind of ecosystem services belong to a certain category. This categorization has often been used in studies and it will also be used in this research project to make a general distinction between ecosystem services.

Table 1 General categories of ecosystem services

Provisioning Services
Goods, such as food or freshwater, that ecosystems provide and humans consume or use. In an urban context this may include, for instance, food production on urban and peri-urban farmland, on rooftops, in backyards and in community gardens.
Regulatory Services
Services, such as flood reduction and water purification that healthy natural systems, such as wetlands, can provide. In an urban context this may include reduction of temperature and air pollution by vegetation through shading, by absorption of heat through evapotranspiration, and by removing pollution through leaves.
Cultural Services
Intangible benefits, such as aesthetic enjoyment or contributing to identity of place that nature often provides. In urban areas recreation and aesthetics is probably the most significant service the natural environment serves to humans. This includes green infrastructure at large, including parks and other public as well as private green spaces.
Supporting Services
Basic processes and functions, such as soil formation and nutrient cycling, that are critical to the provision of the first three types of ecosystem services.

Source: Pauleit et al (2017); Based on MEA (2005), Barthel et al. (2010), Gómez-Baggethun and Barton (2013)

At the end of the 1990s, research on ESS started to find its way into the urban realm, resulting in a rise of publications about specific urban ecosystem services. From the growing knowledge on urban ecosystem services was concluded, that the concept of ESS could have a positive effect on cities' ecological footprint together with a range of social and environmental benefits (Goméz-Baggethun et al, 2013). Beyond social and environmental benefits, the concept of ESS could sometimes also be

attractive in economic sense according to for example Elmqvist et al, (2015). In their study, Elmqvist et al, (2015) found an average monetary value of ecosystem services between 3,212 and 17,772 US$ of benefits per ha and year (e.g. pollution and air quality regulation, energy savings/temperature regulation and recreation and other amenity services). This could, under the right conditions, be attractive in an economic sense.

Even though wide-ranging evidence of the benefits of urban ecosystems exists in the literature, the concept is not uncontroversial. In contrary to delivering services, ecosystems could also generate disservices. These negative effects could include the clogging of gutters by leaves, production of allergenic pollen or the spread of diseases via insects (Escobedo et al, 2011). Another disadvantage could be that enhancing a certain benefit of an ecosystem could lead to negative trade-offs for other aspects of the ecosystem. Enhancement of the recreational value of a park could for example lead to pressure in its biodiversity, due to disturbances generated by an increase in human activity in the park (Chace and Walsh, 2006).

One major pitfall of the concept of ESS is that it builds on conventional approaches to solving environmental problems instead of challenging or replacing them (Pauleit et al, 2017). Conventional planning strategies often do not recognize synergies between ecological and social processes but see them as separate, even though biodiversity and ESS in urban contexts are developed through complex interaction between ecological processes and societal activities ("city as social ecological system" see also section 1.1). Despite this, planning and management strategies do not often acknowledge their role in the development of biodiversity and ESS (Andersson et al, 2014). Accordingly, a lack of knowledge on the role of spatial planning, management and governance of ESS could be noticed. Instead, a lot of research has been focused on the one-way assessment of ESS delivery from nature to humans. Even though the assessment of ESS can be seen as an attempt to showcase the benefits that ecosystems could present to human life, it does not act as a tool to sustain these benefits in the long-term. A discrepancy could therefore be noticed between the study and communication of the values of ESS and the use of ESS in planning practice and management (Albert et al, 2014).

To conclude, ESS could, under certain ecological and social circumstances, harness the ability to provide goods and services to society (Andersson et al, 2014; Goméz-Baggethun et al, 2013; Pauleit et al,2017). The spatial structure among which the scale, form and function of ecosystems are however not always organized in a way that enables a desired outcome of services. This is especially the case in urban areas, which often have heterogeneous land-use pattern within a relatively small area. The blue and green areas containing ecosystems are often scattered around these small non-uniform patches of land. This could result in negative proximity effects as well as poorly spread regulating ESS across the city. Cities, on the other hand, also hold the potential for new spatial designs that integrate ESS in the urban environment, which could restore, strengthen or create new ecosystem functions. However, to exploit this potential, the local ecosystems scattered around the 'patchwork' of heterogeneous urban land-uses could be linked to a city-wide green infrastructural system. A mismatch between social and ecological boundaries could nevertheless be noticed, as the link between the local and regional scale is often insufficiently addressed. This might induce the need for governance models that help to establish the link between local experiences with ecosystem management and knowledge on a higher scale level (Andersson et al, 2014). Accordingly, the concept of UGI and NBS could help to find a more integrated way of incorporating ESS into urban development (Pauleit et al, 2017).

2.1.3 Urban green infrastructure

The concept of urban green infrastructure (UGI) is concerned with the interconnected networks of a variety of 'green' spaces, delivering several services within the urban context (Pauleit et al, 2017; Benedict & McMahon, 2002, 2006; Davies & Lafortezza, 2017). Others have used terms, like for instance 'green infrastructure' (e.g. Cohen-Shacham et al, 2016) or 'green and blue infrastructure' to describe strategically planned and managed, spatially interconnected network of multi-functional, land-based (green) or water-based (blue) landscape features that deliver a variety of ecosystem services (European Commission, 2013). The more general term 'green infrastructure', does not narrow itself down into an urban context and the term 'green and blue infrastructure' explicitly includes waterbodies or aquatic systems into the mix of infrastructures. Within this research project, emphasis will be put on green infrastructures within an urban context while including waterbodies into the mix of possible ecological infrastructures. However, for consistency reasons, the term 'urban green infrastructure' is used throughout this study.

UGI has its roots in the fields of landscape architecture and landscape ecology (Fletcher et al. 2014) and therefore seems to be more connected to urban planning than the other ecologically-oriented concepts (Pauleit et al, 2017). The concept of UGI has been applied practically in different cities around the world (Naumann et al, 2011; Davies et al, 2015). One of the reasons for this is the spatial layer and criteria that UGI components have. These components are often diverse and of a certain quality to contribute to an interconnected network existing at different spatial scales (EC, 2013). Table 2 shows the variety of these components and the variety of functions within the green infrastructural network.

Table 2 Components of UGI

Hubs: Core areas of high biodiversity value such as protected areas (e.g., Natura 2000 sites) and non-protected core areas with large healthy functioning ecosystems
Corridors and stepping stones: natural features like small watercourses, ponds, hedgerows, woodland strips
Restored habitats to reconnect or enhance existing natural areas (e.g., restored reedbed or wild flower meadow)
Artificial features such as eco-bridges, fish ladders or green roofs to enhance ecosystem services or assist wildlife movement
Buffer zones that improve the general ecological quality and permeability of the landscape to biodiversity (e.g., wildlife-friendly farming)
Multi-functional zones with compatible land uses that support multiple land uses in the same spatial area (e.g., food production and recreation)

Source: Pauleit et al (2017); Based on EC (2013)

Another reason why UGI fits spatial planning is because of several principles, which are applicable in urban planning context. Table 3 shows these approaches, both in regard to the green structure and governance processes.

Table 3 UGI principles applicable in planning

Approaches addressing the green structure
Integration: Green infrastructure planning considers urban green as a kind of infrastructure and seeks the integration and coordination of urban green with other urban infrastructures in terms of physical and functional relations (e.g., built-up structure, transport infrastructure, water management system).
Multi-functionality: Green infrastructure planning considers and seeks to combine ecological, social and economic/abiotic, biotic and cultural functions of green spaces.

Connectivity: Green infrastructure planning includes physical and functional connections between green spaces at different scales and from different perspectives.
Multi-scale approach: Green infrastructure planning can be used for initiatives at different scales, from individual parcels to community, regional and state. Green infrastructure should function at multiple scales in concert.
Multi-object approach: Green infrastructure planning includes all kinds of (urban) green and blue space; e.g., natural and semi-natural areas, water bodies, public and private green space like parks and gardens.
Approaches addressing governance processes
Strategic approach: Green infrastructure planning aims for long-term benefits but remains flexible for changes over time.
Social inclusion: Green infrastructure planning stands for communicative and socially-inclusive planning and management.
Transdisciplinary: Green infrastructure planning is based on knowledge from different disciplines such as landscape ecology, urban and regional planning, and landscape architecture and developed in partnership with different local authorities and stakeholders.

Source: Hansen and Pauleit et al (2014); based on Benedict and McMahon (2006), Kambites and Owen (2006) and Pauleit et al. (2011)

Especially, multifunctionality and connectivity are often seen as key principles (Hansen & Pauleit, 2014). An assumption of UGI is that it should be managed in a way that it could deliver multiple ecosystem services. The concept of ESS could therefore be seen as part of UGI as well as NBS. A difference however lies in the way that ecosystems are spatially designed and managed. ESS are often valued on their short-term economic and health benefits, whereas UGI and NBS focus on enhancing the cities' ability to respond to climate change and hazardous conditions by increasing their long-term resilience (Eggermont et al, 2015). By delivering multiple benefits derived from multiple ESS, UGI could help to get more out of nature in contrast to conventional mono-functionally designed 'grey' infrastructure (EC, 2013).

The difference between 'green' and 'grey' infrastructures is not demarcated by a 'hard' line but rather a spectrum ranging from natural towards constructed or man-made infrastructural assets with many hybrid forms (e.g. green roofs or green walls) in between. What could sometimes be unclear is to what extent an infrastructure should be considered as 'natural' in order to qualify it as a green infrastructure. Especially within densely built and highly populated urban environments it is often hard to qualify an infrastructure as exclusively 'natural', because there is often some sort of human intervention involved. However, what makes an infrastructure a 'green' infrastructure lies more in the way they employ ESS. The ability to deliver multiple benefits as well as their alleged multifunctionality, could make a certain 'green' infrastructure a viable development option in a certain planning context. There could however be other viable alternatives (grey, green or hybrid) to choose from. Therefore decision-makers could consider the value of the alleged multifunctionality of UGI and the trade-offs in regard to other alternatives.

To achieve multifunctionality it is often required to involve a group of different stakeholders both from the private and public sector (Naumann et al, 2011). Furthermore, the different departments within public and private sector need to work in a more collaborative manner to enable UGI to be performed in a structural and strategic way. Within the organization of many municipalities, those involved in 'grey' infrastructure are often part of a different department, then those working on 'green' infrastructure. Because of this, there is often a lack of policy integration between 'grey' and 'green' infrastructural options which could disable or prevent the operation of UGI (Davies & Lafortezza, 2017). A concept like NBS, might help to overcome these challenges.

2.1.4 Nature-based solutions

Within the discourse of ecologically-oriented approaches to development, the concept of nature-based solutions (NBS) is the most recent (Nesshöver et al, 2017). The World Bank (MacKinnon, Sobrevila & Hickey, 2008) and the International Union for Conservation of Nature (IUCN) (Cohen-Shacham et al, 2016) introduced the concept in the late 2000s to bring attention to the significance of the conservation of biodiversity in the mitigation and adaptation of climate change (Pauleit et al, 2017). The origin of the concept of NBS lies in climate change mitigation and adaptation, however the scope of the concept is much broader. This is for example noticeable in the number of societal challenges beyond climate change mitigation and adaptation that are potentially addressed with NBS. Table 4 shows a list of societal challenges, including challenges other than climate mitigation and adaptation.

Table 4 Urban challenges potentially addressed by NBS

Topics	Urban Challenges	Sub-challenges
Climate	Climate Issues	Climate mitigation; Climate adaption
	Water Management	Urban water management and quality; Flood management
Environment	Air quality	Air quality at district/city scale; Air quality locally
	Biodiversity and urban space	Biodiversity; Urban space development and regeneration
	Soil management	Soil management and quality
Resource	Resource Efficiency	Food, energy and water; Raw Material; Waste; Recycling
Social	Public Health and Well-being	Acoustics; Quality of Life; Health
	Environmental Justice and Social Cohesion	Environmental justice; Social cohesion
	Urban Planning and Governance	Urban planning and form; Governance in planning
	People Security	Control of crime; Control of extraordinary events
Economy	Green Economy	Circular economy; Bioeconomic activities; Direct economic value of NBS

Source: Nature4Cities (2018a)

Because of this, NBS is also referred to as an 'umbrella concept' which addresses a range of different environmental, social and economic policy aspects (Pauleit et al, 2017). The concept of NBS promotes a variety of different actions, scales and services. NBS could be a specifically engineered green roof to help with water management and heat stress, or it could be a change in the extensive maintenance of a park to enhance its existing ecosystems' biodiversity. Even though an NBS could be varying upon a broad spectrum of solutions, they are often distinguished from conventional engineering techniques (e.g. 'grey' infrastructure), because of their multifunctionality, use and conservation of natural capital, adaptability and resilience (Davies & Lafortezza, 2019; Eggermont et al, 2015; Maes & Jacobs, 2015). In terms of the creation and management of NBS this distinction could also be noticed, as NBS look for integrative governance arrangements instead of conventional government-led conservation (van Ham, 2014). The co-design, co-creation and co-management of NBS is supposed to bring a more participatory governance with the aim to meet the needs of a variety of stakeholders (EC, 2016).

The term ‘nature-based solutions’ suggests being about ‘solutions’ that are ‘based’ on ‘nature’. Compared to the terms ‘ecosystem services’ and ‘urban green infrastructure’, this term seems to be much more straightforward. This is however not necessarily the case because the concept behind the term might be as ambiguous as the previous concepts and therefore require some more explanation.

According to van den Bosch & Sang (2017), nature-based solutions are in some way inspired, copied or supported by nature. A more explicit definition is also given by the European Commission (EC), who defines NBS as “*actions which are inspired by, supported by or copied from nature. They have tremendous potential to be energy and resource-efficient. ...Many nature-based solutions result in co-benefits for health, the economy, society and the environment, and thus they can represent more efficient and cost-effective solutions than more traditional approaches*” (European Commission, 2015). Next to the EC’s definition, another prominent definition is proposed by the IUCN. They defined NBS as “*actions to protect, sustainably manage and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*” (Cohen-Shacham et al, 2016). Both definitions contain the assumption that NBS address societal challenges using ecosystem processes, while generating co-benefits for people and nature. The focus of the IUCN definition is however more on the protection, restoration and sustainable management of ecosystems, while the EC’s notion of NBS is broader because solutions that are only ‘inspired’ or ‘supported’ by nature are included in their definition (Cohen-Shacham et al, 2016). Furthermore, the European Commission also seems to pronounce more ambitious social and economic goals for NBS, such as the provision of business opportunities and supporting citizen well-being (European Commission, 2015).

Concluding from the two most prominently used definitions (definitions from EC and UICN) discussed in the previous paragraph, the question whether an action qualifies as NBS or not is still under debate. A solution based on biomimicry would, for example fit the ‘broader’ definition of the European Commission but would not qualify as NBS in the definition of IUCN. This discrepancy could be caused by unclarity on what is considered ‘nature’ or what is considered ‘natural’. The same conceptual vagueness could be found in the contrast between grey and green infrastructure, as discussed in section 2.1.3.

A lot of interventions may involve some sort of manipulation of ecosystem processes. The level of human intervention could vary between different NBS (Nesshöver et al, 2017). Eggermont et al (2015), created a typology for NBS based on the level and type of engineering that is applied as well as the number of stakeholders involved, which is represented schematically in figure 3.

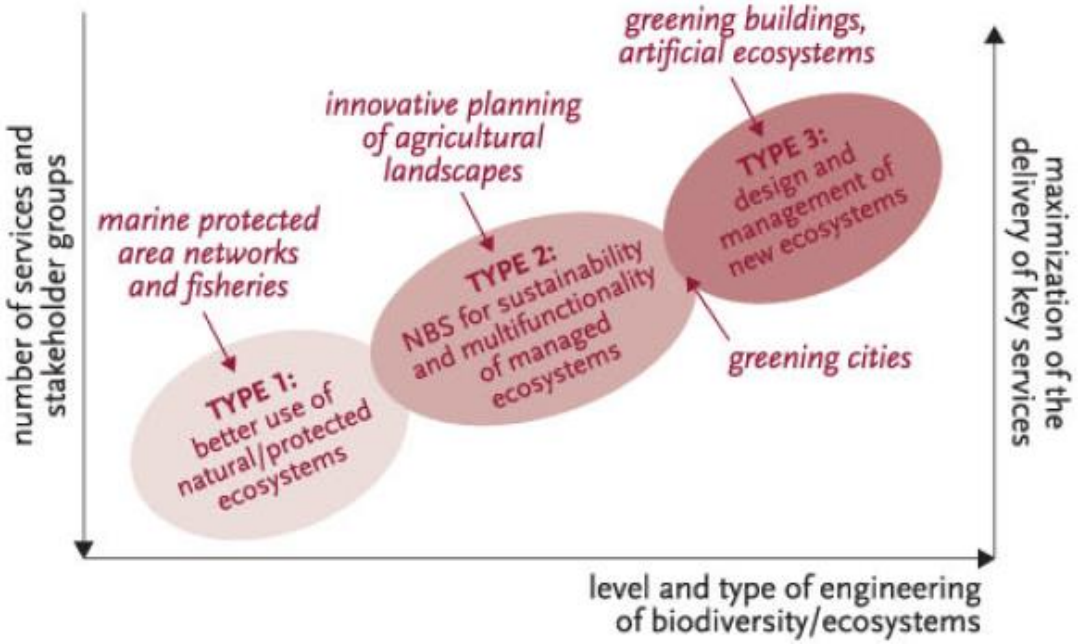


Figure 3 Typology of NBS. Source; Eggermont et al (2015)

Within this typology, NBS could be classified along a gradient were (Eggermont et al, 2015);

- Type 1 means an approach that involves no or minimal intervention to maintain or improve the delivery of ecosystem services. This type of NBS could for example be linked to the concept of biosphere reserves incorporating core protected areas for nature conservation and buffer zones.
- Type 2 means an approach that aims to establish sustainable and multifunctional ecosystems and landscapes. This type of NBS could be connected to concepts like natural systems agriculture, agro-ecology and evolutionary-orientated forest.
- Type 3 means an approach that intensively molt ecosystems or even create new ones. This type of NBS could be linked to for example green and blue infrastructure.

Type 1 fits entirely with the way that IUCN frames NBS, while type 2 and type 3 are often used as examples by the European Commission for turning natural capital into a source for green growth and sustainable development (Eggermont et al, 2015). Figure 3 also shows the term 'greening cities' positioned somewhere between type 2 and 3. From this could be taken that urban NBS are more probable to involve a higher level of engineering than NBS outside of cities. NBS that involve many stakeholders as well as a relatively high level of engineering might benefit from an open approach to NBS and a broad concept of 'nature', matching the European Commission's (EC, 2015) framing of NBS. However, this comes with the risk that the name NBS is being used for 'green' interventions, which do not fit the goals of NBS (e.g. reducing flood risk or decreasing heat island effects). Solutions such as green roofs and green walls could be helpful to mitigate the effects of climate change but need to be coordinated to have an actual effect on city-scale. Without a careful consideration of species and ecosystems these interventions could be counterproductive in the long-term, resulting in increased management costs and biological risks (Eggermont et al,2015). It is not necessarily problematic to have multiple ways of framing the NBS concept, however it might become so when a case does not explicitly explain its rationale behind the interpretations of NBS. Therefore, a specification on a case-by-case basis of what 'solutions' are needed to 'solve' a certain 'problem' could be helpful (Albert et al, 2019).

2.1.5 Ecological concepts in perspective

NBS make use of ESS to provide certain services to generate solutions to societal problems. Different types of ESS (see also table 1 in section 2.1.2) could be delivered through planned or unplanned interconnected UGI. NBS might help to contribute to the functioning of UGI to address certain societal problems, by creating new green spaces or by enhancing existing ecosystems. A component of the UGI such as a park, could therefore be a type of NBS provided that it is designed and managed in a way that it contributes to solving societal problems with the use of ESS in the long-term.

Figure 4 shows the way that ESS, UGI and NBS are embedded within a social ecological system, as well as some potential barriers to the implementation of these concepts. The framework shows that the overarching UGI consists of different components (e.g. waterbodies or parks), which could generate different ESS (e.g. provisioning or regulating services). With the help of these services, a solution to certain societal problem could be found, while at the same time carrying out multiple other functions. This process is however often complicated due to certain barriers (e.g. high costs, lack of understanding or restrictive policy).

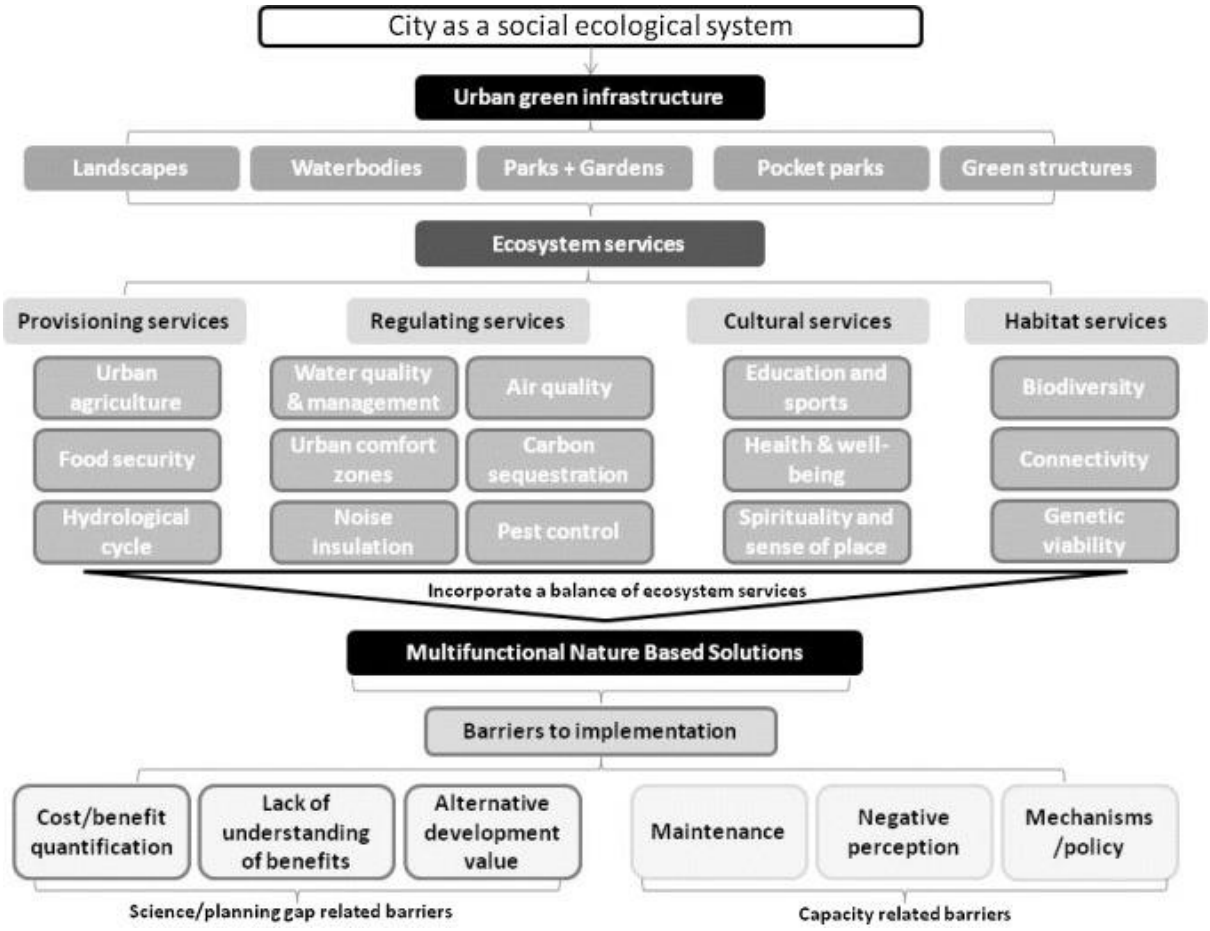


Figure 4 UGI, EES and NBS within a SES. Source; Connop et al (2016)

NBS have a strong focus on inducing biodiversity of natural components to develop solutions to global issues, which is not necessarily the case with the planning of UGI (Davies et al, 2015). The concept is also suggested to be more focused on on-the-ground solutions, than is the case with UGI. Nonetheless, UGI is often more established as a strategic framework within policy than NBS is (Pauleit, 2017). The concept of UGI is believed to lack the focus and immediacy that policy-makers and urban planners desire when addressing urban issues (Davies & Lafortezza, 2019). With the help of NBS, the systemic

and strategic use of ESS within urban policy (e.g. through UGI planning) could be promoted. Further development of the use of ESS concept, especially in terms of assessment tools, could help build an evidence base for NBS and UGI. Better understanding the outcomes of ESS, as the substance of UGI and NBS, might generate legitimacy for its systemic and strategic uptake in urban policy.

Concluding from the previous sections about the concepts of ESS, UGI and NBS, it is important to put emphasis on how they are related to each other. Table 5 gives a comparison of the three concepts based on their main principles, natural components and their operationalization.

Table 5 Comparing NBS with UGI and ESS on the basis of their main principles, natural aspects and their operationalization

	NBS	UGI	ESS
Concept principles			
Maturity of concept (Pauleit et al, 2017)	New concept, definition still Under debate/development	Concept with a history of about two decades; in Europe more recent; definition quite well established but also divergent	Longest history and definition well established, although still debated
Roots of concept (Pauleit et al, 2017)	Rooted in climate change mitigation and adaptation	Rooted in controlling urban sprawl, ecological network creation, but also stormwater management	Rooted in biodiversity conservation
Current focus (Pauleit et al, 2017)	Dealing with multiple societal challenges; biodiversity seen as central to solution	Broad socioecological focus, with major role for landscape architecture and landscape ecology	Biodiversity conservation by (economic) valuation of services provided by nature
Objectives and expected benefits (Dorst et al, 2019)	Aimed at addressing social, economic and environmental issues simultaneously; explicitly solution-oriented	Similarly aimed at addressing multiple sustainability challenges	Similarly aimed at addressing multiple sustainability challenges; emphasizes climate change adaptation as key outcome
Natural aspects			
Forms of nature included (Dorst et al, 2019)	Mixed perceptions of what constitutes nature; artificial (e.g. Biomimicry) or hybrid solutions (combining natural and engineered components) sometimes included	Similar to NBS, yet emphasis on interconnectedness of green and/or blue spaces	Dissimilar to NBS: nature entails ecosystems and biodiversity but not artificial forms of nature
Function of nature (Dorst et al, 2019)	Utilitarian conceptualization of nature; nature can provide multiple benefits to society	Similar to NBS	Similar to NBS
Nature as intervention (Dorst et al, 2019)	Wide-ranging perceptions of what interventions are considered NBS; variety in scope, scale and	Similar to NBS; Main examples: green roofs, ecological corridors, gardens,	Dissimilar to NBS: generally shared view of what are relevant examples; refers to the management,

	range of functions; Main examples: green roofs and walls, sustainable urban drainage systems (SUDS)	parks or plans for such interventions	conservation and restoration of ecosystems; Main examples: coastal defense through vegetation, wetland management, urban green spaces
Operationalization of concept			
Governance focus	Involves trade-offs between co-benefits; integrative and holistic approach promoted Characterized by involvement of a variety of stakeholders (Dorst et al, 2019) Integrative and governance-based approaches are embraced (Pauleit et al, 2017)	Similar to NBS; advocates cross-disciplinary collaboration Originally a strategic, somewhat technocratic approach, emergent shift to a socially inclusive approach (Dorst et al, 2019) Participatory planning processes are favoured (Pauleit et al, 2017)	Similar to NBS; advocates de-compartmentalization within governmental organization for more effective governance Similar to NBS; advocates participatory, community-based management approaches (Dorst et al, 2019) Urban ESS have been in focus only more recently (Pauleit et al, 2017)
Socio-spatial embeddedness	Alignment with socio-ecological and institutional context is essential to effective functioning Urban context increasingly recognised as key context for NBS implementation (Dorst et al, 2019) Urban focus from the Start (Pauleit et al, 2017)	Similar to NBS Roots in planning theory and practice; perceived as a well-suited approach to address the complexities of converging social, economic and environmental interests in cities (Dorst et al, 2019) Well established urban focus (Pauleit et al, 2017)	Similar to NBS; advocates adaptation to place-based features and relies on contributions by local communities Increasing attention for embedding in an urban context (Dorst et al, 2019) Urban ESS have been in focus only more recently (Pauleit et al, 2017)
Application in (planning) practice	Still needs to be developed, but has a strong action focus (problem solving) (Pauleit et al, 2017)	Very well established (Pauleit et al, 2017)	Partly established, but needs operationalisation through other concepts (such as GI, NBS) (Pauleit et al, 2017)

Source: Dorst et al (2019); Pauleit et al (2017); combined and edited by author

2.1.6 The state of NBS research and knowledge gaps

As seen in the previous sections, the NBS concept is linked to several earlier concepts from several different fields. As a consequence, it could be noticed that the concept is approached in different ways in research as well as in practice. This ambiguity could firstly be noticed when looking at the way NBS has been defined by different parties. The definitions proposed by the EC and IUCN, as discussed in section 2.4, are examples of prominently used definitions that are rather different in some ways (e.g. in the way they perceive nature), which could possibly lead to ambiguity. Some definitions like for example the one proposed by the EC, could however also be misconceiving on their own. Because some of the definitions are particularly broad, it could be unclear what the definition includes as being NBS and what it does not. According to a survey carried out by an EU research project called 'Nature4Cities', only a scarce 20% of the respondents accepted the EC's definition of NBS (Nature4Cities, 2017). This ambiguity and newness of the concept could lead to conceptual and practical challenges. It could however also be considered an opportunity, because the loose definition provides an open arena for innovative ideas. This creates room for further discussion, including a broad array of participants (Sekulova and Anguelovski, 2017).

The novelty of the concept and the associated ambiguity could also be noticed in the many ways that NBS is being studied. However, even though NBS is approached from many different angles, fields and scale-levels, most research is derived from two main science domains; the environmental science domain and the social science domain.

Some relevant fields within the environmental science domain are for example, ecology, biology, geology, physical geography, hydrology, soil science and atmospheric science. The NBS research from environmental science fields mainly focuses on the operation of ecosystem processes, the ability of NBS to address environmental challenges and the effect of NBS on the environment. This is for example the case in the article by Keesstra et al (2018), that reviewed examples of NBS to understand *"the superior effect of nature based solutions to enhance the sustainability of catchment systems by promoting desirable soil and landscape functions"* (Keesstra et al, 2018: 998). The aim of this research was not only to evaluate the impact of NBS on the ecosystem, to understand the underlying physical processes and how NBS contributes to the enhancement of ecosystem services, but also to inform policy-makers and other actors about the "superior effect" of NBS.

The effectiveness and impact of NBS is not only studied from an environmental science perspective, but also from a social sciences perspective. Some relevant fields within the social science domain are for example, economics, sociology, psychology, political science, public health and human geography. Beyond the effects of NBS on environmental sustainability, social and economic impacts are also being studied in NBS research. According to Nesshöver et al (2017:1223), *"…social sciences can help us to understand the potential and pitfalls of NBS to inform the design of new NBS, and to improve our general understanding of environmental governance. Social science research can provide insights into how different choices may affect support for and implementation of NBS…"*. Van den Bosch and Sang (2017) for example, studied the potential health benefits that could be distilled from nature's ability to reduce heat stress. A more economically-oriented study has been conducted by Wild, Henneberry and Gill (2017), who compared different ways of evaluating the economic benefits of NBS for urban water management.

Even though traditionally the domain of environmental science and the domain of social science might seem to be separate domains, many recent studies related to NBS show a certain degree of interdisciplinarity (e.g. Albert et al, 2019; Connop et al, 2016; Faivre et al, 2017; Nesshöver et al 2017, Raymond et al, 2017). These studies do not solely focus on the ecological or social considerations for

NBS but view the concept in a more integrative manner. What comes forward in these studies is also an understanding of the city as a complex socio-ecological system where social and ecological processes influence each other, instead of being independent systems. The assessment and evaluation of the effectiveness and impact of NBS in regard to environmental challenges as well as social and economic issues is considered to be an important part of NBS research and marked as a knowledge gap by for example Faivre et al (2017), Kabisch et al (2016) and Raymond et al (2017). Different assessment tools like frameworks, models and performance indicators, have been developed to evaluate the effectiveness of NBS interventions. An example of such a tool is the framework created by the 'EKLIPSE' expert team, who suggest different interventions and indicators for several challenges (Faivre et al, 2017; Raymond et al, 2017). Many assessment tools are however made specifically for a certain type of NBS or a certain context. Assessment of NBS is also prone to uncertainty. The effects of NBS interventions are not always conceivable on an easily measurable geographical and temporal scale (Cohen-Schacham et al, 2019). This applies for the environmental, social and economic assessment of NBS. Therefore, ongoing research on all three components is needed to build a broad evidence base that supports different NBS interventions in different contexts (Faivre et al, 2017; Kabisch et al, 2016; Raymond et al, 2017). To *"Provide the evidence and knowledge base for nature-based solutions"* (European Commission, 2017) is one of the main aims from the EU R&I policy agenda for Nature-Based Solutions and Re-Naturing Cities (EC, 2015). The EU attempts to bring this into action via different knowledge platforms such as the knowledge marketplace made available by the NBS repository called 'Oppla' (Oppla, n.d) or the urban nature atlas developed by the 'NATURVATION' project (NATURVATION, n.d).

Next to creating evidence that supports the application of NBS, another aim from the EU policy agenda is to *"Advance the development, uptake and upscale of innovative nature-based solutions"* (European Commission, 2017). This research branch is particularly focused on the way NBS-related concepts are being translated into actual implementation. For this aim, the EU also started some research projects. The 'UNaLab' project is an example of such a project, which works on creating a European reference framework for upscaling and replication of NBS (UnaLab, n.d). Also, the 'NAIAD' project is an example of such, as it distinguishes itself by studying the insurance value of ecosystems and the way it could help to promote NBS (NAIAD, n.d).

In addition to the showcasing of the (positive) effect of NBS with help of a growing evidence base, attention for the actual operationalization of NBS began to grow. Despite the significant potential of NBS, also supported by the growing evidence base, the use of NBS remained fragmented and marginal in most cities (NATURVATION, n.d). Therefore, research on the actual implementation, management and governance of NBS is needed to understand the way that NBS is socially produced. Similar to the research on the effects of NBS, social sciences could be deployed to study the operationalization of NBS. The social science domain could for example be helpful for studying the social and political processes that shape NBS (Erntson 2013). Projects like the 'NATURVATION' (NATURVATION, n.d) or the 'Nature4Cities' project (Nature4Cities, 2017) have been deployed by the EU to, among other topics, study the operationalization of NBS. The 'NATURVATION' project does so by analyzing successful governance and organization schemes found in practice and looking to better understand why NBS projects are politically contested (Sekulova and Anguelovski, 2017). The 'Nature4Cities' project explores and analyzes innovative multi-actor collaborative models found in the innovation, planning and implementation of nature in cities (Nature4Cities, 2017).

To conclude, ecologically-oriented approaches are becoming more and more recognized in science and policy. Nonetheless their application in practice is still a challenge for most policy-makers, planners, developers, scholars and other actors. As a relatively new concept, NBS will need to be

embedded within existing public and private policies, like in for example spatial planning, environmental assessment or nature conservation (Nesshöver, 2017). This will, at the same time, ask for an evolution of the institutional context in order for shifts in policy to take place (Maes & Jacobs, 2015). Decision-making on NBS will likely be arranged through the involvement of a range of different stakeholders who may have different views and different ways to deal with challenges. Furthermore, a nature-based solution has to be accepted as an alternative to more conventional solutions in order to become implemented (Nesshöver et al, 2017). Application-oriented frameworks to assist the mainstreaming of ecologically-oriented approaches are often lacking (Hansen & Pauleit, 2014). Many possible barriers to the development of such frameworks could be impeding or preventing implementation and up-scaling of these approaches (Connop et al, 2016). To address this challenge, more knowledge on the societal organization and human behavior that underlies the implementation and maintenance of NBS-related initiatives could be helpful. This thesis therefore aims to contribute, by focusing on the governance of NBS. The following chapter introduces the main concepts relevant for studying NBS from this perspective.

2.2 GOVERNANCE OF NBS

The previous chapter discussed the relevant NBS-related concepts and depicted relevant issues, challenges and knowledge gaps currently surrounding NBS. However, one aspect of NBS was highlighted, namely; governance. In this thesis, the main focus is on governance and the way that NBS is socially produced. Therefore, the relevant actors, institutions and their dynamic interactions have been studied in practice. This research has been substantiated with relevant concepts for the governance of NBS explored in the following sections. Firstly, NBS is positioned and defined for use in urban planning and governance research (section 2.2.1 and 2.2.2). Secondly, the concept of multi-level governance is introduced and discussed as a way to emphasize the scales relevant to urban NBS research (section 2.2.3). Lastly, the characteristics of the NBS governance research specific to this thesis are discussed (section 2.2.4).

2.2.1 NBS in urban planning and governance research

Figure 5 illustrates the way that landscape planning and governance research relate to NBS within social ecological systems, according to Albert et al (2019). The figure also shows a simplified version of a process wherein human interventions, among which NBS, could modify ecosystems, which in turn deliver ecosystem services for the social system to take benefit from. Important here is however, to note that NBS actions are not the only type of actions that could be proposed by landscape planning (Albert et al, 2019).

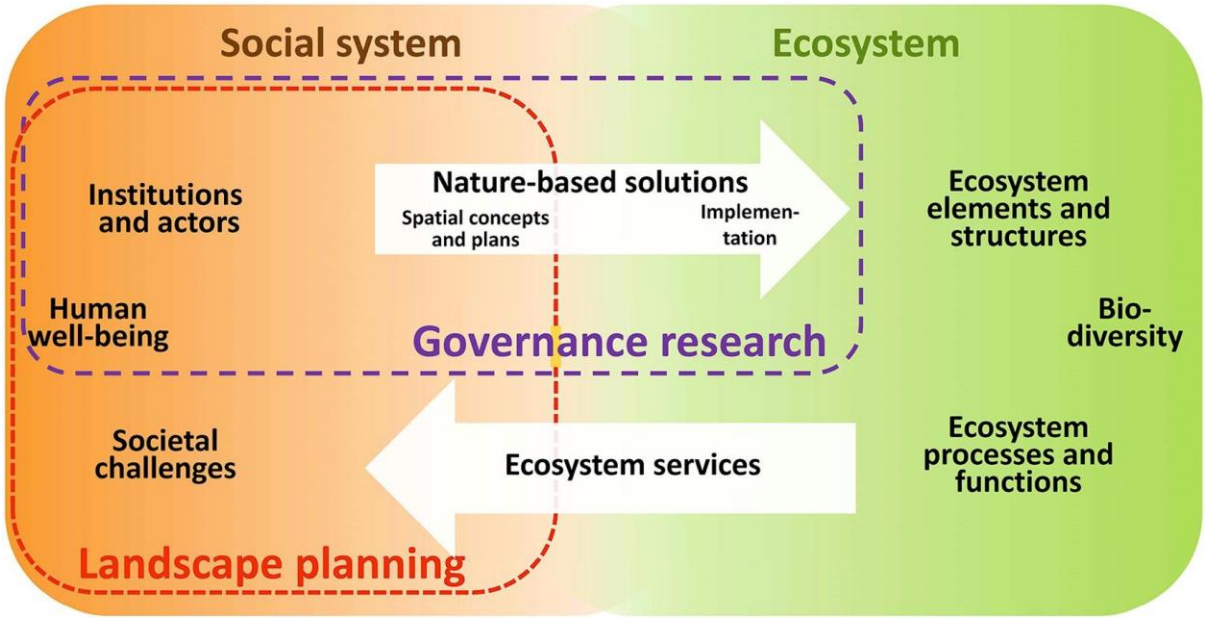


Figure 5 The role of landscape planning and governance research to the development and implantation of NBS within social ecological systems. Source; Albert et al (2019)

In contrast to what is shown in figure 5, this research project is more focused on cities than on landscapes. As a consequence, the term 'urban planning' or more generally 'spatial planning' will be used instead of 'landscape planning'. In the framework, landscape planning is represented in a broad sense covering the entire spectrum of the social system. For 'urban' or 'spatial' planning the same would apply. However, in this research project the focus lies more on the governance part of the framework. Research on governance could compliment spatial planning (or any other kind of planning e.g. 'landscape' or 'urban' planning) through the deliberation of relevant actors, institutions and their dynamic interactions that have an influence on the actualization of sustainable development approaches (Albert et al, 2019). The institutions stand for the relationship between actors and the

main policy processes (the 'rules of the game'), while the actors regulate how the institutions are used (the 'play of the game') (Vatn, 2010; Williamson, 2000). The goal of doing governance research in regard to NBS is gaining knowledge about the transformations that lead to implementation of NBS. It is therefore useful to gain insight in appropriate funding mechanisms, governance and business models for different actor networks and governance contexts. This research project aims to contribute to this goal by looking into supportive governance instances and business models for different NBS in Amersfoort as possible best practice examples (Albert et al, 2019).

2.2.2 Defining NBS for governance research

A first key challenge in applying NBS as an integrated policy concept or as a so-called 'umbrella concept', lies in addressing its vagueness regarding which actions may be considered NBS and which may not (Albert et al, 2019). Adopting a workable and a more clear-cut definition definition could help to provide some structure for and comparability across studies, which is especially helpful in a scientific and planning context (Albert et al, 2017; Nesshöver et al, 2017). Albert et al (2019), proposes such a definition for the use of NBS in planning and governance research. In this article NBS is defined as actions that;

1. "alleviate a well-defined societal challenge",
2. "utilize ecosystem processes of spatial, blue and green infrastructure networks", and
3. "are embedded within viable governance or business models for implementation".

NBS should thus respond to the criteria of "challenge orientation", "ecosystem process utilization" and "practical viability" (Albert et al, 2019).

Firstly, societal challenges that could be addressed through NBS include, for example climate change mitigation and adaptation, sustainable urban development or disaster risk management (European Commission, 2015; Kabisch et al, 2016; Raymond et al, 2017). This however does not imply that NBS are automatically superior over technical solutions. Within spatial planning, NBS should rather be seen as one of the possible solutions, considering also the status quo, other NBS as well as technical alternatives to identify the best solution for a specific planning context (Albert et al, 2019). Secondly, NBS should utilize ecosystem processes to preserve and enhance the delivery of ecosystem services. These processes could be described as any change occurring within ecosystems, including physical, chemical and biological changes (Maes et al, 2013). According to the definition provided by Albert et al (2019), ecosystem processes could be used by NBS through the preservation, restoration or enhancement of green and blue infrastructures. In this research project the term urban green infrastructures (UGI) is used instead of green and blue infrastructures, because focus of this study is more on the urban context, instead of river landscapes which was the focus of the article by Albert et al (2019). UGI are, as earlier discussed (section 2.1.3), understood as strategically planned and managed, spatially interconnected network of multi-functional, landscape features that deliver a variety of ecosystem services (European Commission, 2013). NBS could be considered at different spatial scales, both on the level of a single action or at the level of the infrastructural system (Albert, 2019). Finally, practical viability is an important part of NBS according to the definition of Albert et al (2019). NBS actions need to have a suitable governance or business model in order to evolve from being just a proposition towards an actual implementation. This is important because NBS often require cooperation and knowledge integration of different stakeholders from different backgrounds, because of the institutional context in which these stakeholders work and because of the possibilities that are available in terms of finance.

Beyond its problem orientation and the use of ecosystem processes, NBS should provide social, economic and environmental co-benefits according to for example the two prominent definitions of

NBS provided by the European Commission (EC, 2015) and the IUCN (Cohen-Shacham et al, 2016). Even though the premise of NBS is that they are able to provide co-benefits that are often greater than with alternative technical solutions, it might not be helpful to presume that every NBS will have multiple benefits. Therefore, these co-benefits should rather be assessed on a case-by-case by basis to see what particular co-benefits and trade-offs a certain intervention could generate. This could be helpful while considering the pros and cons of different possible actions, which could result in more informed decisions (Albert et al, 2019).

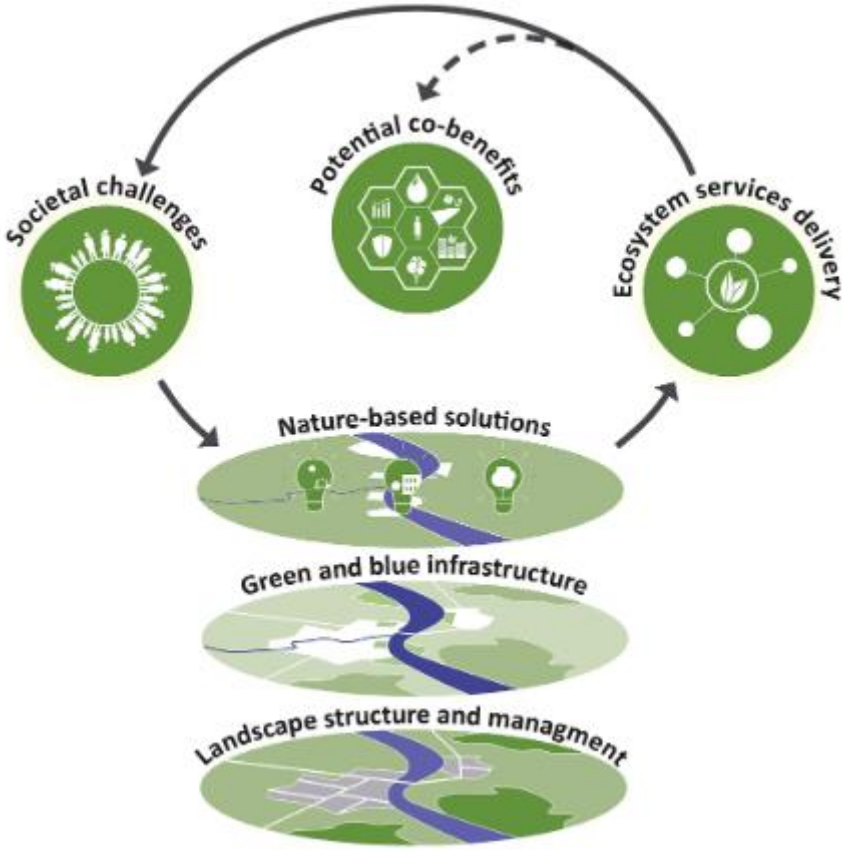


Figure 6 The working and effect of nature-based solutions. Source; Albert et al (2019)

Figure 6 illustrates the conceptual understanding of the working and effects of NBS, according to the definition provided by Albert et al (2019). NBS makes use of ecosystem processes of green and blue infrastructures to preserve or enhance ecosystem services. This preservation or enhancement of desired ecosystem services could in turn help to resolve societal challenges and they could at the same time provide social, economic and environmental benefits. In the article by Albert et al (2019), their definition of NBS is applied in the context of a river landscape which is different to the urban context which is the focus in this research project. The content of the conceptual understanding might be different in an urban context, as NBS in cities might have a higher level of engineering (see e.g. typology from Eggermont et al, 2015 in section 2.4), there might also be different challenges, ecosystems services and co-benefits within an urban context. So, while taking into account these possible differences, the same conceptual understanding of the working and effect of NBS will be used in this research project.

2.2.3 Multi-level governance of NBS

The aim of this thesis is to find how NBS is manifested in the city of Amersfoort. However, next to the city scale, NBS is represented on other scales as well. Implementation of NBS could be done on a city scale, but also on a neighborhood, street or even single-home/ garden scale. With the social-ecological approach in mind, it could be understood that the implementation of NBS on, for example, a street scale is influenced by policies made on a city-scale and vice versa. Because the different scale levels could influence each other, a multi-level governance approach could contribute to the integrality of the research design. In this thesis, multi-level governance is represented in the analytical structure of the empirical research, starting from a strategic level towards an operational and reflexive level, similar to Frantzeskaki & Tilie (2014). Frantzeskaki & Tilie (2014), used a multi-level governance framework to study the dynamics of ecosystem governance in the city of Rotterdam. The framework distinguishes between 4 levels of organizing governance, which are illustrated below.

1. Strategic level: Level with activities and processes of long-term goal setting, policy-making, vision, planning, identity, value and culture of the city.
2. Tactical level: Level with the design of steering activities, programs, funding and the foundation of networks and collaborations.
3. Operational level: Level where implementation and management of policy action plans, infrastructural plans and assets takes place.
4. Reflexive level: Scale that includes monitoring and evaluation of policy and assets, as well as their interaction with citizens.

In this thesis, 4 geographical scales have been taken into account, namely the EU, the national level, the city level and the project level. These scale-levels do not exactly coincide with the governance levels. However, challenges on a relatively high geographical scale-level (e.g. EU or national scale) are likely to be governed on a strategic or tactical level, while on a relatively low scale-level (e.g. project scale), challenges are likely to be governed on operational or reflexive scale. The city scale-level in this thesis, could be seen as an intermediate level located between high and low scale-level. In this level, therefore all governance levels could be relevant. The different levels of governance are represented in the analytical structure of the empirical part, which is discussed in section 3.6.

2.2.4 Characteristics of urban NBS governance

As mentioned earlier, governance research is concerned with relevant actors, institutions and their dynamic interaction (Albert et al, 2019). Those involved in the implementation of NBS have to deal with these dynamics within different dimensions to generate a desirable result. However, within these dimensions, barriers to implementation and upscaling of NBS could occur (Ahern, 2011, Hansen & Pauleit, 2014). This thesis, therefore puts emphasis on these dynamics within practical examples from the city of Amersfoort to investigate how they shape the implementation and upscaling of NBS. However, many dimensions, dynamics and characteristics of different urban and environmental governance arrangements could be found in literature (see e.g. Ahern, 2011; Cohen-Shacham et al, 2016; Cohen-Shacham et al, 2019; Connop et al, 2016; Davies & Lafortezza, 2019; Hansen & Pauleit, 2014; Lawrence et al, 2013; Kabisch et al, 2016; Nature4Cities, 2017; Nesshöver et al, 2017; Sekulova and Anguelovski, 2017; van der Jagt et al, 2017b). When studying governance, it is however more appropriate to include the dimensions that are relevant for a certain type of governance or research aim, than to accumulate all possible dimensions found in the literature (Hall, 2011).

For this thesis' empirical part, the studied characteristics that have been taken into account are derived from the urban forest governance framework proposed by Lawrence et al (2013) who used framework to compare different approaches to urban forest governance in the context of urban

forestry and urban greening. Urban forestry is, among several others, related to the concept of NBS (see also introduction to chapter 2) and also experienced a knowledge gap in terms of governance similar to that of NBS (see section 2.1.6). This knowledge gap is well illustrated by the first paragraph of the paper by Lawrence et al (2013:464):

"Over the last decade there has been an upsurge of interest in urban greenspace, trees and forests. This development has focused largely on the benefits (social, environmental and economic), the distribution of those benefits, and technical aspects of tree and greenspace management. Much less attention has been paid to the processes, interactions, organizations, and decisions which lead to the establishment and maintenance of such resources and provide the benefits. This complex area of human organization and behavior is referred to as governance".

The framework consists of dimensions, that could also be relevant to other types of governance, like for instance NBS governance. However, whether these dimensions are appropriate, depends on the aim of study. In the original paper by Lawrence et al (2013), the following dimensions were used; (1) context, (2) institutional framework, (3) actors and coalitions, (4) resources and (5) processes.

Within each dimension, an array of different aspects could be studied. The aspects investigated within each dimension are shortly discussed below;

(1) Context: As a starting point, ***general information*** regarding the ***type*** of project (single project, program, plan, network, etc.) and ***scale*** (neighborhood, city, region, nation, etc.) is described to get a general overview of the project.
(2) Institutional framework: For the analysis of the institutional framework, first the relevant **policies** for each project are described. In addition, the specific **planning and** legal **regulations** that were relevant for implementation of the project are discussed. For the exemplary projects, also relevant changes in the **ownership** of land is described. This is included in the analysis to see what changes in landownership were required for the implementation of the project and to see what type of landowners are present in the project area. The **access and use rights** could also change, as a result of changes in land-use or ownership and are therefore also added in the analysis.
(3) Actors and coalitions: Within the dimension of actors and coalitions, relevant stakeholders are divided into 2 groups, namely **primary stakeholders** and **other stakeholders**. The primary stakeholders are the ones that have been active with the actual development and implementation of the project. The other stakeholders are does with an interest and a secondary influence on the process, including those who make use of the outcome of the project. The **partnerships** between actors are represented in the framework through a description of their formal connections and the role of the different partners. In addition, a **power analysis** is done to find out with whom the decision-making power lies and how they required that position (e.g. through direct influence, democratic processes, campaigning or other).
(4) Resources: To study the resources that have been used to realize the project, first the type, origin and composition of **funding** of the project is discussed. Secondly, the use of **knowledge and information** is analyzed, to find what kind of information and knowledge (e.g. expert, lay or local knowledge) is used to influence implementation and management of the project. Lastly, other **delivery mechanisms** or policy tools that supported the implementation are discussed.
(5) Processes: Within the process the relevant **discourses** are described through the deliberation of the major narratives, perspectives and conflicts etcetera. In addition, the way that stakeholder **participation, engagement and conflicts** between stakeholders is analyzed to understand its impact on decision-making process and on the project's result. The **monitoring and evaluation** of the project are also included in the analysis.

The dimensions and aspects derived from the urban forest governance framework, discussed above, are suitable for a clear and robust analysis of different governance arrangements. Nonetheless, for the dimension of 'actors and coalitions', additional analysis has been done to get a more in-depth understanding. First of all, for the dimension of 'actors and coalition', the composition, roles and relationships of actor are further analyzed with the help of theories on ideal typical models of governance. This additional analysis is included because it addresses a specific knowledge gap as well as a common enabling/ restricting factor for NBS implementation and management. Sekulova and Anguelovski (2017:26) for example labeled the search for effective models of governance as "an area of further scrutiny". Furthermore, the importance of studying partnerships and the different governance models in which they occur, in regard to the implementation process and effectiveness of the intervention, is shown by a recent paper by Sarabi et al (2019). In their systematic literature review on the key enabling/ restricting factors for the implementation of NBS, they found that partnerships among stakeholders was identified as a key enabling factor in more than half of the cases (27 out of 41 reviewed papers). The additional analysis for the 'actors and coalition' dimension is described in sub-section 2.2.4.1.

2.2.4.1 Models of governance

Traditionally, state actors have been the most prominent actor group involved in the governance and initiation of greening projects. Currently however, a shift in the role of state could be noticed in the urban planning as well as the governance in many countries in the Global North (Sekulova and Anguelovski, 2017). This trend encompasses a shift from centralized urban management towards the involvement of decentralized administrative departments. Furthermore, actors initiating NBS initiatives and involved in the planning and governance of NBS are not exclusively coming from the government sector but could also originate from the community or market sector. Table 6 shows different actors from three main sectors from which NBS initiatives could be originating. The sector from which an initiative is taken, partly determines the essence and certain guidelines for governance arrangements (Nature4Cities, 2017).

Table 6 Different types of actors from main sectors

Sector	Actor
Governments	Regional/ national government
	Local government/ municipality
	Semi-government organizations/ institutions
Community	NGO's/ CSO's/ interest groups
	CBO's/ neighborhood communities
	Citizens
	Research institutions
Markets	Private sector
	Social enterprises/ social entrepreneurs

Source: Nature4Cities (2017). Abbreviations: NGO, non-governmental organization; CSO, civil society organization; CBO, community-based organization

When there are multiple stakeholders other than governmental stakeholders (e.g. municipality), like local communities, civil society or businesses involved in a planning process, the term 'participatory governance' is used (vanderJagt et al, 2017a). In addition to identifying the initiating actor for an NBS intervention, it could be helpful to focus on the role of other participating actors and the way this influences the planning process.

When looking at participatory planning processes, a distinction could be made based on different types of roles played by governmental and non-governmental actors. Ambrose-Oji et al (2011), created a framework based on the 'ladder of participation' (Arnstein, 1969), which depicts these different roles. This framework is represented visually in figure 7.

GOVERNMENT ACTOR ROLE	LEADING ⟷ ENABLING							
Form of participation	Inform	Consult	Involve			Partnership	Empower	
Non-government actor role	Provide information and views about plans for decision making processes		Involved in care and maintenance	Involved in planning decisions	Involved in manage-ment	Collaborative management	Lease of public land	Purchase of public land

Figure 7 Degree of involvement of governmental actors and corresponding non-governmental actor roles based on the Ambrose-Oje et al (2011) framework (source; vanderJagt et al, 2017a)

The framework shows that the position or approach of the government actor influences the role played by non-government actors. The approaches and roles of actors within a governance arrangement, could thereby influence the decision-making process. Generally speaking, the shift of governments away from a leading role means there are more roles left to be played by either the community or the market sector. A popular idea behind this shift, is the premise of sharing responsibilities like opportunity costs and financial risks between governmental actors and the private sector (Sekulova and Anguelovski, 2017). However, the extent to which responsibilities are carried over from the public to the private sector depends on the specific situation. Also, whether these responsibilities are carried out by the community sector, the market sector or both, is dependent on the specific situation. NBS governance, therefore exist on a spectrum, ranging from forms of governance led by the public sector (governments) towards forms of governance led by the private sector (community/ market), with many hybrid forms in between (Nature4Cities, 2017).

This spectrum of governance is also represented in the range of archetypical modes of (environmental) governance distinguished in a paper by Driessen et al (2012). In the paper, 5 different modes of governance are distinguished based on features of within the dimensions of actors, institutions and content of governance. In figure 8, a schematic representation of the 5 different modes of governance is depicted. The schemes show the different relationships between governments, community and markets.

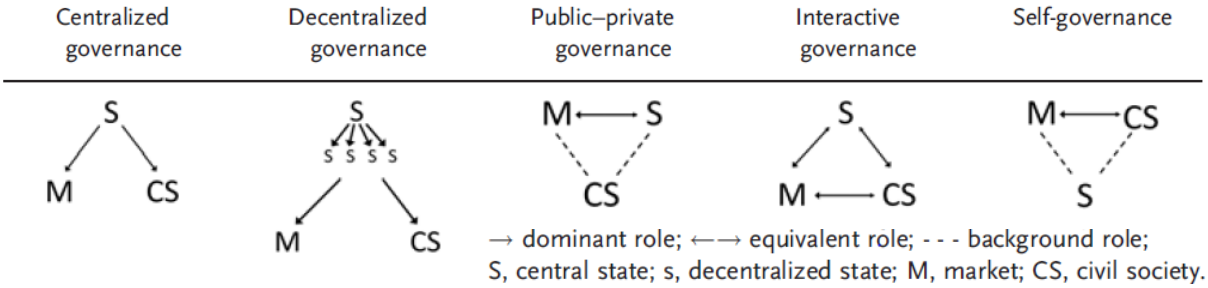


Figure 8 schematic representation of 5 different modes of governance. Source: Driessen et al (2012)

More recently, The Nature4Cities project (Nature4Cities, 2017) created a similar framework for analyzing and characterizing different governance arrangements specifically for NBS governance. The framework is also based on the triangular relationship between state, community and market, as used by others (e.g. Driessen et al, 2012; Lemos and Agrawal, 2006). Within the framework, 5 clusters of

governance have been identified, each holding several governance models. Table 7 gives an overview of the governance models within each cluster.

Table 7 different models of governance within 5 clusters

Cluster	Governance models
1. Traditional public administration	Hierarchical governance
	Closed governance
	Participatory planning & budgeting
2. New Public Management	Public–private partnership (PPP)
	Business-led self-governance
3. Private-private partnerships	Non State Market-driven governance (NSMD)
	Business–NGO partnerships
	Sustainable Local Enterprise Networks (SLEN)
4. Societal Resilience	Co-management
	Civic ecology practices
	Self-governance/grassroots initiatives
5. Network Governance	Collaborative governance
	Adaptive governance
	Adaptive co-management
	Scale-crossing brokers

Source: Nature4Cities (2017)

Describing all different governance models would become too bulky for the purpose of this thesis, therefore only the clusters are shortly described here (see Nature4Cities (2017) for full descriptions):

Traditional public administration: Within the cluster of 'traditional public administration', government- and producer-oriented governance models exist. The models have different levels of low to moderate participation, ranging from no participation at all to inform and consult (according the framework in figure 7). Here a commanding role is played by the government, while the community has the role of client. Challenges and solutions are defined by professionals. Furthermore, a main goal is to maintain stability, which results in uncertainty aversion (Nature4Cities, 2017).

New Public Management: Within the cluster of 'New Public Management', market- and consumer-oriented governance models exists. This cluster is based on the involvement of market actors in governance arrangements, which is done as a means to overcome ineffective governmental management by leaving public tasks to market forces. Within this cluster, there is a competitive context, where the self-interest of individuals is reflected in markets and consumers. The models in this cluster range from almost entirely public sector governance to almost entirely private sector governance. Importantly, this cluster is characterized by hierarchy that can come from both the state or the market (Nature4Cities, 2017).

Private-private partnerships: Within the cluster of 'private-private partnerships', governance models consist of private actors (community and market actors). In contrast to cluster 1 and 2, the models in this cluster are characterized by an absence of hierarchy (Nature4Cities, 2017).

Societal resilience: Within the cluster of 'societal resilience', governance models are highly community based, where communities have the ability to organize and plan (almost) without intermediaries. This cluster can be characterized with a higher level of citizen participation (towards the right side of framework in figure 7) (Nature4Cities, 2017).

Network Governance: Within the cluster of 'network governance', governance models are characterized by a degree of government involvement that is in between leading and enabling (see framework of figure 7). Because of this position of the government, other non-governmental actors are involved in the decision-making processes. 'Network governance' is also called 'collaborative governance', because the interdependent governmental and non-governmental actors need to collaborate to realize a desired result (Nature4Cities, 2017).

The different clusters are located within the framework based on which sector the involved actors originate from (state, community, market). They are also distributed according to their positioning within the spectrum ranging from low to high level of government involvement and according to their level of participation. Figure 9 illustrates the positioning of the different clusters within governance models framework (Nature4Cities, 2017).

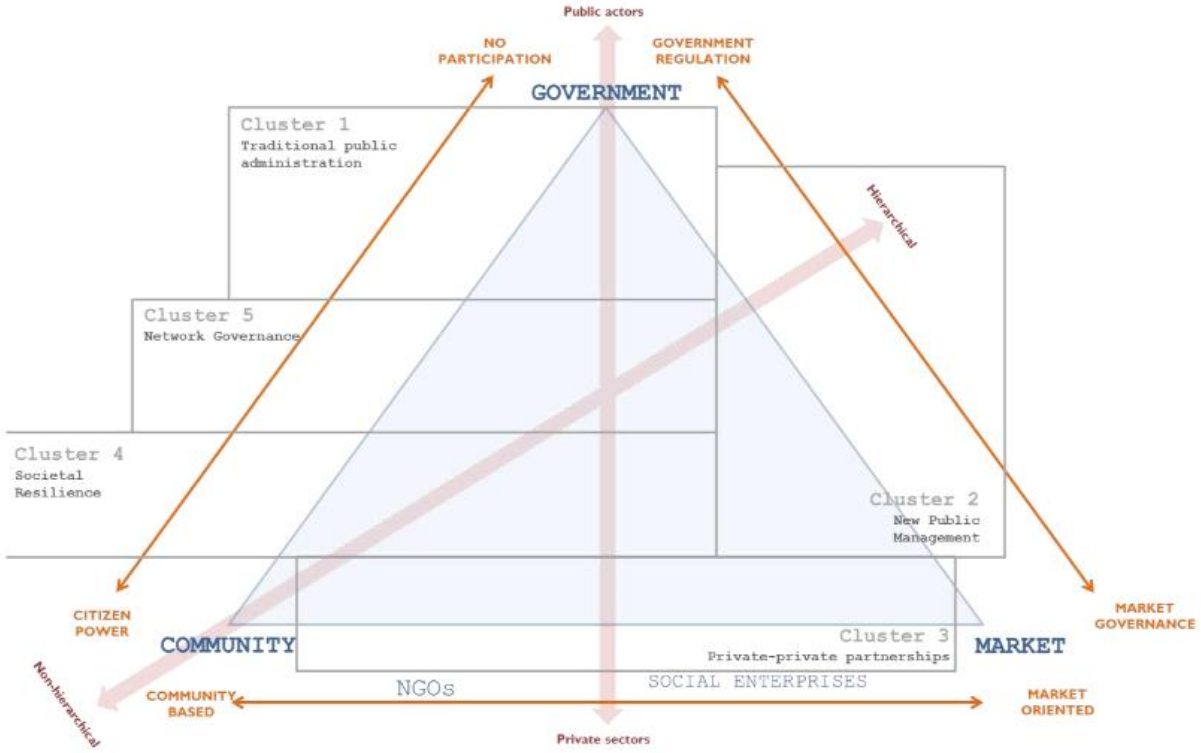


Figure 9 Clusters within the governance models framework. Source: Nature4Cities (2017)

In this thesis, the governance arrangements framework (Nature4Cities, 2017) has been used as a reference and a way to reflect the empirical findings on. With help of the framework, the governance arrangements found in the empirical case have been characterized and evaluated. Furthermore, the framework also helps to easily distinguish between the different governance arrangements, which helps when comparing them.

2.3 ENABLING AND RESTRICTING FACTORS

In the previous sections of the theoretical framework (section 2.1 and 2.2), the relevant concepts to NBS and to the governance of NBS have been discussed. It could be concluded that the way that actors and institutions shape the environment is an important factor in the implementation and further development of NBS. Nevertheless, many barriers could emerge during the planning process of NBS. In the following sections therefore the important enabling and restricting factors are discussed. Firstly, the circumstances in which these factors occur are illustrated in section 2.3.1, after which the factors are categorized in section 2.3.2.

2.3.1 Multiple stakeholders, uncertainty and conflict

Uncertainty is a characteristic that fits with NBS, especially in regard to the complex social-ecological systems they are often part of. Environmental management, in that instance, is often non-linear, heterogeneous and incompletely known (Seastedt, Hobbs & Sudding 2008; Suding, Gross & Houseman 2004). According to Cohen-Shacham et al (2019), uncertainty is not adequately addressed in NBS frameworks. Because of the nature of ecosystems, which are self-organizing and influenced in many ways and on different scales, the results of NBS-interventions are often hard to predict. Monitoring these results is also something that is not yet adequately represented in NBS frameworks, especially in regard to assessment on different temporal scales (Cohen-Shacham et al, 2019).

Two major factors that contribute to the uncertainty of surrounding implementation of NBS are; perceived risk and determining effectiveness (vanderJagt et al, 2017b). According to Hendricks & Calkins (2006), there are several reasons why NBS could be perceived a risk. Firstly, NBS interventions add an extra layer to traditional development and therefore adding to the complexity. Secondly, there is not yet a lot of experience with the developers. Lastly, there could be safety and reliability concerns in regard to incompatibility of NBS with existing built environment. Because of these uncertainties, financial risks are often overestimated (most notably risks associated with maintenance), making it harder to attract investors and stewards (Bayulken & Huisingh, 2015; Chaffin et al, 2016).

There also often many uncertainties surrounding the effectiveness of NBS (vanderJagt et al, 2017b). A reason for this lies in the fact that NBS are designed to not only have economic value, but also social and environmental qualities. Such qualities, like for example esthetic enjoyment of other cultural ecosystem services (see also table 1 in section 2.1.2), are often hard to quantify (Kabisch et al, 2016). These aspects are also generally not taken into account in the decision-making process of profit-oriented businesses (Horwood, 2011). Another problem be that the output of an intervention is only perceptible in the long-term. This is especially the case, when NBS is implemented on a large scale or when the NBS is supposed to bring a solution to a problem that is manifested at different spatial scales. To assess the effectiveness of NBS, evaluation and monitoring should sometimes ideally take place across different scales. The outcome of a certain assessment could nevertheless be valued differently by different stakeholders. To realize clear evaluations, agreeing on a clear definition of success criteria and their measurement instruments is necessary (Nesshöver et al, 2017). In this research project emphasis will be put on the (expected) outcomes of NBS in Amersfoort and the way they are evaluated and monitored.

By learning from the management of former instances of practice, knowledge could be produced on how multiple stakeholders from different backgrounds influence the outcome of the practice. In this research project, the chosen exemplary projects represent such instances of practice. The aim was to investigate how these instances dealt with managing uncertainties and complexity. Ahern (2011), has detected a trend in the way that uncertainty is dealt with, specifically in the context of sustainable urban development and resilience. Early ideas focus mostly on stability and controlling growth and

changes, which refer to a “fail-safe” mentality. This mentality stems from a confidence in the ability of technologies to solve environmental and social problems. Later, a more variable, changing, chaotic and uncertain understanding of the operation natural and cultural systems became more prominent. As a result, a “fail-safe” mentality would no longer be sufficient, as a static landscape condition does not do justice to its dynamic, complex and unpredictable context. Instead of a “fail-safe” mentality, sustainability and resilience could be regarded from a “safe-to-fail” mentality, which requires a more experimental and adaptive approach to planning (Ahern, 2011).

Having multiple stakeholders means there might be multiple views on what NBS are and whether and how they should be implemented. An ecologist might set different requirements to NBS than for example an architect. A multi stakeholder approach is believed to be needed to get the best result from NBS. This does not only mean that there should be more than one knowledge domain that informs the design of NBS, it also means that people from different backgrounds should collaborate to find suitable NBS for a certain problem. Besides the flow of knowledge between different scientific domains, there could be more flow between science, practitioners and local experiences (Nesshöver et al, 2017).

With involvement of multiple stakeholders and different types of knowledge, NBS goals could be set with regard to a shared understanding of the possible options, their costs and the social and environmental impact of these options. Ideally, a win-win situation would be the goal, however this is often challenging to achieve (Nesshöver et al, 2017). There is often a disconnect between short-term actions and long-term goals (Kabisch et al, 2016). Uncertainty about the direct and indirect impacts and cost, could make it hard for stakeholders to commit themselves to NBS (Nesshöver et al, 2017). This uncertainty also does not fit with the traditional short-term decision-making procedures often found in city administrations (Kabisch et al, 2016). It could therefore be hard to find trade-offs with other land-use options. To get a common understanding of the short – and long-term costs and impacts of NBS, oftentimes a value judgement is needed. Many potential challenges exist in generating a common understanding of multifunctionality, benefits and trade-offs of NBS (Nesshöver et al, 2017). Emphasis on the planning process of NBS is critical (Nesshöver et al, 2017), in particular when they involve multiple views, interests and certain trade-offs.

2.3.2 Categorization of factors

The implementation and management of NBS is often dependent on several factors that can be both enabling or restricting. Many studies have been conducted in order to identify the factors that contribute to the ‘success’ or a ‘failure’ of an NBS intervention (e.g. Connop et al, 2016; Kabisch et al, 2016; Nature4Cities, 2017; Nesshöver et al, 2017; Sarabi et al, 2019; Sekulova and Anguelovski, 2017; van der Jagt et al, 2017b). According to Sekulova and Anguelovski (2017), there are a number of studies that identify institutional factors as the most frequently occurring type of barrier for ecosystem-based adaptations. A similar observation could be made for NBS. According to the recent systematic literature review on the enabling and restricting factors for NBS done by Sarabi et al (2019), the most frequently occurring factors (both enabling and restricting) are categorized as socio-institutional factors. Many of the enabling and restricting factors could therefore possibly be found in different governance dimensions (e.g. institutional framework, actors and coalitions, resources and processes). To connect to this, the enabling and restricting factors found in literature could be grouped in accordance with these dimensions, as represented in table 8.

Table 8 Enabling and restricting factors linked to governance dimensions

Dimensions	Sub-aspects	Potential enabling/restricting factors
Institutional framework	Policies, Planning and regulations, Ownership, Access and use rights	Inadequate regulations, Unsupportive legal frameworks (permits/ property rights), Path dependency, Institutional fragmentation
Actors and coalitions	Primary actors, Other actors, Partnerships, Power analysis	Insufficient collaboration, Unclear objectives and goals, Unclear leadership and role
Resources	Funding, Knowledge and information, Delivery mechanisms	Inadequate financial resources, uncertainty about costs/benefits, lack of knowledge or knowledge transfer
Processes	Discourses, Participation, engagement and conflict management, Monitoring and evaluation	The disconnect between short-term actions and long-term goals, The discontinuity between short-term actions and long-term plans, Uncertainty regarding implementation process and effectiveness of the solutions

Sources: Connop et al (2016); Kabisch et al (2016); Nature4Cities, 2017; Sarabi et al (2019); Sekulova and Anguelovski (2017); van der Jagt et al (2017b)

3 CONCEPTUAL FRAMEWORK

The previous chapter discussed the theoretical underpinnings relevant for addressing this thesis' research objectives and questions. In the following chapter, it is discussed how these theories, concepts and frameworks are brought together to form the conceptual framework used for the empirical study of this thesis. First the analytical structure is explained in section 3.1, after which is explained how the NBS projects have been analyzed in section 3.2. Both sections are combined into a conceptual model, which is visually represented in section 3.3.

3.1 ANALYTICAL STRUCTURE

Section 2.2.3. of the previous chapter, introduced the concept of multi-level governance. This concept is represented in this thesis by first focusing on NBS at EU and national scale-level, followed by NBS on city level towards NBS on project scale-level. The different scale-levels are however investigated in different ways. The degree of specificity of the research increases as the scale-level decreases. The analysis of NBS on EU and national scale-level (section 5.1) is mainly descriptive focusing solely on the scope of NBS and the relevant policies. The analysis of NBS on city scale-level (Section 5.2) already becomes more specific by emphasizing not only the policy frameworks, but also on the geographical context, institutions, policy-makers and other key actors. Finally, the analysis on project scale-level (section 5.3 – 5.5) is considered the most specific, as it includes in-depth analysis of the planning process.

In order to study the project scale-level in a systematic fashion, 5 units of observation have been investigated similarly for each project. The units of observation are (1) societal challenges and drivers, (2) objectives and solutions (3) organization and governance (4) enabling and restricting factors (5) Lessons for NBS planning and governance. These units are based on the research objectives/ questions (section 1.2) and the governance-related definition of NBS proposed by Albert et al (2019) (see also section 2.2.2). The "challenge orientation", "ecosystem process utilization" and "practical viability", all represent a distinct objective/ question that have been addressed in the empirical part of this thesis. The "challenge orientation" refers to the societal challenges that are aimed to be solved with NBS-related projects in Amersfoort. Empirically, these societal challenges and underlying drivers have been investigated to uncover 'why' NBS was used in these projects. 'Ecosystem process utilization' refers to the use of ecosystem processes with the aim to bring a solution to certain challenges. For the empirically studied projects in Amersfoort, the predetermined objectives and the actual solutions have been investigated to learn 'what' kind of NBS are implemented, 'what' ecosystem processes were involved and 'what' ESS is targeted. The 'practical viability' refers to the process of going from an idea towards an actual implementation of NBS. Empirically, the organization and governance of NBS-related projects in Amersfoort is investigated to understand 'how' NBS is socially produced. The 2 last units of observation follow directly from the research objectives/ questions and both refer to the 'practical viability of NBS. The unit of 'enabling and restricting factors', is directly linked to the following research objective: *"To explain the enabling and restricting factors underlying the development of NBS"* (see: section 1.2). The unit of 'Lessons for NBS planning and governance' is linked to the second part of the third research question: *"To analyze the urban governance of NBS and to inform governance approaches to effectively promote NBS in a sustainable way"* (section 1.2). This unit of analysis is basically a summary of all relevant learning components extracted from a project. These components form the basis for recommendations to inform future governance approaches.

By combining the concept of multi-level governance (Frantzeskaki & Tilie, 2014; Section 2.2.3), with the governance definition by Albert et al (2019) and the research objectives/ questions, the following analytical structure could be constructed. Table 9 shows this structure.

Table 9 Analytical structure

Governance scale-level (Frantzeskaki & Tilie, 2014; Section 2.2.3)	**Content of NBS analysis**	**Addressed research objective/ question** (Section 1.2)	**Addressed component of NBS definition** (Albert et al, 2019; Section 2.2.2)
EU and National level (Strategic level)	Policy framework and scope	RO 1 and RQ i	Not applied*
City level (Strategic, tactical, operational and reflexive level)	Policy framework and geographical context	RO 1, RQ i	
	Institutions and key actors	RO 1, RQ iii	
Project level (Operational and reflexive level)	Societal challenges and drivers	RO 1 and RQ i	'Challenge orientation' ('why')
	Objectives and solutions	RO 1 and RQ i	'Ecosystem process utilization' ('what')
	Organization and governance	RO 1 + 3 and RQ i + iii	'Practical viability' ('how')
	Enabling and restricting factors	RO 2 and RQ ii	'Practical viability' ('how')
	Lessons for NBS planning and governance	RO 3 and RQ iii	'Practical viability' ('how')

Source: Author's own elaboration of multi-level governance (inspired by Frantzeskaki & Tilie, 2014) and the governance-related NBS definition (proposed by Albert et al, 2019). *Definition by Albert et al (2019) is only applied to project level, similar to their own case-study research.

The analyzes on EU/national and on city level have been done to get a better understanding of the context in which the exemplary projects are situated. From a SES perspective, it is also useful to retain a link between different levels in order to identify interactions between scales. Recommendations on NBS developments could therefore also be shaped by analyzes on levels higher than the specific project level. Nonetheless, the project level analysis has been the main part of the empirical studies for this thesis. The way they are analyzed is described in section 3.2.

3.2 CONCEPTUAL APPROACH FOR ANALYZING NBS PROJECTS

The empirical study conducted for this thesis took place around 3 projects in the city of Amersfoort. A set of 5 units of observation have been analyzed in similar fashion for each project (see previous section 3.1). Different types of analysis and corresponding analytical tools (e.g. theories, concepts, frameworks) have been deployed to address each unit of observation. An overview of the tools used for each unit of observation is shown in figure 10.

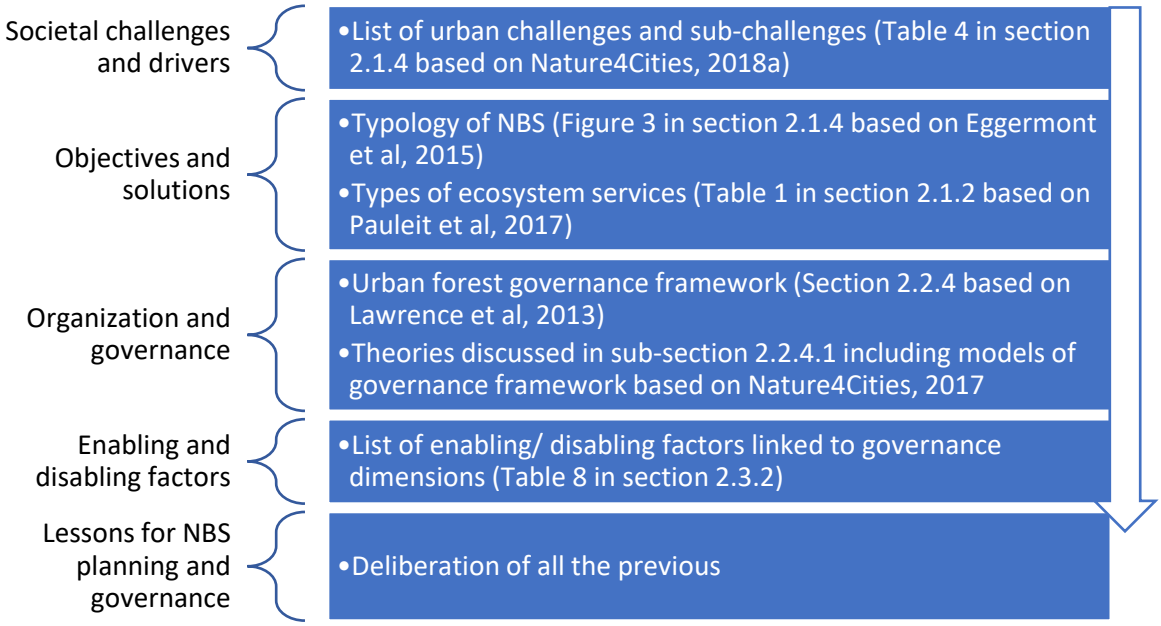


Figure 10 Theoretical tools used for each unit of observation

The nature of each analysis and the tools used for each unit of observation are shortly described below.

Unit 1: Societal challenges and drivers

For the unit of observation '*Societal challenges and drivers',* a descriptive analysis has been conducted. The descriptive analysis featured the societal challenges addressed and the underlying drivers that were the basis for the NBS intervention. As an analytical tool, a list of urban challenges and sub-challenges derived from a 'Nature4Cties' project report has been used (see table 4 in section 2.1.4). The list makes a distinction between challenges within 5 different topics, namely climate, environment, resource, social and economy. Within each topic, several urban challenges are defined, which in turn are divided into urban sub-challenges. The list represents a range of urban challenges that could be addressed by NBS and is therefore used as a means to reflect the empirical findings to. Even though NBS can address more than one challenge, not all challenges are equally important. The hierarchy of challenges are therefore taken into account for this unit of analysis (Nature4Cities, 2018a).

Unit 2: Objectives and solutions

For the unit of observation *'Objectives and solutions'*, also a descriptive analysis has been conducted. The analysis includes a description of the objectives of the project as well as a description of solutions that are implemented. As analytical tools, 2 different typologies of NBS are used. The typology of NBS by Eggermont et al (2015) is used to reflect on the degree of engineering found in the different projects of the empirical case (see also section 2.1.4). The types of ecosystem services from table 1 are used to reflect the empirical findings to, by looking at the type of ecosystem services that were addressed in the projects (see also section 2.1.2).

Unit 3: Organization and governance

For the unit of observation *'organization and governance'*, a more in-depth approach has been applied, combining descriptive and explanatory analysis. The key actors of the projects are for example analyzed in a descriptive way, while the partnerships between these actors are analyzed in a more

explanatory way. For this unit of analysis, the urban forest governance framework by Lawrence et al (2013). The framework is used to systematically analyze each project, by investigating relevant governance dimensions (see section 2.2.4). In addition to the urban forest governance framework, the theories discussed in sub-section 2.2.4.1 are used as a complementary tool. The models of governance framework (Nature4Cities, 2017) is used to reflect upon the findings obtained following the urban forest governance framework.

Unit 4: Enabling and restricting factors

For the unit of observation 'enabling and restricting factors', a descriptive analysis is conducted. As a basis of this analysis, enabling and restricting factors found in NBS literature were used. The factors have been categorized based on the governance dimensions from the urban forest governance framework (see table 8 in section 2.3.2). The empirically found factors have been reflected upon with the help of this categorization. Nonetheless, relevant factors that did not belong to these categories were also included in the analysis.

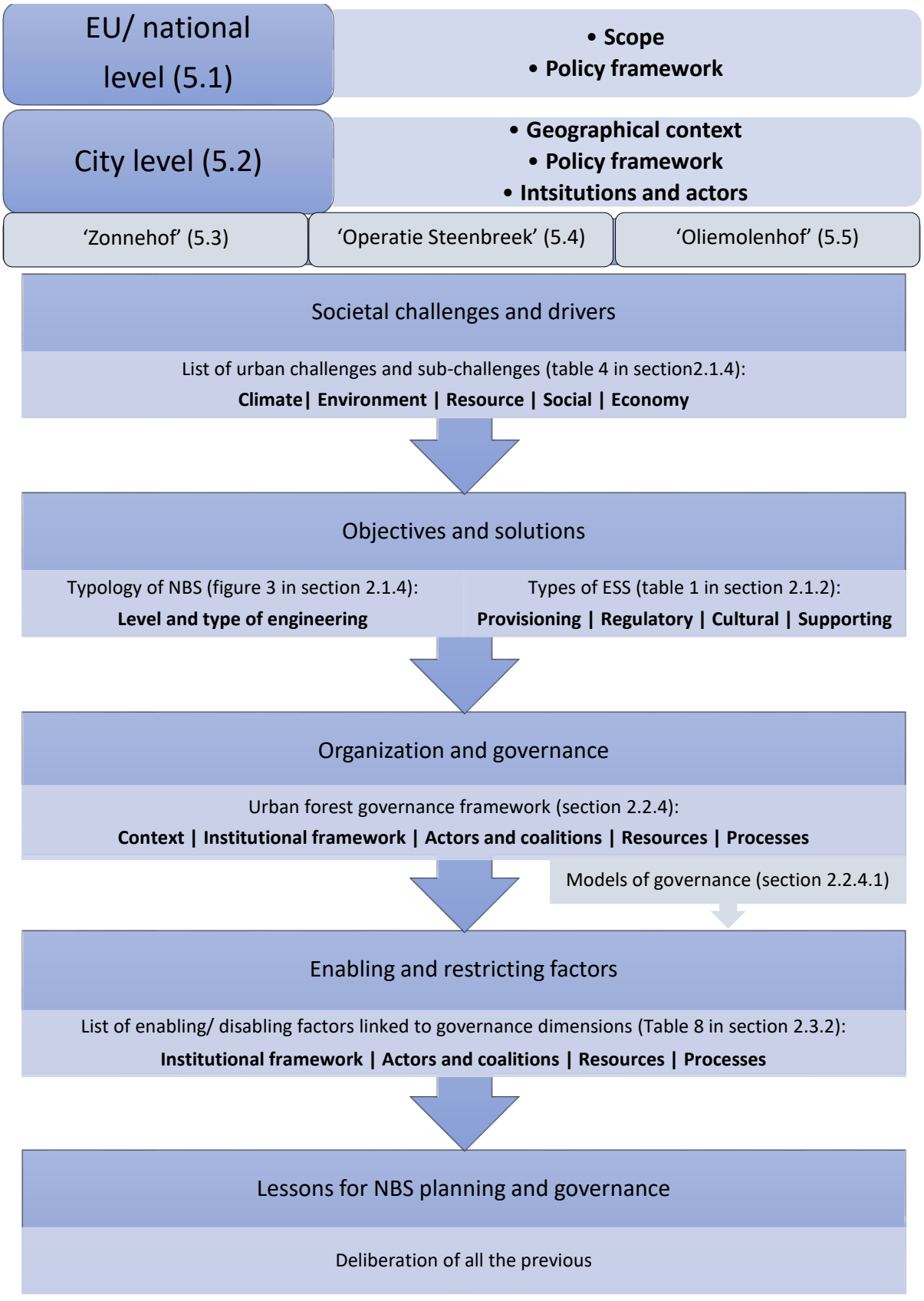
Unit 5: Lessons for NBS planning and governance

For the unit of observation 'lessons for NBS planning and governance' the key components of the projects, which are useful learning outputs for NBS planning and governance, have been collected.

3.3 CONCEPTUAL MODEL

By combining the overall analytical structure of this thesis (section 3.1) with the conceptual approach for analyzing NBS projects (section 3.2), a conceptual model is established. This model gives an overview of the structure and content of the empirical analysis done for this thesis. The outline of the model is used to guide the analysis and structure the findings. A visual representation of the conceptual model is depicted in figure 11.

Figure 11 Conceptual model



Source: Author

4 METHODOLOGY

The previous chapter explained how different theories, concepts and frameworks have been brought together to construct a conceptual framework for this thesis. The following chapter builds on this, by explaining the research design (section 4.1). Furthermore, the methods and techniques for data collection and processing are discussed (section 4.2).

4.1 RESEARCH DESIGN

In this thesis, the overarching strategy is a qualitative 'case study'. According to Yin (2009), research objectives and questions within a case study are addressed by investigating a phenomenon in a real-life context (in this case: the implementation of NBS in the context of Amersfoort) on which the researcher does not have the possibility to control the events. The aims for this thesis resemble these characteristics. A case study, therefore seems to be an appropriate research design.

The case study design for this thesis can be divided into 4 layers namely; the context, the case, the units of analysis and the units of observation. Figure 12 gives a visual representation of the research design and these layers. Each layer covers a certain scale-level and degree of specificity. The main premise of this design is that the case should not be viewed as an isolated instance, but rather as part of a wider context. The same applies for the units of analysis and units of observation respectively. The following chapters of this thesis will start from the outside layer and will work its way to the inner layers, becoming more specific as the scale-level decreases. After reaching the most specific inner layers (units of observation), the findings will be reflected upon and eventually reaching the outside layer again. This premise is based on the social-ecological approach (see also section 2.1) and the multi-level governance framework (see also section 2.2.3). Both theories are conscious of the existence of different scales and their mutual influence. To be able to give a conclusion about the case (city of Amersfoort), different scales have been investigated. The research design in figure 12 displays this by using layers.

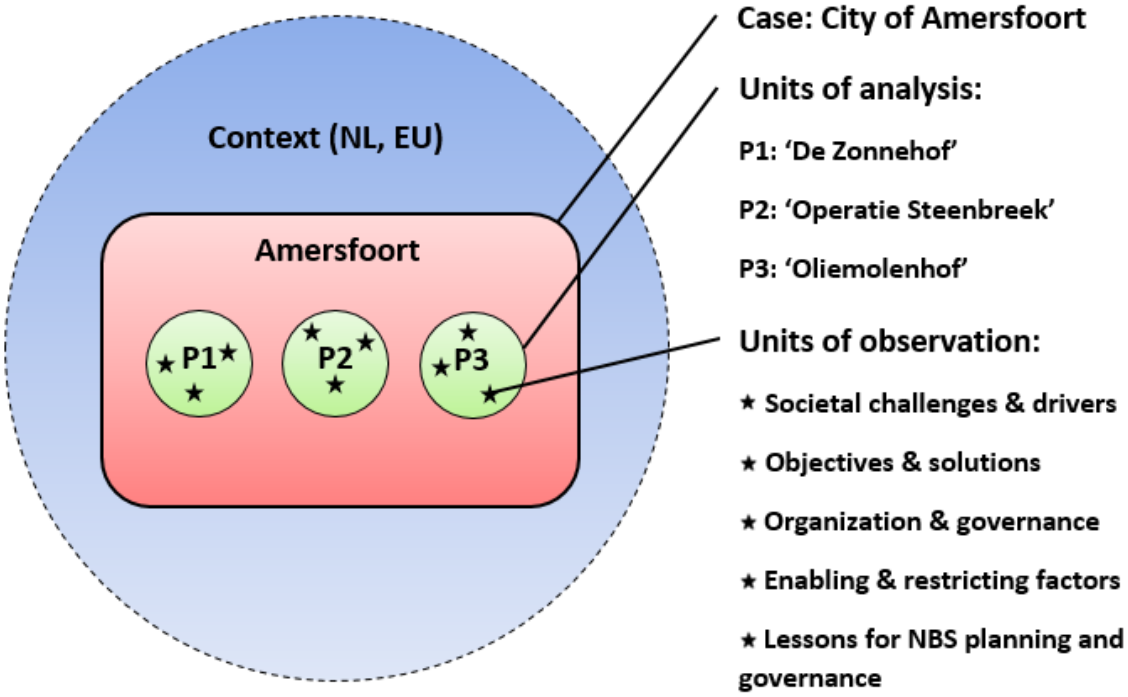


Figure 12 Case study design with different layers of analysis (source; Author)

To clarify the design, each layer will be briefly discussed in the following paragraphs.

1. **Context:** For the case of Amersfoort, which is a city in the Netherlands, the contexts of the Netherlands and the European Union (EU) have been chosen. Both contexts have been chosen because of their institutional and policy frameworks. European agreements on, for example environment, could influence the way that member states form their national policies on NBS. Furthermore, the EU is also an organization that desires to be world leader in the field of NBS and who also promotes NBS through the funding of research programs (EC, 2015). Many of these programs, such as the 'NATURVATION' (Naturvation e.d) and Nature4Cities project (Nature4Cities, 2017), include case study research similar to this thesis, which is advantageous for comparability reasons. European policies do not often directly influence local policies of cities. Most of the time, member states are free to choose their own way of implementing policies. In combination with their own national ambitions in the field NBS-related issues, the national institutional - and policy frameworks could influence the development of NBS on a local scale. For this reason, the most relevant EU and Dutch policies regarding NBS will be analyzed in section 5.1.

2. **Case:** The investigated case in this thesis, is the city of Amersfoort in the Netherlands. The city has been chosen for several reasons. In contrast to most cities, that have been studied in regard to NBS or other ecologically-oriented concepts, are mostly relatively big cities. For the NATURVATION project, the cities of Amsterdam, Utrecht and The Hague are for example used for case studies. These three cities belong in the top-4 biggest cities in the Netherlands, while Amersfoort is only about the 14th biggest city in the Netherlands (UNdata, 2019). In order to add new examples to the pool of NBS case studies, smaller cities might also be interesting to look at. Another reason to study Amersfoort is because of recent spatial developments in the city, among which NBS-related projects. In 2007, the city of Amersfoort won the 'Entente Florale' prize for being the 'greenest' city of Europe (ANP, 2007). Even though the city still has some notable green elements and an overall green appearance, there are also areas that have lost their green character because of ongoing urban development. The exemplary projects in this thesis show an ambition of the city, to reverse this trend and maybe becoming the 'greenest' city of Europe ones more. This ambition could also be noticed by the number of local businesses, NGO's, citizens organizations, etcetera dealing with for example, sustainability, climate adaptation or biodiversity (Gemeente Amersfoort, 2016). This combined with a relatively green city administration (RTV Utrecht, 2018), makes Amersfoort a good place to study NBS-related projects as well as the governance aspects dealing with multiple stakeholders. In section 5.2.1 and 5.2.2. respectively, a short description of the geographical context and an analysis of the local policy framework is given. The institutional set-up and relevant actor discussed in section 5.2.3.

3. **Units of Analysis:** Within the city of Amersfoort several NBS-related projects have been carried out. In order to find "how" these projects managed to make spatial changes as well as "what" these changes include and "why" it needed to change, it is important to zoom in to the project level. The units of analysis in this thesis are the following projects within the city of Amersfoort; 'Zonnehof', 'Operatie Steenbreek' and 'Oliemolenhof'. The locations of these projects are represented in figure 13.

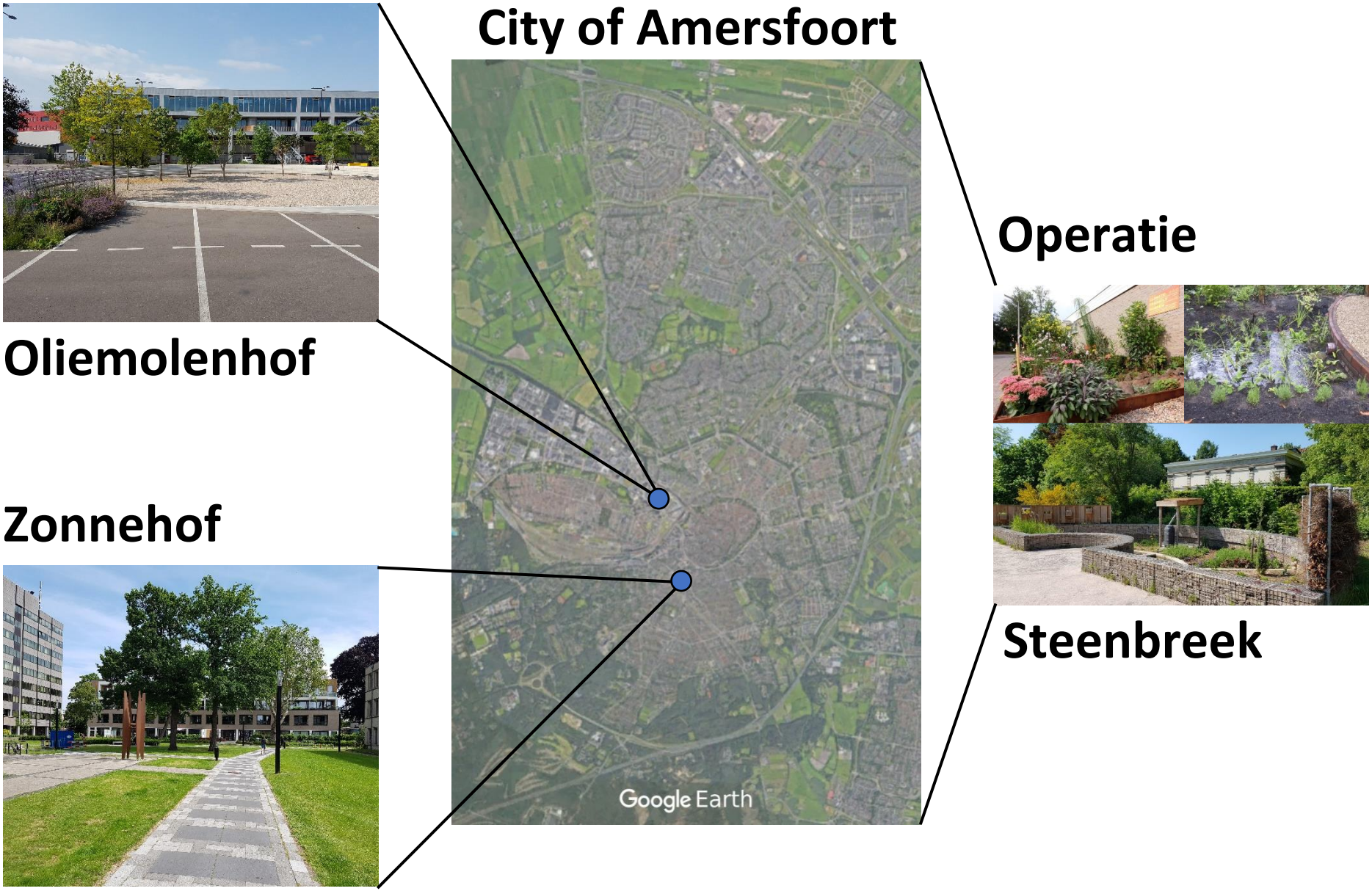


Figure 13 Projects used for empirical study.
Picture Oliemolenhof (source; Author 12/07/19); Picture Zonnehof (source; Author 18/06/19); Picture City of Amersfoort (source; Google Earth)
Pictures Operatie Steenbreek (source, Lekker in je tuin, n.d. put together by author)

Both the 'Zonnehof' and 'Oliemolenhof' have specific locations, while 'Operatie Steenbreek' is a city-wide project. The choice for these three projects was based on a couple of conditions. Most importantly, the project needed to approach the NBS definition formulated in section 2.2.2. The following aspects are therefore taken into account; "challenge orientation", "ecosystem process utilization" and "practical viability" (Albert et al, 2019). In regard to the "challenge orientation" and "ecosystem process utilization", many projects qualified. To narrow the number of projects down, the condition of "practical viability" played a significant role. "Practical viability" is interpreted as being a 'how' question; how did the project manage to realize their goals? This is an important question in regard to governance, which is a distinctive factor within this thesis. Based on the "practical viability", projects were chosen because of their distinctiveness in the overall strategy for realizing their goals. During a preliminary investigation, the three chosen projects were estimated to all have a distinctive strategy and type of organization. The units of analysis are discussed in section 5.3 ('Zonnehof'), section5.4 ('Operatie Steenbreek') and section 5.5 ('Oliemolenhof').

Units of observation: The analysis of the chosen projects, could have been done in many different ways and by looking at different aspects. For this thesis however, the following units of observation are chosen; 'societal challenges & drivers', 'objectives & solutions' and 'organization and governance'. These units of observation are the aspects of the projects that have been investigated in order to create the desired narrative for each project. The first unit of observation, 'challenges & drivers', is taken into account to find the main cause and driving forces behind each of the projects. It aims to answer a "why" question, like for example; why is a certain intervention needed? Or why does it have to include NBS instead of another option? The second unit of observation, 'objectives & solutions', is taken into account to be able to describe the actual plans and their implementation. It aims to answer a "what" question, like for example; what kind of NBS is deployed to fulfill a certain objective? Or what type of ecosystem service had been targeted with a certain solution? The third unit of observation, 'organization & governance', is taken into account to explain the way that involved actors influence the outcome and planning process of a certain project. It aims to answer a "how" question, like for example; how did a certain actor influence the planning process? Or how has the projects' financial aspects influence the outcome?

4.2 DATA COLLECTION AND PROCESSING

The data collection methods in this research project are mainly qualitative, realizing an in-depth narrative on the way that nature-based solutions are manifested in planning policy and practice in Amersfoort. The two main data collection methods are; a desk research and stakeholder interviews.

A desk research has been conducted to explore the case, its context and the exemplary projects. Using different sources such as policy reports, websites and databases, general information could be gathered on EU, NL and local NBS policy contexts and on the exemplary projects. The stakeholder interviews were held with relevant researchers, architects, planners and others who influenced the planning process. In total 8 semi-structured interviews have been conducted, each with a duration between 45 and 60 minutes. All interviews have been audiotaped and transcribed. The first interviewees were selected, based on their involvement with one, or more, of the three projects or because of their overview on the topic and its stakeholder network. A snowballing technique was used to find other respondents. To give an overview, the respondents are listed based on the actor they belong to, their function or role and the type of knowledge they were asked for. Table 10 shows the list of respondents.

Table 10 Overview of respondents

Respondent # (Date)	**Actor**	**Function/ role**	**Type of knowledge**
1 (18/06/19)	Bureau G84: Bureau for garden and landscape architecture	Landscape architect	Project 'Zonnehof' and general knowledge
2 (25/06/19)	Wageningen University & Research + Stichting Steenbreek (foundation)	Coordinator and project manager	Project 'Operatie Steenbreek' and general knowledge
3 (27/06/19)	Self-employed gardener + Stichting steenbreek (foundation)	Self-employed gardener and rainwater coach	Project 'Operatie Steenbreek' and general knowledge
4 (01/07/19)	Municipality of Amersfoort	Water and sewage advisor	Project 'Zonnehof' and general knowledge
5 (02/07/19)	Water authority: Vallei & Veluwe	Policy advisor and account manager	All projects and general knowledge
6 (05/07/19)	Municipality of Amersfoort	Advisor for living environment	All projects, general knowledge and * policy framework in particular
7 (12/07/19)	Schipper Bosch: Development & investment firm	Manager projects and development	Project 'Oliemolenhof' and general knowledge
8 (18/07/19)	Twynstra Gudde: Consultancy firm	Environmental manager and process director in water sector	All projects, general knowledge and * knowledge on organization and governance in particular

Source: Author. * Respondents chosen for alleged knowledge on particular topic. The effect of this, is explained in the discussion of the research methods for each research question, which can be found below.

The interviews are conducted with help of an interview guideline, containing project-specific as well as more general questions on the implementation of NBS-related projects in Amersfoort. Interview topics and questions were set up in accordance with the units of observation, the research objectives/

questions and components of the NBS definition for planning and governance research by Albert et al (2019). Table 11 shows the connection by building on the analytical structure (section 3.1).

Table 11 Example interview questions per unit of observation

Unit of observation	Addressed research objective/ question	Addressed component of NBS definition (Albert et al, 2019)	Example interview questions
Societal challenges and drivers	RO 1 and RQ i	'Challenge orientation' ('why')	What societal problem has been attempted to be solved with the help of (…project A…)?
Objectives and solutions	RO 1 and RQ i	'Ecosystem process utilization' ('what')	What were the (expected) results relative to the societal challenge? To what extent did ecosystem processes contribute to solving this problem?
Organization and governance	RO 1 + 3 and RQ i + iii	'Practical viability' ('how')	Could you indicate what the most important actors/stakeholders were for this project? Was there a quick consensus about the objectives and expected outcomes between the various parties or did many compromises have to be made? How is the project funded?
Enabling and restricting factors	RO 2 and RQ ii	'Practical viability' ('how')	* What do you see as the main enabling and restricting factor for the implementation and promotion of nature-based solutions?
Lessons for NBS planning and governance	RO 3 and RQ iii	'Practical viability' ('how')	What should happen, based on your experience, to ensure an effective sustainable implementation of nature-based solutions in the future?

Source: Author; reused parts of table 9 from section 3.1 (analytical structure). * The main enabling and restricting factor were asked as a concluding question. However, during the interview another technique was used to find the enabling and restricting factors. This technique is explained below, in the paragraph about the research methods for research question 2.

After completing the interviews, the data has been structured following the conceptual framework. Firstly, the data is structured following the levels of analysis as illustrated (table 9) and discussed earlier (section 3.1). The gathered data has first been divided between EU and national level analysis, city level analysis and project level analysis. After this separation, the data is split up again for each level, based on the different types of analyzes done within each level. Because the project level involves specific and in-depth types of analyzes, the data needed to be categorized ones more for each separate unit of observation. The theories, concepts and frameworks used to analyze each unit have already been addressed in the earlier chapters of the thesis and could be found combined in the conceptual model (Section 3.3).

In order to eventually reach an answer to the research questions, different methods were used. The rationale behind the method for each question and how they are implemented is explained below;

Research question 1: *To what extent and in what way is the concept of NBS being used and promoted in planning policy and practice in Europe, the Netherlands and Amersfoort?*

The approach for this research question consisted of two parts; 1) an analysis of the way that NBS is manifested within European and Dutch policy and practice and 2) an analysis of the way that NBS is manifested within policy and practice in Amersfoort. It is important to distinguish these two parts, because different methods were used for both. For the first part the analysis was led by a literature review, for example by looking at EU and Dutch government websites, reports, articles etc. A report that was particularly helpful in describing the policy frameworks on EU and national level, was the 'NATURVATION' report by Davis et al (2018). This report was used as a starting point for the rest of the analysis. Information on NBS at the EU and national level was only partly collected through interviews. Respondents were more likely to give information about the local situation, which is why the analysis of the second part was more strongly based on interview data. The interview with a municipal policy-maker was done with special attention to the local policy framework (interview 6). For this interview extra questions were added to the basic interview guide, which already contained basic questions about the policy framework (see interview guide in the annex). The added questions were inspired by the interview guide used by Davis et al (2018), which was used for the analysis at the EU and national scale. Some of the added questions were; *which departments could become involved in NBS? What policies and policy documents are considered most relevant to NBS? What funding instruments are available for the implementation? To what extent do these policies set mandatory requirements? Are quantifiable goals been set for these policies?* In addition, also for the second part, a literature review was done focusing more on local sources. The analysis resulted in a description of both NBS in the EU and the Netherlands (Section 5.1) and NBS in Amersfoort (Section 5.2).

Research question 2: *What enabling and restricting factor for the implementation of NBS could be identified and how do they influence the development and integration of the NBS concept into policy and practice in Amersfoort?*

The main method of data collection for this research question was interviewing. The approach for this research question has been focused on figuring out the way that certain enabling and restricting factors are manifested in the case of Amersfoort. Within the interview, respondents were asked to give their opinion about aspects that could be seen as an enabling or restricting factor regarding NBS implementation. These aspects were formulated in advance and are based on enabling and restricting factors found in literature (see table 8 in section 2.3.2). To illustrate how this played out during the interviews, a legal aspect could be used as an example;

The interviewer could for example ask; *Is the current legal framework something that is obstructing or supporting NBS implementation? And why?*

The respondent would then react with something like; *Obstructing, because… or; Supporting, because… or; I do not know/not relevant.* (note: just an illustrative example)

In addition, room was left for respondents to share experiences with enabling and restricting factors that were not part of the earlier formulated list. In practice most relevant enabling and restricting factors already became apparent before the actual section about these factors was completed. The section that covered the enabling and restricting factors, therefore also functioned as a confirmation in many interviews. In the processing of this interview data, most emphasis was put on the reason why a certain factor was experienced as an enabling or a restricting factor.

Research question 3: *What institutions and actors are relevant to the implementation of NBS in and what governance approaches would be beneficial for realizing preferred development strategies?*

For the third research question the main of data collection was also interviewing. The questions asked were intended to evoke respondents to share their thoughts on the course of the planning process they were associated with. The main goal was to create an overview of what happened during the process, who were involved and what aspects were the most influential for the realization of the project. This interview data has been streamlined in consistent manner for each project with the help the urban forest governance framework (Lawrence et al, 2013). This resulted in a narrative that characterizes each project in terms of its governance. Because the main enabling and restricting factors can be assigned to certain governance dimensions, they are linked to the governance approaches. During the comparison of the governance approaches, these factors and the narratives are combined to come to a conclusion about the effectiveness of certain approaches for realizing certain development strategies.

5 RESULTS

The previous chapter discussed the overall research design and the main methods used to collect and process data. In the following chapter the results of the conducted research are presented. The results are presented in accordance with the analytical structure and categories presented in the analytical model in chapter 3. The chapter therefore starts with a description of the EU and Dutch context (section 5.1) and by the description of the city of Amersfoort (section 5.2). This is followed by the analysis of the exemplary NBS-related projects 'Zonnehof', 'Operatie Steenbreek' and 'Oliemolenhof', which will respectively be discussed in section 5.3, 5.4 and 5.5.

5.1 THE STATUS OF NATURE-BASED SOLUTIONS IN EUROPE AND THE NETHERLANDS

5.1.1 Scope

After its introduction in the late 2000's, the term "nature-based solution" has attracted more and more attention in research and policy spheres. The NATURVATION project, funded by the European Union, is a good example of an ongoing (2016 until 2020) research project that is focused on NBS. Within the study, 1000 NBS-related projects scattered around 100 European cities were examined. The results of this analysis are presented in the "Urban Nature Atlas", which is basically a database of NBS within these cities (NATURVATION, n.d).

The scope of 1000 projects within 100 cities shows that NBS is already established in a lot of European countries and cities. One of the countries contributing to the "Urban Nature Atlas", is the Netherlands. The cities participating in the Netherlands are Amsterdam, The Hague and Utrecht, who each contributed 10 NBS-related projects to the atlas (NATURVATION, n.d). These numbers also show that NBS are already established in these 3 Dutch cities as well. However, to get a better understanding of the development of NBS in Europe and the Netherlands the next section (section 5.1.2) focusses on the policy instruments that might drive this development.

5.1.2 Policy frameworks

Even though there seem to be many NBS projects carried out in Europe, the concept itself is not always represented appropriately within the relevant policy domains. Davis et al (2018) Investigated the appearance of the concept of NBS, as well as other related terms (e.g. green infrastructure, ecosystem-based approach and sustainable management) within selected EU and member state policy - and funding instruments. Table 12 shows all the considered instruments for the most relevant policy fields on EU level.

Table 12 Relevant EU policy fields and instruments

Policy Field	EU Policy instrument
Biodiversity	• Habitats Directive (1992) • Birds Directive (1979/2009) • Biodiversity Strategy to 2020 (2011) • Green Infrastructure Strategy (2013) • LIFE+ (the EU's financial instrument supporting environmental, nature conservation and climate action projects)
Water	• Water Framework Directive (WFD) (2000) • Floods Directive (2006)
Marine environment	• Marine Strategy Framework Directive (MSFD) (2008) • Blue Growth Strategy (& Guidance) (2012)

	• European Maritime and Fisheries Fund (EMFF) (2014)
Forestry	• Forest Strategy (2013)
Agriculture and regional policy	• Common Agricultural Policy (CAP) (2013), including the European Agricultural Fund for Rural Development (EAFRD) • Urban Agenda for the EU (i.e. Pact of Amsterdam, 2016)
Adaptation	• Climate Change Adaptation Strategy (2013)
Research	• 7th & Horizon (H2020) Framework Programs for Research and Innovation
Cohesion and growth	• Europe 2020 Strategy (2010) • Circular Economy Action Plan (2015) • Cohesion Fund • European Social Fund (ESF) • European Regional Development Fund (ERDF)
Environmental assessment	• Environmental Impact Assessment Directive (EIA) (1985) • Strategic Environmental Assessment Directive (SEA) (2001) • Protocol on Strategic Environmental Assessment (2008)

Source: Davis et al (2018)

From their analysis, Davis et al (2018) concluded that there are multiple EU and member state policy instruments that explicitly mention NBS-related concepts. However, when NBS-related concepts are mentioned in policy, they barely contain quantitative and measurable aims regarding the implementation and quality of NBS. Accordingly, many relevant policies only require voluntary NBS action or none at all. The policy framework analysis also showed a substantial neglect of urban areas when it comes to NBS. However, when policies on urban areas were included, they mainly focused on maintaining and restoring existing green and blue areas in contrast to introducing NBS for the creation of new green and blue areas.

The way that NBS-related concepts are represented within policy frameworks at national and EU-level can differ highly, as well as between different member states of the EU. In the Netherlands there seems to be a bit divergent policy framework in comparison to EU standards. One possible reason for this, lies in the level of adoption of EU vocabulary used in regard to NBS. Within Dutch national policy terms like 'building with nature', 'natural climate buffers', 'natural eco-corridors', and 'allowing natural processes more space' are more common than the terms like "nature-based solution" or "green infrastructure" used by the EU. The concept "ecosystem services" however, could be found more than one national policy. Nonetheless, the low level of EU vocabulary could be due to the fact that the country already has experience with implementing and funding NBS-related concepts. A policy, including funding, for the realization of the 'National Ecological Infrastructure' has, for example been active as early as the year 1990 (Davis et al, 2018). Because they are already used to certain terms, they might not feel the urge to change their own vocabulary only because the EU started to introduce new words.

More recently the 'Deltaplan on Spatial Adaptation' and the upcoming 'Environment and Planning Act', could be influential in the implementation and upscaling of NBS-related concepts. Both policy instruments depend on some form of involvement with governmental organizations on a lower geographical scale, like the provinces, water authorities (In Dutch: waterschappen) and municipalities. The 'Deltaplan on Spatial Adaptation' presents a long-term strategy that is recently still focused on analysis of the problem at hand, which is mainly water resilience and climate adaptation. The mapping of vulnerabilities and conducting risk dialogues are examples of steps that are being taken at regional and local level (Interview #8, table10). It is only after the analysis phase, that climate-resilience can be embedded into policy and actions, which is aimed to be completed in 2020. So, how the 'Deltaplan on

Spatial Adaptation' will influence is the implementation of NBS is still unclear and also dependent on local conditions. For the upcoming 'Environment and Planning Act' roughly the same applies. Each municipality can decide to what extent they want to follow the new planning act. Nonetheless, one of the main starting point from the new act, is to provide space for sustainable development. The 'Environmental and Planning Act' for example provides room to implement an ecosystem approach. It does however not give incentives to do so (De Graaf et al, 2018). Both the 'Deltaplan on Spatial Adaptation' and the 'Environment and Planning Act' have the potential to make an impact on the implementation and upscaling of NBS-related concepts, however it is unsure to what extent they will be supportive. This still depends on the local implementation of these policies.

5.2 THE STATUS OF NATURE-BASED SOLUTIONS IN AMERSFOORT

5.2.1 Geographical context

In the city of Amersfoort, the challenges surrounding climate change and sustainability could be seen as a derivative of the challenges on European and national scale. The "energy transition" challenge is a major topic in the national climate debates and could also be seen as the most prominent challenge in Amersfoort. This challenge also seems to overshadow the other challenges in regard to climate change. Nonetheless, there is also a major 'water' challenge that is relevant to the city of Amersfoort. This climate adaptation challenge is relevant because of the geographical position of the city, relative to two major ridges called the 'Utrechtse Heuvelrug' and the 'Veluwe' (Interview #2, table10). The city of Amersfoort is situated in a "bottleneck" between these ridges, which causes water to flow from these ridges into the valley and towards the city. Figure 14 shows the position of the city, which illustrates the city's relation with water from the two ridges. Because of this relation, the city has to deal with large amounts of water, which could become more problematic when extreme weather events become more frequent due to climate change (Gemeente Amersfoort, 2016).

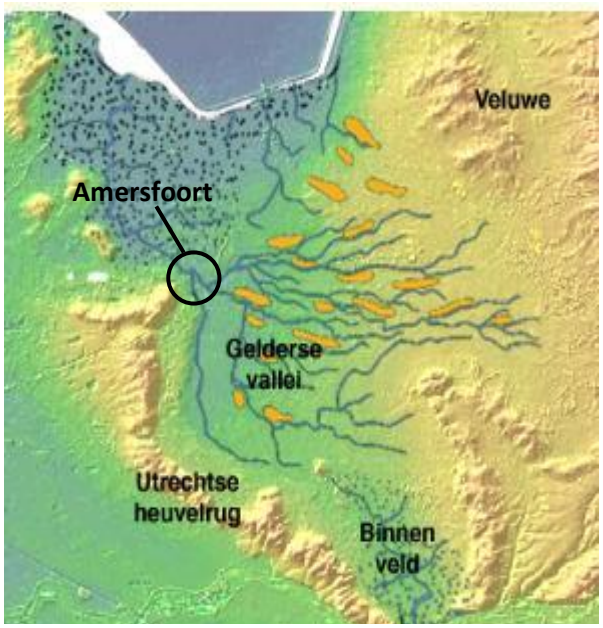


Figure 14 Geographical positioning of Amersfoort relative to ridges. Source: "De Eem vs. De Rijn," (n.d), edited by Author.

In the investigated NBS projects in Amersfoort, water-related challenges were the most prominently targeted in relation to climate adaptation. Urban heat was mentioned less prominently.

5.2.2 Policy framework

The city administration of Amersfoort has projected their spatial plans for the city into a document which they call "Structural Vision Amersfoort 2030". Many other Dutch cities work with similar documents, which are often a combination of different long-term sectoral visions. The structural vision aims to reveal connections between the different sectoral agendas in order to set a coherent course for the city, steering the city's spatial policies (Gemeente Amersfoort, 2013). The 2030 vision document for Amersfoort has been written between 2010 and 2013. From 2013 until now (2019) however, some policy programs are already finished, while other policy programs have been added to the structural vision of the city. Spatially, the 'Structural Vision Amersfoort 2030' works in a manner,

where different parts of the city are being designated into zones. Each zone has their own characteristic. On the basis of these characteristics, desirable visions are assigned to each part of the cities. The locations of the 'Zonnehof' and the 'Oliemolenhof' projects, which are investigated in this thesis are mentioned in this document.

A more recent policy document, in regard to NBS, is the "Green Vision". The "Green Vision" was created in 2016 through an interactive policy process, which entails a collaboration between councilors, residents, interest groups, green experts, aldermen and civil servants (Gemeente Amersfoort, 2016). The 'Green Vision', summarizes the contemporary (2019) approach towards climate adaptation and the role of "green" therein. This approach is characterized by a bottom-up way of planning and focusses on working together with the communities and market parties. It assumes a proactive community and a community that wants to manage and co-produce their own environment. The role of the municipality is therein more diverse and also less hierarchical. They often play a more facilitating role, in which bottom-up initiatives are encouraged. This type of mentality has also been noticed by some people that have been interviewed for this thesis (e.g. Interview #2; Interview #3; Interview #5; Interview #6, table 10). Interesting enough, they all explained this mentality in a similar fashion, which is something along the lines of; "finding the right energy" or "looking where the energy is". What is meant by this is, that actions are focused on facilitating people or organizations that show (enough) motivation to make a change to their environment. This goes along with the bottom-up planning mentality, because the initiatives (energy) comes from within the communities and businesses instead of being imposed from above. In that sense, the 'Green Vision' endorses a different approach than more "traditional" planning approaches.

Figure 13 shows what documents are steering for the city's spatial policies. Next to the "Green Vision", the "Policy Vision Green-Blue Structure" from the year 2004 has been concerned with NBS-related topics. This policy still applies, however its implementation program has already come to an end (Gemeente Amersfoort, 2016), making it less relevant than the more recent "Green Vision". Nonetheless, the municipality is currently (at the time of writing this thesis) working on mapping the green and blue infrastructures of the city. This could possibly have a positive effect on the conservation and enhancements of UGI in the city (Interview #3, table 10). The UGI maps were not yet completed at the time of writing and therefore not including in this thesis. The effects of mapping the cities UGI could be interesting to investigate in future research.

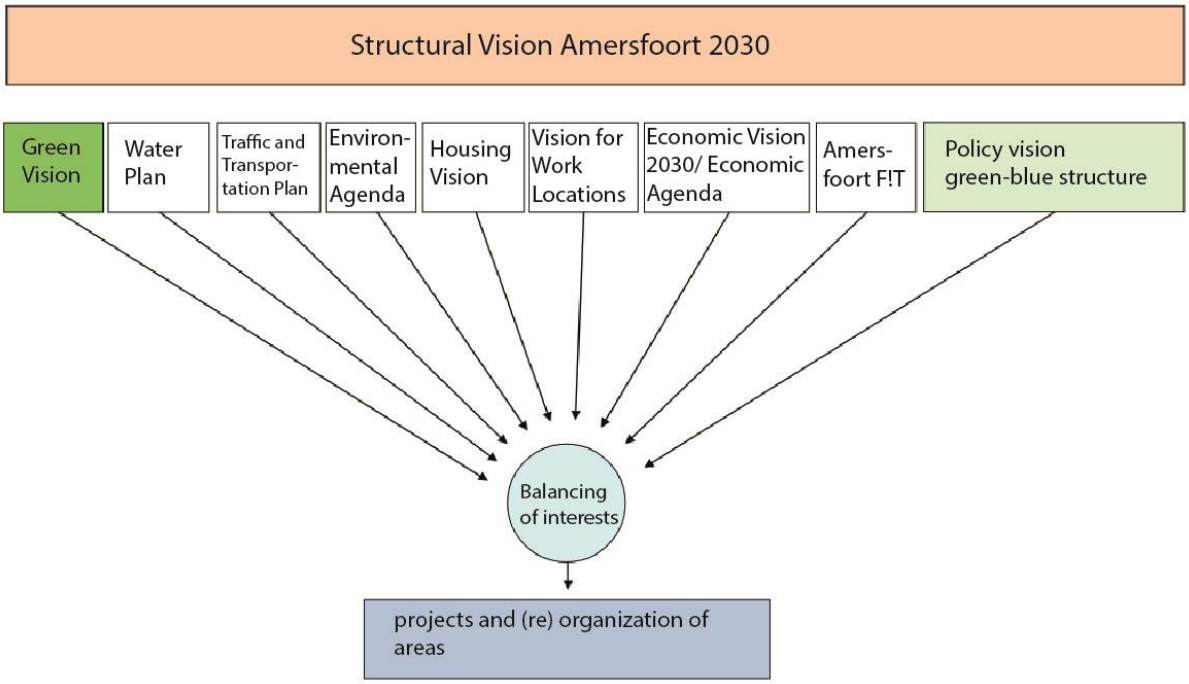


Figure 13 The Green Vision and other municipal documents steering the city's spatial policies. Source; Gemeente Amersfoort (2016), translated into English by author.

When it comes to policy implementation, the "Green Vision" can be best seen as part of the program; "Climate Proof and Green City". In this program, the important role of natural elements for climate adaptation is being endorsed. However, in contrast to "nature" (represented in "Green Vision"), the topic "climate adaptation" does not have a specifically dedicated policy but is rather represented in a bundle of existing policies (Gemeente Amersfoort, 2019). Another major difference is the budget that is made available for implementation of the combined program "Climate Proof and Green City". The budget for projects within the "Green Vision" is 2 million euro from 2019 until 2022 (500.000 euro each year), while there is no money made available specifically for "climate proofing" the city (Gemeente Amersfoort, 2019; Interview #6, table 10). Climate adaptation is a topic that is supposed to be mainstreamed into existing policy fields. One of the ways to achieve this is the introduction of a checklist for "climate proof building" to increase the number of municipal projects that meet certain quality standards in regard to climate adaptation (Gemeente Amersfoort, 2019). Furthermore, the municipality of Amersfoort has recently put together a new manual for the planning and design of public space, which contains comprehensive guidelines for most relevant aspects of public space, such as climate adaptation, accessibility, green elements, soil and substrate, etcetera. In this way, they aim to incorporate all these aspects into the planning and projects (Interview #6, table 10).

For the investigated projects in this thesis, not every policy is as relevant as the other. The 'Operatie Steenbreek' project for example, seems to be shaped more by recent policies and in particularly the 'Green Vision'. The 'Zonnehof' and 'Oliemolenhof' projects are less shaped by the 'Green Vision' but have more to do with the other policies in the 'Structural Vision Amersfoort 2030'.

5.2.3 Institutional set-up and key actors

For the creation and implementation of policies relevant to NBS, different institutions and actors are important. The initiation of an NBS project (or any other spatial project) could start from different sectors in society (government, community and market; see table 6 in sub-section 2.2.4.1). In the projects investigated in this thesis, the actors came from different sectors of society. The birthplace

of an initiative is partly prescriptive for the conditions that the project should meet (Nature4Cities, 2017). Despite this, the projects all followed the local planning system. The municipality of Amersfoort has been involved in all the investigated projects, differing from being landowner, initiator, facilitator, director or regulator. Despite their variable role, the local planning system seems to be shaped by formal municipal regulations. These regulations are often prepared by the departments that are involved. In Amersfoort, the municipal departments that are the most relevant to NBS-related topics (e.g. spatial planning, urban development, climate change adaptation and mitigation, nature, sustainability, biodiversity, etcetera) are the departments of: 'city and development', 'projects and programs', 'living environment' and 'living and working climate' (Interview #6, table 10). The different aspects that are often required for NBS projects, are scattered of the different departments. Each department translate their strategic plans into policy documents, similar to what is depicted in figure 13. Theoretically, all the sectoral plans are combined and balanced, after which certain actions are taken. In practice however, this process is sometimes associated with longevity, ambiguity or conflict (Interview #2; Interview #6; Interview #7, table 10). In collaborative processes, where the municipality is dependent on actors from other societal sectors, this could become problematic.

In many NBS-related projects, the municipality works together with different partners on who act on different scale-levels. On a regional level, relevant partners are for example; the provinces of 'Utrecht' and 'Gelderland', the water authority 'Vallei and Veluwe' and 'Utrechts Landschap'. These regional actors could contribute financial support and knowledge. On a city level, certain interest groups are important like, for example environmental and nature organizations. On a neighborhood level, the main partners are the citizens themselves, however also local businesses, developers and investors are relevant actors (Gemeente Amersfoort, 2016). In the case of Amersfoort, the water authority seems to be emerging as an active stakeholder in terms of climate adaptation and urban water management. This is however not that unexpected, considering the geographical position of the city and the associated water challenges (see section 5.2.1).

5.3 THE 'ZONNEHOF' PROJECT

The 'Zonnehof' project started from the desire of local residents and companies as well as the municipality to refurbish the outdated 'Zonnehof' square, which was a paved parking lot with little qualities in terms of living/working environment. There were already plans for the redevelopment of buildings neighboring the square, with the most prominent plan being the transformation of the former city library ('De Zonnehof') into an apartment building. Instead of focusing solely on the real-estate, the rest of the square's environment became part of the urban renewal at the same time. In 2013, a group of people representing the local residents and companies, started a citizens' initiative called; BIZ! (Burgerinitiatief Zonnehof! which translates into: Citizens' Initiative Zonnehof!).

5.3.1 Societal challenges and drivers

The citizens' initiative aimed to create a low-traffic, green space in proximity to the city center for locals as well as visitors (Burgerinitiatief Zonnehof, 2013). To meet the initiative's requirements, the square needed to transform from a car-oriented place (drive-through and parking) to a more park-like and car-free place. The initial challenges that were aimed to be solved with help of the project were mainly social of nature, as the interventions should benefit the recreational value as well as the overall quality of the environment for the local residents and businesses. The project was therefore mainly driven by the desire of residents to give their own working - and living environment a make-over. For the refurbishment of the square, a design was developed by the citizens' initiative and with the help of the local landscape design bureau G84, who at the time of these developments, was located on the square as well.

Even though a design for a green new square was already made, a new actor started to interfere with the planning process. The regional water authority, which is called 'Waterschap Vallei & Veluwe', saw opportunities for the water-related goals they wanted to achieve within the city. Due to the high amount of hard impermeable surfaces on the former square, rainwater would regularly flow to lower situated areas causing harm there (for example by flooding the nearby underground parking facility) (Interview #1; Interview #4; Interview #5, table 10). The municipality also wanted to solve these water issues and therefore set some requirements in regard to the water management aspects of the project. According to the hired landscape architect, this 'water challenge', ended up being the most prominent challenge of the project (Interview #1, table 10). For the water authority, the project is seen as an overall quality injection for the area, while at the same time being an example of "good" urban water management. Such an example could be used to inspire other urban areas within the water authority's region or even to others outside the region (Interview #5, table 10).

To conclude, the main societal challenges were linked to water management. Nevertheless, the project has been driven by a citizens' initiative who mainly wanted to upgrade their living/working environment.

5.3.2 Objectives and solutions

The main objective of the project was to change the character of the square, so that it would fit the desires of the residents living/working there. This objective however needed to be combined with the water task brought forward by the water authority and the municipality. As a general solution, that worked for both objectives, a reduction of 'hard' poorly permeable surfaces and an increase in green surfaces was promoted. Ironically, the square was originally designed as a green square in 1959. The square however started to become more car-oriented and crowded with buildings, transforming into a car route and parking place over the years. One of the objectives of the project was to re-establish some of the green appearance that the square originally had. The following figures (figure 16 - 18) show the transformation that the square went through from 1959 until current times (2019).

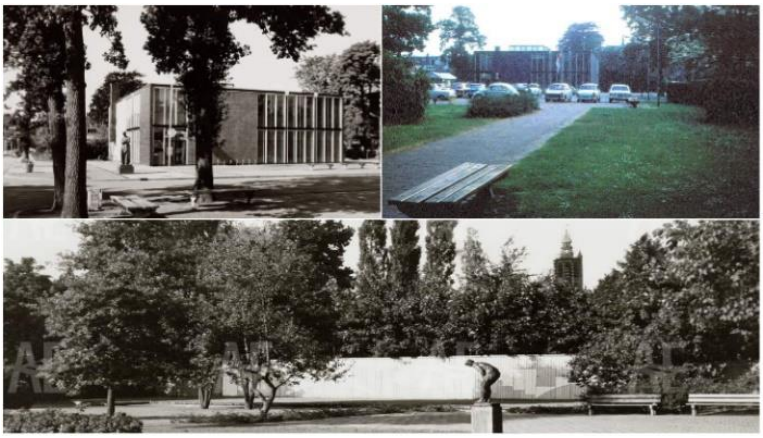


Figure 15 Impression of the original design of ‘Zonnehof’ square in 1959. Source: Burgerinitiatief Zonnehof (BIZ!), 2013

Figure 16 Impression of stony situation of ‘Zonnehof’ square in 2013. Source: Burgerinitiatief Zonnehof (BIZ!), 2013

Figure 17 Impression of 'Zonnehof' square after urban renewal in 2019 (Source: Author, picture taken on 18/06/19)

The main objective for the area was to create a park that was less dominated by cars and concrete than in the situation depicted in figure 17. In the new situation (see figure 18), natural elements have a more dominant position than before. This not only helped to give a greener park-like appearance to the area, but it also provided a quieter experience for those using the square due to the absence of cars passing through. Furthermore, the natural elements in the new situation act mostly by delivering cultural ecosystem services, like for example esthetic enjoyment (see table 1 in sections 2.1.2).

The 'greening' of the area was already part of the original plans, initiated by the citizens' initiative. The function of green would initially be related mostly to its esthetic value and appearance in contrast to the former paved and car-oriented situation. However, the 'greening' of the area also fitted the municipality's and water authority's policy towards urban climate adaptation. Green space can for example limit heat stress and infiltrate stormwater to limit nuisance (Waterschap Vallei en Veluwe, n.d.). One major objective regarding climate adaptation was to prevent regular floods of lower situated areas, including an underground parking facility. The hard poorly permeable surface of the former square caused water to flow from the square into lower areas, where it regularly caused harm. In order to prevent this from occurring, water-resilience measures were added to the plans of the square.

Because the water objectives were added at later stage of the planning process, the water measures needed to align to the earlier landscape design made by bureau G84. Because this landscape plan was valued by the citizens' initiative, big adjustments were not desired. Most of the solutions regarding water are therefore realized below ground level. The main interventions above ground are rain infiltration areas. These areas are lowered pieces of the land, which are dry most of the time except when there is long lasting rainfall with a certain intensity. In such a situation, the infiltration areas fill up with water, after which the water can slowly infiltrate in the soil. Even though the infiltration areas are one of the most prominent above ground solutions, they do not stand out. The areas are only noticeable because of their slight slope within the landscape, which is not something that interfered with the earlier design of bureau G84 (Interview #1, table 10).

5.3.3 Organization and governance

Context: The 'Zonnehof' project, consists of a refurbishment of an outdated public square, including adaptive measures for water management. The square is located in an inner-city neighborhood of about 218 inhabitants (Gemeente Amersfoort, n.d.-a). The square is surrounded by offices, shops and homes and used to function as parking facility for these amenities.

Institutional framework: The process for the 'Zonnehof' project formally started with the creation of the citizens' initiative in the beginning of 2013 (Burgerinitiatief Zonnehof, 2013). The 'Green Vision' and the 'Program: Climate Proof and Green City', did not yet exists at the time, so the 'Structural Vision Amersfoort 2030', would probably have been the most important steering document for urban development and renewal projects such as the 'Zonnehof' project. The project has been carried out, following local planning systems and municipal regulations. The area where the project took place fell under municipal ownership and was publicly accessible. However, the area went from being a parking facility towards a pocket park. As a result, access for cars is restricted in the current situation.

Actors and coalitions: The starting point for the redevelopment of the 'Zonnehof' square, lies with the formation of the citizens' initiative who wanted to refurbish the square alongside the developments that were going on in terms of adjacent real-estate. The citizens' initiative can therefore be seen as the initiating actor. Even though these initiators were equipped with relevant knowledge on urban planning and architecture, they still needed other parties to carry out the project. First of all,

the relevant landowners needed to be taken into account. Except for the neighboring real-estate, the 'Zonnehof' square is public land owned by the municipality of Amersfoort. Approaching the municipality, therefore is a logical first step. The first designs for the "greening" of the square were based on ideas from the citizens' initiative and executed by bureau G84. These plans fitted the municipality's ambitions in terms of climate-resilience, who therefore started to take responsibility for the realization of the project. In addition to the municipality, the water authority started showing interest in the project because of its water management potential. The new green square had the potential to retain rainwater, which was also in the interest of the municipality. For the water authority, the water retainment is beneficial because less water spills into the sewage system, meaning less water treatment costs. Another benefit of the water retainment, which is beneficial for both the municipality and the water authority, is the reduction of nuisance in lower situated streets and building (e.g. underground parking facility) (Interview #1; Interview #4; Interview #5, table 10; Waterschap Vallei en Veluwe, n.d). Because of these mutual gains as well as the water authority's willingness to contribute financially, a collaboration was formed.

Resources: Different types of knowledge have influenced in the decision-making process of the project. The members of the citizens' initiative consisted of professionals working in architecture, real-estate, urban development etcetera (Burgerinitiatief Zonnehof, 2013). The citizens' initiative influenced the initial design through expert knowledge on urban design. Furthermore, the members could combine their expertise with their local knowledge of the city and neighborhood. In the original plans, bureau G84 was hired to create a landscape plan and design for the square, because of their expertise in landscape architecture. Their plans were later complemented with expert knowledge on water management from the water authority. At the basis of this knowledge was a technical report from water engineering bureau 'Wareco', made to inform the technical feasibility of the water management implementations (Klein Overeem, 2016). The whole process has been guided by the municipality, who made knowledge available on, for example the local sewage systems and infrastructure (Interview #4, table 10). In terms of financing, the project has been realized using municipal funds, a direct investment from the water authority for the financing of the water system and a fund for urban renewal made available by the Province of Utrecht (Interview #5, table 10). The financial contributions from the water authority and the province were important mechanisms that helped the implementation of the project. As a catalyst for the project however, the establishment of an agreement between the citizens' initiative and the municipality was essential.

Processes: Because the citizens' initiative was already convinced by the design made by bureau 84, they did not want to deviate from this. In order to realize both the wishes of the citizen's initiative as well as the water objectives, certain trade-offs were made. In order to interfere as minimal as possible with the initiative's design, the water-related plans were for the most part designed below ground level. In the end, the citizens' initiative was satisfied with the result because of the green character of the new square. The water authority was satisfied because of the possible saved water treatment costs and possible saved costs in terms for an insufficient future sewage capacity and associated maintenance. However, it was also important for the water authority to create an example of an inner-city water and climate adaptive project, which could be used to inspire others (Interview #5, table 10). The municipality was satisfied, because they could respond to the citizens' initiative. They also benefit from avoiding potential costs for maintenance and repair caused by extreme weather events. In addition, the municipality needed to employ less funding instruments, because the water authority also made a financial contribution (Interview #4, table 10). Even though a joint plan and financing could eventually be arranged for the project, a certain level of uncertainty still exists. The uncertainty mainly exists in the assessment and monitoring of the "successfulness" of the project. The initial objective of the citizens' initiative was basically to change the square's character and to create a green

park-like place where people would like to stay. Whether this has been successful or not is highly subjective and is likely more based on preference than on exact measurement. Even though some of the people who were involved see the result as positive in terms aesthetic and recreational value (Interview #5, table 10; Waterschap Vallei en Veluwe, n.d), others might not. The successfulness in terms of water-resilience and climate adaptation are more tangible than for instance the aesthetic value, however they are often still hard to predict, monitor or assess. For the 'Zonnehof' project, measurements were done to predict how much water needed to be contained given a certain downpour occurring according a certain frequency. For the 'Zonnehof', a higher value for the downpours was used, than was necessary. This was done to create a margin, so that when the intensity or frequency of rain would be higher than predicted, the square could still contain water until a certain amount (Interview #1; Interview #4; Interview #5, table 10). This tends to a 'fail-safe' mentality (Ahern, 2011), as discussed in sub-section 2.3.1. The problem is however, that it is not sure how these downpours will behave further into the future. There are also no standards that dictate when a climate measure is done to the extent that it becomes successful. One respondent illustrated this as follows:

"What do I have to do to become resilient to climate change? I do not know. Do I have to store a certain number of millimeters of water? Do I need to have a certain amount of green? There is no standard on climate change yet, so I don't know if the 'Zonnehof' will still be suitable in 20 years. That is a bit of a search and that also raises the question; when is good, good enough? I mean; do I have to invest a million? Do I have to invest three million? What does it bring us? I find that difficult, that it is quite a search of how far to go?"

(Interview #5 Policy advisor and account manager, 'Water authority')

Similar concerns were expressed by a respondent working for the municipality. The following quote illustrates this:

"We [the municipality] want to be climate proof in 2030, but when are we climate proof? That is very complicated. (...) Also, if you are doing redevelopments, you want to be able to store enough water during a downpour, but how can you know exactly how much water you need to be able to store? When have we done enough?"

(Interview #6 Advisor for living environment, 'Municipality o Amersfoort')

The findings for the organization and governance of the 'Zonnehof' project are summarized in table 14.

Table 14 Organization and governance of the 'Zonnehof' project

The 'Zonnehof' Project	
Type Description	Project Citizens initiative for urban renewal
Scale	Neighbourhood
Context	
Object of planning	Refurbishment of outdated public square (including water resilience function)
People	218 inhabitants (2019)
Institutional framework	

Policies	EU: Green Infrastructure Strategy (2013), Water Framework Directive (2000), Floods Directive (2013), Climate Change Adaptation Strategy (2013) NL: National Ecological Infrastructure, Deltaplan on Spatial Adaptation, Environment and Planning Act Local: Structural Vision Amersfoort 2030, Policy Vision Green-Blue Structure
Planning and regulations	Local planning systems (bottom-up initiative), following municipal regulations.
Ownership	Public: municipal ownership
Access and use rights	Public access, restricted for cars.
Actors and coalitions	
Primary stakeholders	Citizens Initiative (BIZ!), Municipality, Water authority, Province (Utrecht), Landscape Design Bureau (G84), Water Engineering Bureau (Wareco)
Other stakeholders	Other citizens and businesses
Partnerships	Design partnership: Municipality, citizens initiative and landscape design bureau Water partnership: Municipality, water authority and water engineering bureau
Power analysis	Citizens initiated project, but municipality managed the rest of the process
Resources	
Funding	Governmental (Province and Municipality) funding + direct investment from water authority
Knowledge and information	Expert knowledge on urban design (also local knowledge; BIZ!), landscape architecture (G84) and water management (water authority, Wareco)
Delivery mechanisms	Agreement between municipality and citizens initiative; Financial contribution from water authority and province.
Processes	
Discourses	Green square discourse: Create a park-like and green living/ working environment; Water management discourse: Potential of the area in regard to water management should also be exploited.
Participation, engagement and conflict management	Water management discourse conflicted with existing design supported by citizens initiative but was fixed through mutually acceptable compromises (designing below ground level)
Monitoring and evaluation	'Fail-safe' mentality: Choosing a higher value for downpours, which the square can process to create a margin.

Source: Author (based on Lawrence et al, 2013)

5.3.3.1 Governance model

Based on the findings for the 'organization and governance' of the 'Zonnehof' project, a characterization of the governance model can be made. In the 'Zonnehof' project, the municipality, the water authority, the citizen's initiative and others worked together in a collaborative process. The role of the municipality and the citizen's initiative in the initial plan were more or less equivalent. The water authority joined the project later in the process but was also granted an equivalent role in relation to the other actors. The planning process is therefore not characterized by hierarchy, but rather by equivalent roles. This governance approach therefore resembles the 'Interactive governance' mode, based on Driessen et al (2012). From the five clusters of governance models (see

table 7 in sub-section 2.2.4.1), the governance approach of the 'Zonnehof' project mostly resembles cluster 5; 'Network Governance'. Figure 19 depicts the positioning of this cluster within the governance models framework.

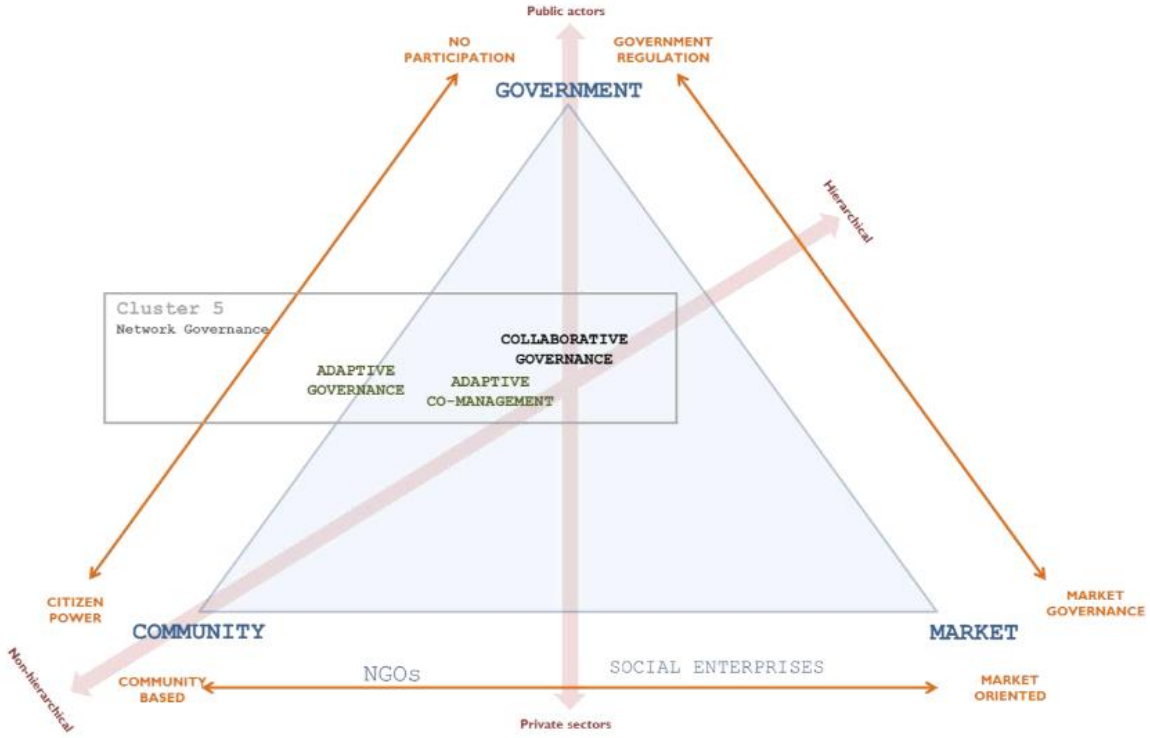


Figure 18 Positioning of cluster 5 within the governance models framework. Source; Nature4Cities, 2017.

5.3.4 Enabling and restricting factors

Generally, interviewees (Interview #1; Interview #4; Interview #5, table 10) as well as others (Waterschap Vallei en Veluwe, n.d) seem to be positive about the 'Zonnehof' project. This positive attitude towards the project is not only based on the outcome of the project, but also on the process. The collaboration between citizens, municipality and water authority is particularly viewed as a factor of success for the project (Waterschap Vallei en Veluwe, n.d). One way that this positive attitude could be noticed, is through the fact the project is being used as an example not only for its results but also to showcase the collaborative process (Interview #5, table 10; Waterschap Vallei en Veluwe, n.d).

The fact that the project is used as an example of "good practice", might insinuate that such collaborations do not take place that often or do not take place in a successful way. In regard to this, an interviewee from the water authority noticed that an important restricting factor lies in the persistence of so-called "sectoral silos" (Interview #5, table 10). A sectoral silo is a metaphor that is used to describe a traditional self-containing city department, that solely operates within their own sector and use their own "sectoral language" (Kabisch et al, 2016). The experience with this phenomenon from a respondent from the water authority is illustrated by the following quote:

"For the topic of climate this [sectoral silo's] is really a thing. At many municipalities, you can see that the topic of climate lies with people from water, but they are not the ones steering developments in public space. That [steering developments in public space] is done by people from project development or people who do the urban planning, so there you need to be making a connection."

(Interview #5 Policy advisor and account manager, 'Water authority')

5.3.5 Lessons for NBS planning and governance

For the 'Zonnehof' project, the main governance challenges had to do with bringing together the different interests of the actors. The project took a turn after the water authority started showing interest in the project. Their interests would have potentially been conflicting with the plans that were already there. Conflict was however avoided, because of the ability of the different actors to find compromises. The water authority carried out their plans below ground-level to minimize conflict with the design of that was already present. To do so, the water authority needed to concede but they were nonetheless satisfied with the result. In the end, the actors were able to find the right configuration between the different functions. In addition, the financial contribution from the water authority has been a positive impulse for the realization of the project as a whole. For the planning of NBS projects it could therefore be helpful to look at the potential of multifunctionality and therefore multiple actors. This does not only increase efficient land use, but it could also increase the possibilities in terms of feasibility. In the case of the 'Zonnehof' project, multifunctionality and collaboration has brought a positive result in terms of partnerships as well as functionality. This "success" has been taken as an example by involved actors as well as others, to inspire similar actions in other places. For the planning and promotion of NBS this could therefore be helpful.

5.4 THE 'OPERATIE STEENBREEK' PROJECT

'Operatie Steenbreek' was established in 2015 as a national movement against the garden paving trend that could be noticed in many private gardens in the Netherlands. About 80 municipalities as well as some provinces and water Authorities participate in the operation. The municipality of Amersfoort is one of the participating municipalities and is part of the movement since 2016 and is still currently active. Under the title 'Operatie Steenbreek', each municipality is still free to determine their own approach. Accordingly, 'Operatie Steenbreek' in Amersfoort might have a different approach than other municipalities (Stichting Steenbreek, n.d). For this thesis the focus is on the municipality of Amersfoort, so only 'Operatie Steenbreek' in Amersfoort has been investigated.

5.4.1 Societal challenges and drivers

The main societal challenge that is being targeted with 'Operatie Steenbreek', is to reverse the trend of paving and sealing private gardens. However, the underlying motive for the initiative has to do with climate-resilience, biodiversity and the overall well-being of all that lives in the environment. The garden paving trend could lead to an increasing area of poorly permeable surfaces, which has negative effects for urban well-being caused by extreme weather conditions (Field et al, 2012; Gartland, 2012; Matthews, Lo & Byrne, 2015; See also section 1.1). The effects of climate change and extreme weather as well as the negative role that poorly permeable surfaces can have in that sense, is not something that is often acted upon by garden-owners. For various reasons, gardens are still being paved in Amersfoort. Driven by this observation, the societal challenge could also be described as being mainly an "awareness" challenge. In order for garden-owners to remove stones from their gardens and replace them with plants and trees, they first need to be aware of the pros and cons after which they might decide to take action (Interview #2; Interview #3; Interview #8, table 10)).

5.4.2 Objectives & solutions

The main objective of the 'Steenbreek' activities in Amersfoort is to create awareness, to share knowledge and getting people excited to get involved in the greening of their own gardens as well as the city as a whole. There are many ways to achieve this objective, therefore many solutions have been suggested and experimented with. One major part of the 'Stone Break' strategy in Amersfoort is built for the provision of information on what citizens could do themselves in terms of greening their gardens. In order to make this information easily accessible, the local online platform 'lekker in je tuin' (which translates into 'nice in your garden') was created. This platform is, among other things, used to showcase inspirational examples of easy to maintain gardens as well as providing do-it-yourself starting kits and finding local associated businesses (Het Groene Huis, n.d). In addition to this platform, several projects have been set up as part of 'Operation Stone Break Amersfoort'. The development of exemplary climate-resilient and biodiverse gardens is one of the most prominent projects in Amersfoort. In this project, people with a paved garden can sign up to get a garden make-over. In exchange, the garden is used as an example garden on the website or during excursions. The gardens are often marked with some sort of sign that explains why the garden is climate-proof and how they connect to the 'Stone Break' initiative. The gardens are designed and implemented by local professional landscape architects and gardeners, with knowledge on how to create a water-resilient and climate-proof garden. An impression of some of these climate-proof example gardens is given in figure 20.

Figure 19 Impression of three climate-proof example gardens. Source: Lekker in je tuin (n.d.-b)

The gardens can contain different types of NBS, however they mostly revolve around water storage, drainage or disconnection from the stormwater networks. The examples shown in figure 20 display three gardens with three different water elements. Even though the gardens look more natural than before, engineering and technology often still play a substantial part in the garden's solutions. The garden in the left top corner of figure 20, for example uses a permeable type of pavement which is processed into a grid. Figure 21 shows this grid and the type of pavement that goes inside. By using such a grid, water can infiltrate more easily than before, while the space can still be used to park cars (Lekker in je tuin, n.d). In the example garden shown in the bottom of figure 20, also a certain level of engineering could be noticed. Figure 22 zooms in on the small green roof depicted in the bottom of figure 20. Figure 22 shows a construction that can capture water so that it can be released when its needed. Even though this solution makes use of natural elements, there is still a substantial level of engineering involved. The type of NBS highly depends on the local circumstances, like for instance the positioning, relative altitude, native plants species and the nature of the local challenge

Figure 21 Permeable pavement used in example garden. Source: Lekker in je tuin (n.d.-b)

Figure 22 Construction connecting small green roof to rain barrel. Source: Lekker in je tuin (n.d.-b)

(e.g. whether there is need to retain or remove water). Because of the diversity of such circumstances within the city there is not a "one size fits all" kind of solution applicable for the whole city. Because of this, 'Operatie Steenbreek' is being picked up and organized more on a neighborhood or even street level, than on a city-level (Interview #2; Interview #3, table 10).

5.4.3 Organization & governance

Context: 'Operatie Steenbreek' is a city-wide project, which aims to inspire private garden owners to design their gardens in a more sustainable fashion. One of the most important goals is to make people aware of climate change. Only about 10% of the city's population is aware, therefore the goal is to persuade the other 90% (Interview #2, table 10). In a city of about 156,285 inhabitants there is much potential in relation to that goal (Gemeente Amersfoort, n.d.-a).

Institutional framework: The 'Operatie Steenbreek' project is a relatively young project and it reflects the current municipal mindset in regard to climate change adaptation, greening and water resilience. This mindset is based on relationships between the state, community a market, that are different to traditional top-down planning. The municipality does not always employ a pro-active attitude but searches for initiatives from the community and markets. The 'Green Vision' and 'Program: Climate Proof and Green City' are good examples of steering policy documents for 'Operatie Steenbreek'. Both employ a bottom-up philosophy of which 'Operatie Steenbreek' is an embodiment. The implementation of the actual gardens is done within the local planning system. There are certain municipal regulations for private gardens, like building height etcetera. However, within these rules the garden-owners can decide. The gardens are privately owned and also privately accessed.

Actors and coalitions: As a starting point for the project, the municipality had to decide to join the 'Operatie Steenbreek' movement. Because they did, they are the initiating actor. Together with the water authority they stimulate and facilitate a diversity of bottom-up initiatives. The actual implementation of on-the-ground actions are however strongly dependent on other actors. Because of the voluntary and experimental nature of 'Operatie Steenbreek', actors with different levels of involvement are present in the network. The project involves implementation on the land of private homes, therefore the main stakeholders are the home-owners themselves. Without the home-owners' consent, there is no actual implementation. Other actors that are directly involved in the implementation, are the local professionals that design and construct the gardens for the home-owners. These gardeners, garden designers and consultants work on a semi-voluntary basis. While getting a relatively small monetary compensation, they are building a network of clients and other businesses they could use to their benefit (Interview #3, table 10). 'Operatie Steenbreek' could be seen as a marketing mechanism (Interview #8, table 10) for both local businesses as well as for promotion of the bigger picture of "sustainability", "climate change" and "resilience". All actors who are not directly involved in the implementation of private gardens, support this mechanism in other ways, be it from a business point of view, a "sustainability" point of view or both. Beyond garden owners themselves, the municipality and the local professionals a couple other actors are affiliated with 'Operatie Steenbreek', namely the water authority, knowledge institutes, NGO's and other citizens and businesses not directly involved in implementation. All the affiliated actors form a network. The cooperation of actors is done in sub-networks that are focused on a particular action. The composition of actors in a sub-network is dependent on the kind of action that is carried out. According to an interviewed landscape designer/gardener (Interview #3, table 10), a distinction could be made according the type of involvement of different actors. Some actors are involved in the coordination of the project, such as the municipality, water authority and knowledge institutes. Other actors are involved in the actual implementation of gardens, such as the home-owners themselves and the local professionals (gardeners, garden designers and consultants). There is also a group of

actors like NGO's and other businesses that have attached their names to the 'Operatie Steenbreek' movement. These actors do not have a clear "stake" but are interested in the project. In return for being part of the project, they could offer different types of compensations like for example, special offers of garden supplies from an affiliated garden center or lectures on biodiversity from an affiliated NGO. In terms of power, these actors do not play a big role. A bigger role is played by does coordinating the network as well as those involved in the actual implementation of the gardens. The most power lies, in that sense, with the home-owners themselves, as they ultimately decide over their own gardens.

Resources: The organization of the project has been funded by the municipality and the local water authority. The funding has been between 20,000 and 40,000 euros per year. This funding is used as financial support for all actors in the network. Apart from the exemplary gardens, the home-owners however finance their own gardens. The budget made available by the municipality and water authority is mostly used for making a garden make-over more attractive for the garden-owners. This is done through means, such as marketing, special offers and awareness campaigns. To make this happen, two types of knowledge are used. First there is knowledge on climate adaptation, combining local and expert knowledge. Secondly, knowledge on project coordination and promotion is used.

Processes: The 'Operatie Steenbreek' project is organized through a network of actors with different backgrounds and interests. What brings the actors together, is some sort of affiliation with the general moto of the operation (Gemeente Amersfoort, n.d.); "tiles out, green in". The affiliated actors act on this moto from two different discourses. Firstly, actors could act on behalf of their own business interests. They view 'Operatie Steenbreek' as a marketing mechanism for business, which could broaden their network of potential clients, customers and partners. Secondly, actors could act because they belief in a more sustainable society and that the 'Operatie Steenbreek' project could contribute to this, at least on a local scale. They view 'Operatie Steenbreek' as marketing mechanism for promoting this "sustainability" idea and creating awareness. In practice the reason why actors are connected to the project is often a mix of the two discourses. According to (Interview #2, table 10), the affiliated actors all have a self-interest, because everyone wants to earn money. Nonetheless, the local professionals for example do a lot more work than they get payed for (Interview #2; Interview #3, table 10). There is often a voluntary aspect that is mixed with the self-interest. The actions taken in name of 'Operatie Steenbreek' are diverse and subject to change. This resulted in a dynamic and diverse actor network with sub-networks that act according to the type of action that is relevant at a certain moment. When a different type of action is required, other actors might be called in to carry out tasks specific to that specific action. The size of the network therefore increases or decreases in an organic fashion (Interview #2, table 10). Most of the project's actions have a voluntary and experimental nature, focused more on bringing awareness, inspiring people and building networks, than on reaching concrete and quantifiable targets. The overall strategy could therefore be characterized as a 'learning by doing' approach, where initiatives are assessed through trial and error. This is done, to learn what type of actions and associated actors best fits a certain type of situation (Interview #5, table 10). This tends to a 'fail-to-safe' mentality (Ahern, 2011), as discussed in sub-section 2.3.1.

The findings for the organization and governance of the 'Operatie Steenbreek' project are summarized in table 15.

Table 15 Organization and governance of the 'Operatie Steenbreek' project

The 'Operatie Steenbreek' Project	
Type Description	Network Community network for the 'greening' of private gardens
Scale	City
Context	
Object of planning	Greening' or 'climate-proofing' of private gardens
People	156,285 inhabitants (2019)
Institutional framework	
Policies	EU: Green Infrastructure Strategy (2013), Water Framework Directive (2000), Floods Directive (2013), Climate Change Adaptation Strategy (2013); NL: Deltaplan on Spatial Adaptation, Environment and Planning Act; Local: Structural Vision Amersfoort 2030, Green Vision, Policy Vision Green-Blue Structure, Program: Climate Proof and Green City.
Planning and regulations	Local planning system; Regulated by garden-owners themselves, provided that it does not impede municipal regulations.
Ownership	Private: private home + garden
Access and use rights	Private access
Actors and coalitions	
Primary stakeholders	Citizens (private garden owners), Local professionals (e.g. gardeners, garden designers and rainwater coaches), Municipality, Water Authority, Knowledge institutes (WUR)
Other stakeholders	NGO's, Business and other interested actors
Partnerships	Network of affiliated organizations: e.g. Municipality, water authority, knowledge institutes, local professionals, citizens
Power analysis	Municipality stimulates and facilitates diverse bottom-up initiatives
Resources	
Funding	Project's organization is funded by municipality and water authority; Gardens are funded by private garden-owners themselves (except for example gardens).
Knowledge and information	Expert knowledge on climate adaptation (also local knowledge, e.g. rain water coaches) and project coordination/ promotion (WUR, water authority).
Delivery mechanisms	Barriers to implementation are minimalized through attractive offers from affiliated organizations and local professionals (e.g. free consulting from rain-water coach)
Processes	
Discourses	Main discourse: "tiles out, green in"; Different types of affiliation: Marketing mechanism for business, marketing mechanism for promoting "sustainability" and creating awareness, or a mix of both.
Participation, engagement	Dynamic participation: Network increases and decreases in an organic fashion

and conflict management	
Monitoring and evaluation	'Safe-to-fail mentality': Bringing awareness, inspiring people and building networks is more important than reaching concrete and quantifiable targets; 'Learning by doing'; Trial and error.

Source: Author (based on Lawrence et al, 2013)

5.4.3.1 Governance model

Based on the findings for the 'organization and governance' of the 'Operatie Steenbreek' project, a characterization of the governance model can be made. In the 'Operatie Steenbreek' project, a mix of diverse actors (state, community, market) work together on small grassroots initiatives in a dispersed and polycentric network. The network is aimed to make citizens aware of climate change and to enable communities to organize themselves. The on-the-ground actions are in that sense organized with as little as possible interference from the government. This governance approach therefore resembles the 'Self-governance' mode, based on Driessen et al (2012). From the five clusters of governance models (see table 7 in sub-section 2.2.4.1), the governance approach of the 'Operatie Steenbreek' project mostly resembles cluster 4; 'Societal Resilience'. Figure 23 depicts the positioning of this cluster within the governance models framework.

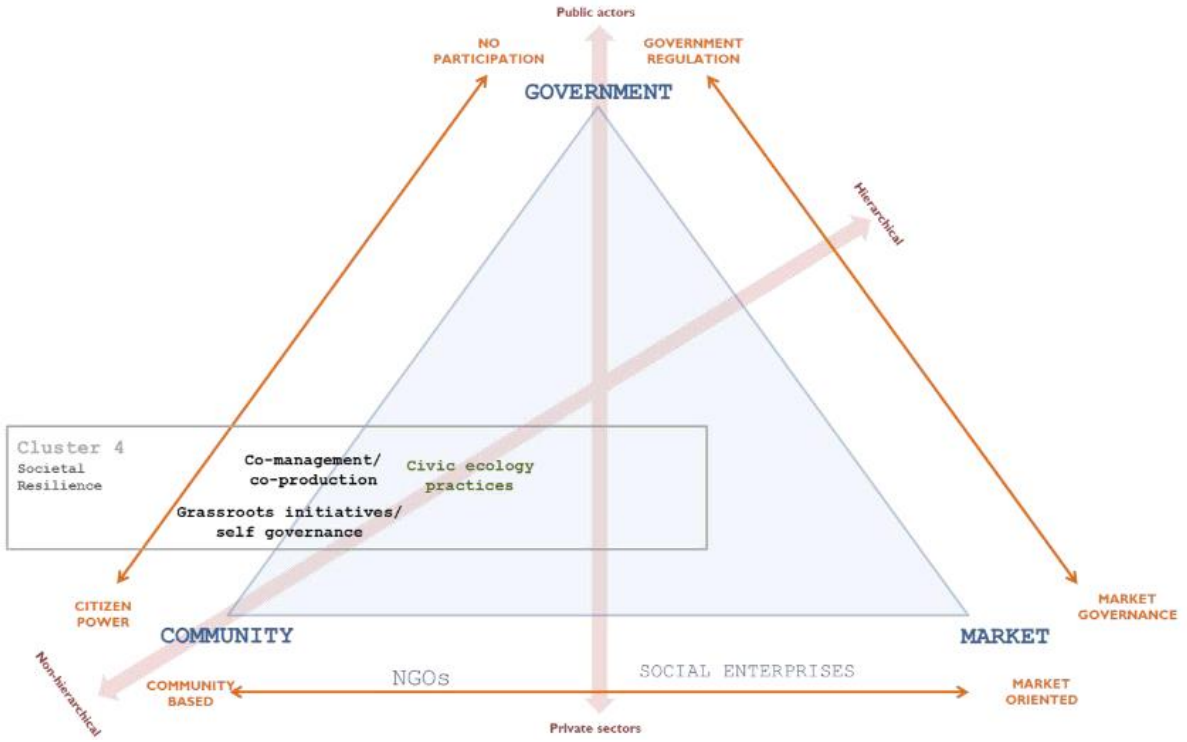


Figure 23 Positioning of cluster 4 within the governance models framework. Source; Nature4Cities, 2017.

Even the governance approach can be characterized by 'self-governance' or 'societal resilience', on a more strategic level, other characterizations are more prominent. On a strategic level, actors from the state, like the municipality and the water authority are more prominent. Therefore, on a strategic level, the project tends to resemble an "adaptive" management style from cluster 4; 'Network Governance'.

5.4.4 Enabling and restricting factors

The 'Operatie Steenbreek' project relies on the collaboration between actor within the network. Collaboration can therefore be seen as an important enabling factor. On the other hand, when collaboration does not take place sufficiently enough, it could be a restricting factor. In the case of 'Operatie Steenbreek' the aim is to bring together people from different sectors, so that an integral approach becomes more feasible. A barrier for collaboration lies in the fact that many of the involved actors are working on a (semi) voluntary basis and, therefore still need to be accountable towards the organizations they work for. This often involves that they need to work in traditional patterns. This is seen as a common problem by a coordinator of the project, which is illustrated by the following quote;

"This is always a problem. It is a human thing. The energy to change something is hard to hold on to. It must now be done by people who have many other activities in addition to continuing this change. The burden is also very high. People have to keep a lot of records, which is time that they could have spent in terms of content. Many people also work according to old patterns. People should actually deal with the same topic all day long and clearly determine what happened that day."

(Interview #2 Coordinator and project Manager ('Stiching Steenbreek')

Many people involved in the 'Operatie Steenbreek' project are motivated to make a change but are obligated to follow old patterns. These old patterns could for example also be found in the internal organization of the municipality (Interview #2; Interview #3, table 10). In combination with institutional fragmentation and the persistence of "sectoral silos", this could impede internal cooperation and therefore making integral projects often very difficult and time-consuming processes. A coordinator of the project uses a metaphor of the internal mechanisms of a windmill to illustrate his view on these issues:

"That [time-consuming process] is very characteristic in Amersfoort. When it comes to working together, it often takes months. You can actually see each department as a gear and it [the municipal apparatus] only turns when they [the gears] fall together and push each other away, so that the mill turns. That is constantly faltering and sometimes it just goes in the opposite direction and then you have to take a step back. This also applied to 'Steenbreek' in the beginning. Now we are three years later, and that windmill is running."

(Interview #2 Coordinator and project Manager ('Stiching Steenbreek')

A local gardener and rainwater coach also noticed difficulties in the municipality's ability to collaborate, both internally and externally. This is illustrated in the following quote:

"This [collaboration] is very difficult, certainly within the municipality but also when they work together with other parties and networks, because then you don't belong to the municipality. You can do your thing outside, but they don't look outside the organization either. This is in developing but does not happen enough."

(Interview #3 Self-employed gardener and rain-water coach 'Stichting Steenbreek')

Another comparable restricting factor was highlighted in the same interview. According to the respondent, a discrepancy could be noticed between the short-term actions and long-term goals. The following quote illustrates this:

"They [governmental actors] are forced by politicians to choose short-term options and the long-term ones are difficult. The short term is for many political councilors a quick way to score. They will not always admit that they want to score, but it will give them energy if they are able to realize the things

they stand for. They want to score by realizing something in the time they are there. So, then it is still short-term."

(Interview #3 Self-employed gardener and rain-water coach 'Stichting Steenbreek')

Furthermore, the experimental strategy of the project, could be an enabling as well as a restricting factor. On the one hand, this strategy contributes to finding the right solutions for the right places and people, which allows for more flexibility. On the other hand, these processes are often lengthy and only make relatively small changes to the environment, resulting only in relatively small impact. The project is, in that sense, more interested in bringing incremental change, than making impact through a single implementation. This is tied to the nature of the 'Operatie Steenbreek' project but could also be caused by a lack of financial resources made available, due to uncertainty.

Many uncertainties exist for the 'Operatie Steenbreek' project. To start, the project has unclear objectives and goals in terms of its scope. It is for example unclear how many gardens need to be implemented each year. This aggravates the uncertainty regarding the effectiveness of the project in terms of climate adaptation and resilience. Because of this, the costs and benefits of the project become more uncertain. As a result, decision-makers might be acting reservedly when it comes to spending their funds, because its unknown how much money is needed and what the benefits are. Nonetheless, funds have been made available for a project such as 'Operatie Steenbreek', which is not always the case in other municipalities (Interview #2, table 10). An important enabling or restricting factor, could therefore also be, the political will to invest time and money in such projects. A coordinator of the project illustrates how changes in political views on climate change, influenced the 'Operatie Steenbreek' project:

"In recent years things have gone very quickly. A motivation is that the municipality is already talking about disconnecting rainwater, sawing down rain pipes. They mentioned that themselves a number of times. The national government too, which is also talking about disconnecting rainwater. Because of that, there is attention and then the media is added. We are regularly in the newspaper, for example 'AD' or 'DeStadAmersfoort'. That has everything to do with the fact that politics have become involved. If politicians get involved, then housing cooperatives also think "oh" that is interesting, we have to do something with that. That also applies to other parties. That does not always go well, but it is more important to us that something happens. A lot has happened in Amersfoort in the past year and that has mainly had to do with a number of motions, early last year. It now works a lot easier with the workgroup."

(Interview #2 Coordinator and project Manager ('Stiching Steenbreek')

The main goal of the project is to make people more aware of climate change. Political and media attention could contribute to reaching this goal.

5.4.5 Lessons for NBS planning and governance

The main governance challenges for the 'Operatie Steenbreek' project had to do with creating and maintaining an adaptive network capable of adjusting to different circumstances. The 'Operatie Steenbreek' project is in that sense less focused on making a direct environmental impact but more on building a network that can make an incremental impact over longer period of time. In terms of planning and governance, this strategy could be interpreted in different ways. On the one hand, the separate actions do not generate that much impact in terms of climate adaptation and mitigation. On the other hand, the project does build a foundation for future developments in terms of the network as well as awareness of climate related issues. This governance approach is innovative, because it focusses on dispersed community-based networks that are able to govern themselves with minimal

interference from the municipality or others. This relates to the bottom-up mentality that is being endorsed in the recent 'Green Vision' from the municipality. The strategy however requires an active community, which is not self-evident. The strengths and weaknesses of the project lie in the operation of the network, as the power of this strategy is determined by the operation of the network as a whole instead of the separate components. When the project loses momentum, there is a change that actors will lose the energy to commit themselves to the project. Nevertheless, this governance approach could eventually increase the societal resilience of communities. Communities are, in that way becoming better capable to adjust to various social and environmental challenges. In regard to the complexity and uncertainty surrounding the effects of climate change, building societal resilience could be a desirable development. A resilient network allows for experimentation and learning, which possibly contributes to finding solutions that solve local challenges and are supported by the local community.

5.5 THE 'OLIEMOLENHOF' PROJECT

The 'Oliemolenhof' is a square located in the middle of a former industrial neighborhood, called the 'Oliemolenkwartier'. Nowadays often referred to as 'De Nieuwe Stad' ('The New City' in English), this city district is being transformed into a modern mixed-use neighborhood (De Nieuwe Stad, n.d). Within this brownfield redevelopment, the 'Oliemolenhof' plays a central role, as it connects the different parts of the neighborhood together. The project has been realized in the year 2017 (VIC Activating Landscapes, n.d).

5.5.1 Societal challenges and drivers

Before the transformation of the 'Oliemolenhof', the square was entirely covered with asphalt and held about 400 to 500 parked cars on peak days. Because it is a public square, it was not solely used with the purpose of parking. Especially at night time there was nuisance, caused by for example sex workers, drinking and drugs. The nuisance started to become increasingly irritating, because more and more businesses started to settle in proximity to the square. Therefore, more people were confronted with this nuisance (Interview #7, table 10). The 'Schipper Bosch' company, that develops and invests in the whole area of the 'Oliemolenkwartier' (or 'De Nieuwe Stad') (De Nieuwe Stad, n.d), wanted to counteract this nuisance to keep the tenants satisfied. This developer/investor redeveloped an old toothpaste factory, which is located in the area. This old factory became a modern office/working space, attracting many companies from different branches. As the area started to grow economically, it was noticed that the 'Oliemolenhof' was lacking behind in terms of development. The public square could be seen as a vacant intermediate area in the middle of commercial development. To change this, Schipper Bosch started with the redevelopment of the square (Interview #7, table 10).

The drivers for the redevelopment of the square were mainly economic and social, hence the desire to create a square that is attractive to citizens as well as businesses (VIC Activating Landscapes, n.d). Nonetheless, environmental aspects also played a role. These aspects were mostly taken into account in the design and implementation of the square (Interview #7, table 10).

5.5.2 Objectives and solutions

The main objective of the redevelopment project was to create an appealing public space for citizens as well as for businesses. In contrast to the former monofunctional parking places, the desire was to create a space were people could meet, sit down or walk around during their lunch (VIC Activating Landscapes, n.d). However, because people still need to park and deliveries still need to be made, a substantial part of the square is still bituminized. However, despite the quantity of asphalt that was needed, there was still a desire to create a square that has a green character and that is nice to stay in. Even though the main drivers for the project were social and economic, sustainability aspects such as energy transition, recycling, climate adaptation and biodiversity were taken into consideration during the design and implementation phase.

In the final result, a mix of natural and technical solutions could be found. A more technical solution could be found in the way that electric driving has been made part of the design. As a way to facilitate electric driving in the area, 20 electric charging stations placed in the square. The charging stations do not only charge cars but are they also used as power source for events (Interview #7, table 10; VIC Activating Landscapes, n.d). An example of such a charging station is represented in figure 24. Also, during the actual construction, sustainable technological options have been considered. An example of this, is the choice to use recycled asphalt instead new asphalt (VIC Activating Landscapes, n.d).

Figure 24 Example of an electric charging pole on the square. Source: VIC Activating Landscapes (n.d).

In contrast to these technical solutions, other more natural solutions were implemented in the square's design. One of the most notable changes relative to the former situation, is the presence of trees and plants. In total 42 trees were planted, which are scattered around the area. The trees are placed within green planes, which are filled diverse plant species. An example of such a green plane is shown in figure 25, giving an impression of the diversity of plant species that could be found in the undergrowth of the trees on the square.

Figure 25 Example of a green plane including trees and plants (source; author, picture taken on 12/07/19)

The green elements have an important function in terms of the biodiversity of the square as well as the biodiversity of the area as a whole. By adding a diverse set of trees and plants it is aimed to attract other types of organisms, such as bees and butterflies. Adding trees and plants does not only increase the natural habitat, it also brings the habitat closer to neighboring green areas. This improves the

biodiversity (Noss, 1991; Taylor et al, 1993) and it might contribute to the survival of certain species, such as bees, who are facing a decline.

Another function of the trees is to bring shadow to create a more pleasant climate on the square but also ease the possible heat coming from the asphalt (VIC Activating Landscapes, n.d). Another climate adaptive solution is the use of washed shells instead of concrete for the center of the square. Because of the shells, water can more easily sink into the soil than would have been the case with concrete. The square can therefore contain more water during peak showers, making the area more resilient to flooding (Interview #7, table 10). On the contrary, water infiltration can be helpful to prevent dehydration of the soil during periods of drought (VIC Activating Landscapes, n.d).

5.5.3 Organization and governance

Context: The 'Oliemolenhof' project concerns the redevelopment of an outdated and fully paved parking facility into a multifunctional square. The project could be viewed as part of a bigger development, which is concerned with the 'Oliemolenkwartier' neighborhood. The biggest part of the area is occupied by (outdated) industrial other commercial real-estate (e.g. offices and catering), furthermore the area only houses 120 citizens (Gemeente Amersfoort, n.d.-a). The desire for this neighborhood is to become an innovative "micro city" with a mix of functions, which is being developed together with the citizens following a bottom-up approach (De Nieuwe Stad, n.d).The transformation in this part of the city is called 'The New City' and is represented in figure 26. Figure 26 shows the situation of the city district before the redevelopment of the 'Oliemolenhof' in 2017, which was still a concrete plain used for parking. The location of the 'Oliemolenhof' is indicated by a black circle in figure 26.

Figure 26 City district 'Oliemolenkwartier' ('The New City') before redevelopment of the 'Oliemolenhof'. Source: De Nieuwe Stad (n.d), edited by author.

Institutional framework: The 'Oliemolenhof' project has been completed in the year 2017. At that time one of the most relevant relatively new policy documents for NBS was the 'Green Vision'. For the 'Oliemolenhof' project specifically, other policies probably have been more relevant, as the project itself was seen as part of a larger urban regeneration/ redevelopment plan ('The New City'). As a consequence, the Structural Vision Amersfoort 2030 is an important policy document, as it specifically

designates the neighborhood as an area for (re)development (Gemeente Amersfoort, 2013). The redevelopment took place using the local planning system and was initially regulated by the municipality. After the land was bought from the municipality by a local developer/ investor, the regulations for the project were settled in a public-private partnership between the municipality and the developer/ investor. Before the redevelopment the square was a parking facility for regular cars. After the redevelopment the access became restricted for non-electric cars to park on. Nonetheless, the square remained publicly accessible for regular cars to drive through as well as for pedestrians and cyclists.

Actors and coalitions: During the decision-making process of the 'Oliemolenhof' project, the two main actors were the municipality and a local developer/ investor (Schipper Bosch). Both actors needed to collaborate via a public-private partnership to find the right development for the square. After they came to an agreement, most of the remaining implementation and maintenance was left for the developer/ investor. In that sense, the developer/ investor took over the leading role, which was traditionally played by the municipality. For the design, implementation and maintenance of the project, the developer/ investor worked together with an urban design bureau ('ZEEP') and a landscaping bureau ('VIC Landscapes'). These actors worked together to create a cohesive urban – and landscape design. The landscaping bureau therein implemented all the green elements of the square. This bureau is also maintaining the area.

Resources: Local knowledge was an important factor for the initiation of the plan. The developer/ investor and municipality saw the former outdated and underdeveloped square as a threat for the social, economic and environmental quality of the neighborhood as a whole. Knowledge of these local conditions, originating from local businesses and citizens as well as from their own experiences led to a growing urgency to redevelop the square. Beyond the initiation, mostly expert knowledge was employed to realize the plans. Firstly, the expert knowledge on project management and investment of the developer/ investor, was needed to acquire the land and lead the process. Secondly, expert knowledge of an urban design bureau was needed to inform the design of the square. Lastly, a landscaping bureau was hired for their expert knowledge on landscape design, implementation and maintenance. Financially, both the municipality and the developer/investor contributed to the construction of the square. Because the developer/investor was already landowner and developer of many areas in the 'Oliemolenkwartier'/ 'Nieuwe Stad', they were able to include the square into the land exploitation for the entire area. The yields, mainly from real-estate, were in this way used to finance the redevelopment of the square. Uncertainty on the effectiveness of the project and the associated risks (especially in regard to maintenance) are usually factors that impede developers to get involved in NBS-related projects (vanderJagt et al, 2017b; also see section 2.3.1). Generally, short-term developers and builders are mostly focused on a quick development of real-estate, with the surrounding area being of secondary importance and often even considered a cost. One reason for this is, that green elements do not provide a direct income. Nonetheless, green elements could be considered as factors that enhances quality of the area as a whole, possibly increasing the monetary value of real-estate as well. So, when an actor is a long-term investor, landowner as well as the developer of a project, every long-term investment in the (green) area is earned back by the actor (in one way or another). Because profits do not have to be made in relatively short-terms, more attention could be given to the quality of the environment (Interview #7, table 10). The acquisition of public land was the main delivery mechanism for the implementation of the 'Oliemolenhof' project.

Processes: Landownership of the 'Oliemolenhof' used to be in hands of the Municipality, which is the case for many public spaces in Amersfoort. Because of the desire to develop the square, the developer/ investor needed to collaborate with the municipality. An initial plan for the square was

submitted to the municipality to see whether they were interested in developing the square as a mixed-use square with a green character. Because of the desire to combine many functions in one place, there was a change that functions would conflict with each other or with the municipal policies and guidelines. Even though 'greening' certain parts of the city fits with the municipal policies (e.g. the 'Green Vision', see also section 5.2.2), the plan was met with criticism. Employees from different municipal departments assessed the plan and saw aspects that, in their eyes, conflicted with other functions. The trees that were included in the plan would for example be in conflict with the requirements for certain types of traffic. Because nearby companies needed to be supplied with goods, the square needed to retain its infrastructural function. Supply trucks, for example, needed to be able to make a turn on the square to properly reach their destinations. According to one of the municipal representatives, trucks would however be hindered, because of the number and design of the trees in the plan. The trees were also regarded as a risk in terms of maintenance, especially considering they would possibly be run over and damaged due to the traffic. Instead of open green areas with trees in it, the municipality would rather see a metal-fenced tree, protected against collisions and therefore less expensive to maintain. Similar critiques from other departments were expressed towards the plan, making it hard to add quality to the area. If these critiques would have been taking into account, the plan would have been of a lower spatial quality than initially intended, according to the developer/investor. This obstructed the developer/investor in such a way, they did not want to go through with the development as such, which impeded the collaboration between the developer/investor and the municipality in that particular configuration. As a consequence of the critique on the design and the associated restrictive conditions, the developer/investor decided to change its approach (Interview #7, table 10). Most of the requirements imposed by the municipality had to do with the management and maintenance of public functions in the area. Because of their landownership they hold a responsibility in the management and maintenance of these functions. The developer/investor saw this as an opportunity, because if the municipality would be released of these responsibilities, they might set less restrictive conditions for the square's design. Consequently, the developer/investor bought the land from the municipality. In this way they could develop the land with less restrictions from several governmental organizations. In return however, the developer/ investor took over the responsibility of the long-term management of the area, including maintenance. Beforehand, there were still some conditions that needed to be agreed on before development could start, however these conditions did not interfere with the design as much as before the land transaction. Consensus on the design of the square was reached after the municipality had shown confidence in the realization and long-term management and maintenance of the plan. During the phases that followed, the municipality has been less involved. Only a couple of quality checks were done during and after the implementation. Further monitoring and evaluation of the project is therefore done by the developer/ investor. According to the developer/ investor, the short -term economic value of green elements is hard to measure, however the new and greener square brings spatial quality to the area. This should contribute to the attractiveness of the area for new renters and to the satisfaction of local businesses and citizens currently present (Interview #7, table 10). In that sense, it is more useful to refer to the indirect and long-term economic value of having a "high" spatial quality. The long-term occupation rate and the level of satisfaction could be examples of indicators for the project's "successfulness".

The findings for the organization and governance of the 'Operatie Steenbreek' project are summarized in table 16.

Table 16 Organization and governance of the 'Oliemolenhof' project

The 'Oliemolenhof' Project	
Type Description	Project Public-private partnership in redevelopment project
Scale	Neighbourhood
Context	
Object of planning	Development of multifunctional square on former concrete parking area
People	~ 120 inhabitants (2019)
Institutional framework	
Policies	EU: Green Infrastructure Strategy (2013), Water Framework Directive (2000), Floods Directive (2013), Climate Change Adaptation Strategy (2013), Circular Economy Action Plan (2015); NL: National Ecological Infrastructure, Deltaplan on Spatial Adaptation, Environment and Planning Act Local: Structural Vision Amersfoort 2030, Policy Vision Green-Blue Structure
Planning and regulations	Local planning system, regulated in a public-private partnership
Ownership	From public to private: public municipal land sold to private developer/ investor in exchange for maintenance responsibility
Access and use rights	Public access for walkers and cyclists, restricted for parked non-electric cars
Actors and coalitions	
Primary stakeholders	Municipality, Developer/ Investor (Schipper Bosch), Urban Design Bureau (ZEEP), Landscaping Bureau (VIC Landscapes).
Other stakeholders	Other citizens and businesses
Partnerships	Public-Private Partnership: Municipality and developer/ investor; Design partnership: Developer/ investor and urban design bureau; Implementation and maintenance partnership: Developer/ investor and Landscaping bureau.
Power analysis	Developer/ investor took over leading role from municipality after land acquisition
Resources	
Funding	Co-funding from municipality and developer/ investor
Knowledge and information	Knowledge on local conditions (Municipality) Expert knowledge on project management/ investment (Schipper Bosch), urban design (ZEEP), sustainable landscaping, design, implementation and maintenance (VIC Landscapes)
Delivery mechanisms	Public land acquisition by developer/ investor
Processes	
Discourses	Municipality: Development may not impede public functions and need to fit municipal maintenance schemes; Developer/ investor: Municipal requirements (e.g. maintenance) make it too hard to add spatial quality to the area.
Participation, engagement	Initial development plans conflicted with municipal requirements, but this was fixed through deal on landownership and maintenance

and conflict management	
Monitoring and evaluation	Evaluation based on the "successfulness" of the development of the neighborhood as a whole; Indirect and long-term economic value of having a high spatial quality

Source: Author (based on Lawrence et al, 2013)

5.5.3.1 Governance model

Based on the findings for the 'organization and governance' of the 'Oliemolenhof' project, a characterization of the governance model can be made. In the 'Oliemolenhof' project, the municipality and a developer/ investor worked together in a public-private partnership. This governance approach therefore resembles the 'Public-private governance' mode, based on Driessen et al (2012). From the five clusters of governance models (see table 7 in sub-section 2.2.4.1), the governance approach of the 'Oliemolenhof' project mostly resembles cluster 2; 'New Public Management'. Figure 27 depicts the positioning of this cluster within the governance models framework.

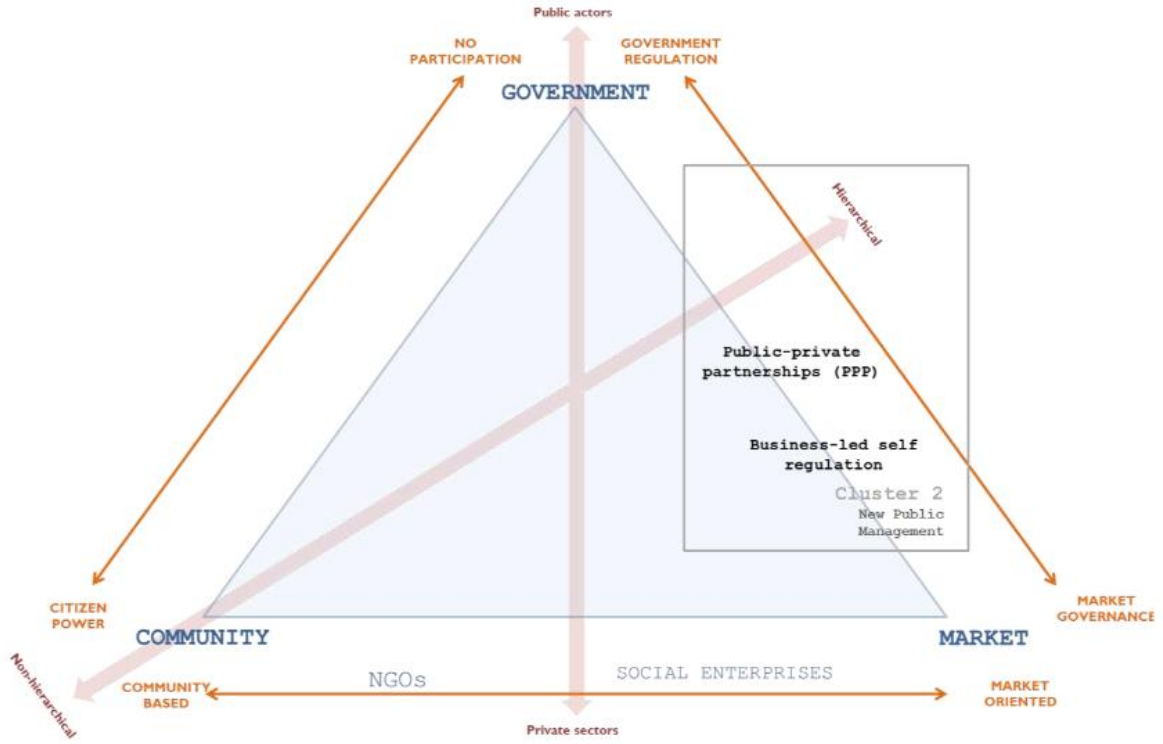


Figure 27 Positioning of cluster 2 within the governance models framework. Source; Nature4Cities, 2017.

Even the governance approach can be characterized as 'public-private' or 'new public management', the governance approach shifted from being government-led to business-led. The land transaction that took place and the corresponding agreements between the municipality and the developer/ investor, changed the way the project has been managed.

5.5.4 Enabling and restricting factors

For the 'Oliemolenhof' project, the main enabling and restricting factors are institutional by nature. The regulations imposed by the municipality originally formed a barrier for the developer/ investor to start developing the square. This ultimately led to a land transaction involving both actors. As the developer/ investor bought the land, this barrier could however be broken. An interviewed manager

projects and development (Interview #7, table 10) also saw some other restricting institutional factors that have to do with path dependency, institutional fragmentation and the (dis)ability to work in an integral manner. These factors were put as attributes to the sustainability strategies of the municipality in more general terms. The following quote by this manager projects and development, illustrates these concerns:

"It is not necessarily so that they [municipality] are sticking to old habits, because in other areas you can really see the municipality making decisions that are forward-looking. What I see is an inability to have an integral view of things. If I look at the policies that are being adopted on housing, transformation and plan-making, they are all small fragments that a decision is made about. This probably feels very pleasant to have done as a municipality, but that it causes new problems, hindrance or delays, is not taken into account at all. The sustainability challenge is very easy to make a political decision about, but what are the consequences in general and to what extent does that touch on policy? For example, they have now established a gas bill: Amersfoort must be rid of natural gas in 2030, that's the plan. At the same time, they establish a property bill: All newly built homes must comply to particular rules. So, both directly influences the feasibility of new projects. Furthermore, as you [municipal decision maker] load the trolley [capacity of objectives to be addressed] fuller and fuller and make the wish-list longer, the chance that you will get all your presents [satisfying results] becomes smaller. Therefore, I see inability in the integral project design."

(Interview #7 Manager projects and development 'Development and investment firm')

The different sectoral visions and bills could be impeding an integral approach, especially when more and more are added. The interviewed project developer highlights that the possibilities to create an integral project is also impeded by the lack of hierarchy within the decision-making process. This view is illustrated by the following quote from the manager projects and development:

"It is very difficult for us as a market party to test all the municipal policies on for example sustainability, greening or housing construction programming and transformations, in relation to each other and to value which one is more important than the other. We cannot make this nuance. And the tricky part is, when you are talking about collaboration between departments, if I sit with all people [civil servants] who deal with a single piece of policy, then everyone says it is equally important. So good project management from the municipality, that is my concern."

(Interview #7 Manager projects and development 'Development and investment firm')

When each representative of a certain sector defends their own vision, it could become harder to shape a project in an integral manner. This is especially the case when there is no municipal project manager who weighs all the interests. Because of this, the metaphorical "trolley" is becoming more and more overloaded with things that need to be considered, without making clear decisions for the specific project at hand.

To conclude, most barriers lie in the institutional dimension and in the collaboration between the municipality and the developer/ investor. By deploying the right resources, these barriers could be sufficiently broken down. Because of this, most enabling factors could be found in the dimension of 'resources'.

5.5.5 Lessons for NBS planning and governance

The main governance challenges for the 'Oliemolenhof' project with the partnership between the municipality and a developer/ investor. The main difficulties in this partnership were caused by the regulations set for development of the area. These regulations were established by the municipality

who as landowner bore the responsibility for the maintenance of the area. The regulations for development were set with this responsibility in mind and were too restrictive for the developer/ investor to follow through with project. To overcome this barrier the municipality and the developer/ investor started negotiating about a solution. Eventually a deal was closed, where the land was sold to the developer/ investor, who in return took over the maintenance responsibilities. What makes such an arrangement interesting in terms planning and governance of NBS, lies in the fact that the developer/ investor was able to commit themselves to area for the long-term. Because of this commitment, different choices could for example be made for the implementation of natural elements in the square. In general project development, the area surrounding real-estate objects (including natural elements) are seen as a cost item. In the case of the 'Oliemolenhof' project, a bigger investment for these natural elements could be made, because they were viewed as something that contributes to the spatial quality. Through this, these elements were awarded an indirect long-term economic value for the area. The development of NBS could be promoted, by giving natural elements an economic development value. This governance strategy has its pitfalls. In the case of the 'Oliemolenhof' project, the developments must be seen within its context. Because the developer/ investor has invested in the neighborhood, they were able to include the redevelopment of the square into their business case and exploitation for the entire area. Because of their long-term commitment on the development of the neighborhood, they were able to make bigger investments into the development of the square than a conventional developer would. So, with the economic valuation of NBS comes certain requirements in terms of size and duration of the exploitation it is part of. This governance strategy is therefore better suitable for bigger development projects, like for example the development of new residential areas or the redevelopment of industrial or business parks (like the 'Oliemolenhof' project). In addition, developers and/or investors need to be convinced of the value of NBS to make them invest in them. In that sense, research on the effectiveness of NBS and on reliable evaluation methods could be helpful to convince them to invest in NBS. What helped the development of NBS in the 'Oliemolenhof' project was that the developer/ investor was aware of the value of the natural elements and willing to invest.

6 DISCUSSION

The following chapter builds on the previous one, by reflecting on and discussing the results of the empirical study. Based on the examined units of observation, the commonalities and differences between the exemplary projects will be explained and reflected upon in section 6.1 to 6.5.

6.1 SOCIETAL CHALLENGES & DRIVERS

When looking at the initial societal challenges attempted to be addressed with the three projects, it can be noticed that social aspects are most prominent. Environmental challenges like climate change mitigation and adaptation, biodiversity or water management are also addressed in the projects, however these challenges have a more secondary nature. Table 17 gives an overview the addressed societal challenges and gives an explanation of why environmental challenges should be considered secondary challenges.

Table 17 Primary and secondary challenges addressed in exemplary projects.

Project	Primary challenge	Secondary challenge	Explanation
'Zonnehof'	Refurbishment of an outdated living/working environment	Mainly water management issues	The water management issues were not part of initial plan but came later in the process
'Operatie Steenbreek'	Creating awareness among citizens to inspire action	Combination of climate adaptation challenges related to having a paved garden (e.g. draught, heat, flooding etc.)	Most actions (e.g. websites, lectures and brochures) are only indirectly focused on climate adaptation
'Oliemolenhof'	Creating a safe and pleasant square without nuisance and crime that is used by local citizens, businesses and for events	Combination of different environmental challenges including, energy transition, water management and biodiversity	Environmental issues are looked at during design and implementation, but initial challenges are social/economic of nature

Source: Author

These environmental challenges can therefore not be viewed as the underlying drivers for all of these interventions. The 'Zonnehof' and 'Oliemolenhof' project have similar primary challenges, concerning public squares that were problematic in terms of their livability and extensive recreational function. Both projects addressed environmental challenges as secondary challenges and they addressed them only in the design and implementation phases. Because of this, it could not be viewed as the underlying driver of the projects. In contrast, the 'Operatie Steenbreek' project does address environmental challenges in their actions from the start. Even though not many actions are directly addressing the environmental challenge, the underlying driver of the project is climate adaptation. The way this challenge is being addressed is, however less direct (in the physical sense) than is the case with the 'Zonnehof' and 'Oliemolenhof' project.

6.2 OBJECTIVES & SOLUTIONS

The solutions that have been implemented in the three projects all involve a relatively high level of engineering (see typology of NBS by Eggermont et al, 2015 in section 2.1.2). This is however something that was to be expected, as this thesis focuses on NBS in urban areas. NBS is often designed in accordance to the expected interaction between humans and the ecosystem. These interactions are likely to happen to greater extent and more frequently in the inner-cities, than in for example nature reserves. Therefore, NBS in nature reserves tend to be more extensively implemented and maintained and urban NBS tend to be designed to fit the urban structure, while providing natural benefits.

In the projects investigated for this thesis, the solutions made use of ecosystem processes but were combined with more engineered grey infrastructures. For the 'Zonnehof' and 'Oliemolenhof' projects, natural elements were added to and designed in combination with grey infrastructural elements, with the objective to fit the squares to the green and grey infrastructures of the area. In order to bring forward a sustainable solution, both projects considered both green and grey components. The components that were actually used in the final design were, however chosen based on their ability to contribute to a desired sustainable goal and not because they were green of grey. The choice for a more natural or a more engineered solution was partly determined by the boundary conditions of the project. For the 'Zonnehof' project, the water management solutions needed for example to be built in a technical fashion below ground level, because it could not interfere with the original plans. For the 'Oliemolenhof' project, the square needed to remain a transit and parking function, which contributed to the current design instead of, for example creating an entirely unpaved green field. Also, other engineered solutions were implemented, such as the charging stations for electric cars. These charging stations are not considered natural components but are considered to contribute to the sustainability objectives for the square. For the 'Operatie Steenbreek' project, it seems that a harder line is drawn between green and grey infrastructures, which could be noticed from their motto (Gemeente Amersfoort, n.d.); "tiles out, green in". The ostensible opposition between green and grey infrastructure portrayed in the motto is however more relevant to the 'awareness' objective of the project. It shows citizens that there could be alternatives to paving their gardens, which could be beneficial in several ways. However, in the actual implementation of water resilient and climate-proof gardens, also more engineered and technical solutions have been applied. Rainwater that needs to be drained in a delayed fashion for example, need to be stored via green roofs and tanks just as depicted in figure 22 (section 5.4.2).

The opposition between green and grey infrastructures (also touched upon in the introduction of this thesis, based on e.g. Lafortezza et al, 2018 & Davies & Lafortezza, 2019) has, within the investigated projects, shown to be more prominent as a mindset or "awareness", than something that has become a standard design principle for sustainable development. The implemented solutions are shaped more by thinking in terms of "sustainability" in a broad sense and not necessarily in terms of removing grey and inserting green infrastructures. Even the 'Operatie Steenbreek' project, implemented grey elements (despite of its motto). What for example could be noticed, is that traditional grey elements are replaced with a more sustainable, but still grey variant (e.g. by implementing water permeable asphalt to replace the old type of asphalt). Furthermore, some grey elements are essential in urban designs. In water-related NBS projects, grey elements are for example often used to guide water or store the water. Replacing grey with green infrastructures should not be viewed as a goal on its own. Oftentimes hybrid forms of grey and green infrastructures or the restructuring of grey infrastructures can be desirable options for sustainable development.

To conclude, the qualitative distinction where grey infrastructures are depicted as less sustainable than green infrastructures, which might be conceived from a motto such as "tiles out, green in", is not

being endorsed as such in practice. Grey elements remain important and technological options are considered sustainable (e.g. water permeable concrete). Green elements are however being implemented more extensively in regard to climate change adaptation and mitigation, which indicates that the qualities of green infrastructures in regard to sustainability are more and more recognized. The involved actors of the three exemplary projects chose the solution or combination of solutions, which they believed would contribute to the desired sustainability objectives, disregarding whether they were man-made or natural. Nonetheless, within all three projects, a certain awareness on the benefits of green infrastructures was notable, which led to the use of green elements in their designs.

The two main types of ESS that were targeted with the green elements in the projects were cultural services and regulatory services (see table 1 in section 2.1.2). This corresponds with the primary and secondary societal challenges that were found for the projects (see section 6.1). Provisioning and supporting services (see table 1 in section 2.1.2), were not or less prominently mentioned as targeted ESS in the projects.

6.3 ORGANIZATION AND GOVERNANCE

In order to compare the investigated projects in terms of organization and governance, an overview is presented in table 18. The table is an aggregation of the output tables for each individual project depicted in the results chapter (chapter 5). For each governance dimension (context, institutional framework, actors and coalitions, resources and processes), the relevant sub-aspects are discussed separately.

Table 18 Overview of organization and governance of investigated projects

Case	***'Zonnehof'***	***'Operatie Steenbreek'***	***'Oliemolenhof'***
Type Description	Project Citizens initiative for urban renewal	Network Community network for the 'greening' of private gardens	Project Public-private partnership in redevelopment project
Scale	Neighbourhood	City	Neighbourhood
Context			
Object of planning	Refurbishment of outdated public square (including water resilience function)	Greening' or 'climate-proofing' of private gardens	Development of multifunctional square on former concrete parking area
People	218 inhabitants (2019)	156,285 inhabitants (2019)	~ 120 inhabitants (2019)
Institutional framework			
Policies	EU: Green Infrastructure Strategy (2013), Water Framework Directive (2000), Floods Directive (2013), Climate Change Adaptation Strategy (2013) NL: National Ecological Infrastructure, Deltaplan on Spatial Adaptation, Environment and Planning Act Local: Structural Vision Amersfoort 2030, Policy Vision Green-Blue Structure	EU: Green Infrastructure Strategy (2013), Water Framework Directive (2000), Floods Directive (2013), Climate Change Adaptation Strategy (2013); NL: Deltaplan on Spatial Adaptation, Environment and Planning Act; Local: Structural Vision Amersfoort 2030, Green Vision, Policy Vision Green-Blue Structure, Program: Climate Proof and Green City.	EU: Green Infrastructure Strategy (2013), Water Framework Directive (2000), Floods Directive (2013), Climate Change Adaptation Strategy (2013), Circular Economy Action Plan (2015); NL: National Ecological Infrastructure, Deltaplan on Spatial Adaptation, Environment and Planning Act Local: Structural Vision Amersfoort 2030, Policy Vision Green-Blue Structure
Planning and regulations	Local planning systems (bottom-up initiative), following municipal regulations.	Local planning system; Regulated by garden-owners themselves, provided that it does not impede municipal regulations.	Local planning system, regulated in a public-private partnership

Ownership	Public: municipal ownership	Private: private home + garden	From public to private: public municipal land sold to private developer/ investor in exchange for maintenance responsibility
Access and use rights	Public access, restricted for cars.	Private access	Public access for walkers and cyclists, restricted for parked non-electric cars
Actors and coalitions			
Primary stakeholders	Citizens Initiative (BIZ!), Municipality, Water authority, Province (Utrecht), Landscape Design Bureau (G84), Water Engineering Bureau (Wareco)	Citizens (private garden owners), Local professionals (e.g. gardeners, garden designers and rainwater coaches), Municipality, Water authority, Knowledge institutes (WUR)	Municipality, Developer/ Investor (Schipper Bosch), Urban Design Bureau (ZEEP), Landscaping Bureau (VIC Landscapes).
Other stakeholders	Other citizens and businesses	NGO's, Business and other interested actors	Other citizens and businesses
Partnerships	Design partnership: Municipality, citizens initiative and landscape design bureau Water partnership: Municipality, water authority and water engineering bureau	Network of affiliated organizations: e.g. Municipality, water authority, knowledge institutes, local professionals, citizens	Public-Private Partnership: Municipality and developer/ investor; Design partnership: Developer/ investor and urban design bureau; Implementation and maintenance partnership: Developer/ investor and Landscaping bureau.
Power analysis	Citizens initiated project, but municipality managed the rest of the process	Municipality stimulates and facilitates diverse bottom-up initiatives	Developer/ investor took over leading role from municipality after land acquisition
Resources			
Funding	Governmental (Province and Municipality) funding + direct investment from water authority	Project's organization is funded by municipality and water authority; Gardens are funded by private garden-owners themselves (except for example gardens).	Co-funding from municipality and developer/ investor
Knowledge and information	Expert knowledge on urban design (also local	Expert knowledge on climate adaptation (also	Knowledge on local conditions

	knowledge; BIZ!), landscape architecture (G84) and water management (water authority, Wareco)	local knowledge, e.g. rain water coaches) and project coordination/ promotion (WUR, water authority).	Expert knowledge on project management/ investment (Schipper Bosch), urban design (ZEEP), sustainable landscaping, design, implementation and maintenance (VIC Landscapes)
Delivery mechanisms	Agreement between municipality and citizens initiative; Financial contribution from water authority and province.	Barriers to implementation are minimalized through attractive offers from affiliated organizations and local professionals (e.g. free consulting from rain-water coach)	Public land acquisition by developer/ investor
Processes			
Discourses	Green square discourse: Create a park-like and green living/ working environment; Water management discourse: Potential of the area in regard to water management should also be exploited.	Main discourse: "tiles out, green in"; Different types of affiliation: Marketing mechanism for business, marketing mechanism for promoting "sustainability" and creating awareness, or a mix of both.	Municipality: Development may not impede public functions and need to fit municipal maintenance schemes; Developer/ investor: Municipal requirements (e.g. maintenance) make it too hard to add spatial quality to the area.
Participation, engagement and conflict management	Water management discourse conflicted with existing design supported by citizens initiative but was fixed through mutually acceptable compromises (designing below ground level)	Dynamic participation: Network increases and decreases in an organic fashion	Initial development plans conflicted with municipal requirements, but this was fixed through deal on landownership and maintenance
Monitoring and evaluation	'Fail-safe' mentality: Choosing a higher value for downpours, which the square can process to create a margin.	'Safe-to-fail mentality': Bringing awareness, inspiring people and building networks is more important than reaching concrete and quantifiable targets; 'Learning by doing'; Trial and error.	Evaluation based on the "successfulness" of the development of the neighborhood as a whole; Indirect and long-term economic value of having a high spatial quality

Source: Author; based on Lawrence et al (2013)

6.3.1 Context

The 'Zonnehof' and 'Oliemolenhof' project are similar because they both encompass a transformation of a city square, while the 'Operatie Steenbreek' network encompasses city-wide transformations of private gardens. All three projects are thus concerned with transforming existing urban areas, instead of developing green fields. Except for these similarities, there are many differences in the local contexts. Each neighborhood has their own characteristics and also their own sustainability challenges. For the 'Zonnehof' project the water management challenge for example related mostly to lower situated areas. Because water could be stored at the square, the water-related problems for lower situated areas (e.g. parking facility) could be reduced. For the 'Oliemolenhof' project, the water-related problems were more directly noticeable on the area itself as well as the surrounding areas. The 'Operatie Steenbreek' project has to deal with a variety of different contexts, as the private gardens could be anywhere in the city. Having to deal with different types of contexts, could be increasing the complexity of working with NBS, as even within cities or neighborhoods differences can occur. An interviewee summarized these issues as follows:

"*You cannot just apply something generic to a city*"

(Interview #2 Coordinator and project Manager 'Stiching Steenbreek')

6.3.2 Institutional framework

Policies:

From the three exemplary projects, the 'Operatie Steenbreek' project is the youngest and also still ongoing (2019). The project therefore relates to the more contemporary policies such as the 'Green Vision' and the 'Program: Climate Proof and Green City'. The 'Operatie Steenbreek' project shares the same mentality and approach towards climate change adaptation and the role of nature therein, as is portrayed in these recent policy documents. This approach could be summarized by the following terms; bottom-up, incremental, flexible and accepting of uncertainty ("safe-to-fail", refering to Ahern, 2011). 'Operatie Steenbreek' is a network that operates following similar kinds of principles. The two other projects, the 'Zonnehof' and the 'Oliemolenhof', were established before the 'Green Vision' and the 'Program: Climate Proof and Green City' became relevant policies. Both projects were more steered by the 'Structural Vision Amersfoort 2030', which was more steering on the urban development as a whole, instead of focusing on climate change adaptation in particular.

Planning and regulations:

Because all 3 projects are located in the city of Amersfoort, they basically fall under the same planning regime. There is however a difference in the way the projects have been regulated. The 'Zonnehof' is, despite being a bottom-up initiative, regulated mostly following municipal standards. The 2 others are less prominently regulated by the municipality. For 'Operatie Steenbreek' applies that within the boundaries of a private garden, municipal regulations become less evident. After all, garden-owners can (to a certain extent) determine what happens to the garden themselves. Redevelopment of the 'Oliemolenhof' was firstly attempted to be realized following standard municipal regulations. This failed, because of the restrictive outcome this would have on the initial designs. To solve this problem, the project was regulated through an agreement between the developer/ investor and the municipality. A possible explanation for the differences between the projects regarding regulations could be found in the landownership.

Ownership:

Landownership is an important factor for many urban developments like housing or infrastructure, however the same applies to projects related to urban nature, sustainability, climate change adaptation/ mitigation or biodiversity. An interviewed environment manager and process director from the water sector, illustrates the importance of emphasizing landownership in climate change adaptation:

"If you are talking about extreme weather and who should do something to minimize its impact, you are basically looking at all people who own land. They are the ones that have to take action on their property, like a green roof, water permeable pavement, a water square or planting trees. That is what we need, and everybody should contribute."

(Interview #8 Environmental manager and process director in water sector 'Consultancy firm')

Landownership is also an important factor by which the projects can be distinguished. Within the projects investigated in this thesis, the ownership ranged from public to private ownership. The 'Zonnehof' is owned by the municipality, which is the owner of many public spaces within the city. 'Operation Steenbreek' is focused on privately owned gardens, which together also cover a significant part of the city. The 'Oliemolenhof' was formerly owned by the municipality but has been sold to a developer/ investor. The size of land owned by businesses could also be significant in cities, this could for example be noticed when regarding business parks or (former) industrial sites. Having different NBS-related projects with different landowners is positive when referring to the conclusion of the quote by the environmental manager and process director from the water sector (Interview #8, table 10); *"everybody should contribute"*. By organizing projects in the public sector as well as in private housing and business sector, a bigger part of the city becomes involved in climate change adaptation then when only on sector would act.

Landownership also partly predetermines to what extent certain requirements are being set for a certain project. Different owners might set different requirements for different projects. A municipality could for instance set a certain requirement for the size of a tree, which might be the opposite to when a homeowner or business would set such a requirement. When looking at the exemplary projects, the level of municipal regulation seems to be less when there are other landowners than the municipality. Landownership comes with some rights and obligations. Landowners often have a say in what happens on the land, however also often bear responsibility for the land (e.g. maintenance). When considering a certain development, landowners often set requirements (because of their right to decide) that at least ensures that they can take their responsibility for the land (e.g. obligation to maintain the land). Because the municipality bears a public responsibility, their regulations are often more comprehensive and standardized than often the case with private landowners. The effect that different owners could have on the execution of a development, is well illustrated in the exemplary project of the 'Oliemolenhof'. The initial plans for the 'Oliemolenhof' made by a developer/ investor, were turned down by the municipality. A major reason for this was, that the municipality (landowner at the time) was far from convinced that they would be able to fulfill their obligation to the maintenance of the land, because of different features of the plan (e.g. trees and green areas). An interviewee working as manager projects and development at the 'Oliemolenhof' illustrates the differences between the municipality and the involved developer/ investor regarding maintenance, through the following quote:

"They [municipality] said; it is OK if you create a nice square, but we only have a maintenance budget of inner-city category X. We therefore not going to develop green in this intensity (according to initial

plan), because we will not be able to do the maintenance. For your view; the municipality had an annual maintenance budget that we [developing/ investment company] spend in one and a half month."

(Interview #7 Manager projects and development 'Development and investment firm')

In order to be less bound to municipal regulations, the developer/ investor decided to buy the land from the municipality. In return, the developer/ investor had to take over the maintenance responsibilities from the municipality. In this way, a certain intensity of green development was made possible, which would not be the case if the land was still owned by the municipality.

Access and use rights:

In the extension of planning, regulation and ownership issues, the accessibility and use right of the 3 exemplary projects can be compared and discussed. In 2 of the 3 projects, access and use rights have been changed. For the other one ('Operatie Steenbreek') the access is private and the use rights are reserved to the garden-owners. The biggest change in terms of access and use rights in the 'Zonnehof' project, was the ban of automobiles on the square (Burgerinitiatief Zonnehof, 2013; Interview #1, table 10). The removal of parking spaces as well as the roads, made the square inaccessible by car. Instead a mix between a bike lane and walkway is implemented in the square. For the 'Oliemolenhof' project, public access and use rights apply, except for non-electric cars who want to park on the square.

6.3.3 Actors and coalitions

Stakeholders:

For the each of the 3 investigated projects in this thesis, different networks of actors could be identified. With the help of the conceptual knowledge from sub-section 2.2.4.1, the different actors from each exemplary project and their role in the planning process have been analyzed. Even though the term "governance" is often associated with a move away from "government" when regarding decision-making processes, the local government is still considered a primary stakeholder in all three exemplary projects. The role of the municipality is, nonetheless different in each project and also, in some ways, different from the "traditional" role of government. The municipality only initiated 1 of the 3 exemplary projects; 'Operatie Steenbreek'. The initiating role could be associated with a top-down hierarchical approach to planning. In the case of the 'Operatie Steenbreek' project, this is however not the case, because of the voluntary nature of the project. With this project, the municipality wants to stimulate others to take action, without having a predetermined development agenda themselves. They are nonetheless a primary stakeholder (initiator of network), be it more in a facilitating role instead of decision-making role. In the case of the 'Zonnehof' project, the municipality was not the initiating actor. They were however supportive to the desired developments of the citizens' initiative. As landowner, the municipality had a strong influence on the project, especially in the role of regulator. As regulator, they set certain requirements to the projects, however within the set framework others were involved in the decision-making process. In the case of the 'Oliemolenhof' project the role of the municipality is ambiguous. For this project, the municipality was also not the initiating actor. They were nonetheless important stakeholders because of their landownership. Similar to the case of the 'Zonnehof' project, the municipality initially took on the role of regulator. However, this changed drastically when the land was sold to a developer/ investor. This purchase led to a change in the role of the municipality, going from a leading/ regulating role towards a more enabling role, empowering other actors to develop the land (see also figure 7 in sub-section 2.2.4.1). Concluding from the three investigated projects, the role of the municipality is not static, but diverse.

Also, the way of leading projects does not seem to be in line with a traditional top-down way of planning. The municipality leaves many tasks to the communities themselves or to the market. In the investigated projects, the municipality was not trying to control an entire planning process or proactively implementing a project from "A" to "Z". They have, nonetheless played a directing and facilitating role but in a less hierarchical manner.

Because a less hierarchical role is played by the municipality, other primary actors have emerged from other sectors of society such as the community or the market. Actors from the community for example played an important role in the 'Zonnehof' and 'Operatie Steenbreek' projects and an actor from the market played an important role in the 'Oliemolenhof' project. Also, other actors from the state sector have emerged as important stakeholders. In the investigated projects, the water authority has for example been actively involved in two of the three projects. Especially in the 'Zonnehof' project, their role is notable, as it was divergent from what the water authority traditionally does. An interviewed policy advisor and account manager (Interview #5, table 10) from the water authority also experienced discussions within the organization of the water authority, about involvement in projects such as the 'Zonnehof' project. These discussions are about whether it is in the interest of the water authority to invest in projects that are for a large part about urban renewal, instead of water. The following quote illustrates the interviewees' stance in this discussion;

"We actually get a bit of a discussion like, is that actually in our interest? So, I say; it is very much in our interest, because I want to set a good example and as water authority, we want to look further than just technical solutions. We also want it to make a social contribution and give quality to the environment. So, that is also an experiment for us. The integration of solutions in an urban area is not self-evident for the water authority."

(Interview #5 Policy advisor and account manager 'Water authority')

The water authority is looking more and more beyond the borders of the water sector and tries to act in a more integral manner (Interview #5, table 10). This is a positive development when it comes to the implementation of NBS-related projects in Amersfoort, as most of the projects involve water challenges (see section 5.2.1). Furthermore, because of their regional presence, the water authority could also play an important role of promoting such projects, as well as transferring obtained knowledge to other places in the city, other municipalities in the region and also outside the region.

Partnerships and power:

In the investigated projects, different types of partnerships could be observed. The partnerships are obviously different from each other, as each project had their distinct set of actors involved. Even though some actors were present in more than one project (e.g. municipality, water authority or citizens), the partnerships have been diverse because these actors played different roles in different circumstances. According to Driessen et al (2012), the partnerships between the different actors or their modes of governance, are determined by the roles played by different actors as well as their mutual power relations (see figure 8 in sub-section 2.2.4.1). In figure 8 a distinction is made between a dominant role an equivalent role and a background role. Based on the roles played by the actors from different sectors (state, community and market), the state-centered modes of governance (centralized and decentralized governance in figure 8) do not really apply to the investigated projects. This corresponds with the less hierarchical role of the municipality as discussed earlier. The modes of governance are rather characterized by partnerships that are less hierarchical from the state's perspective. The investigated projects show that the partnerships are not static and could change during the process. For the 'Zonnehof' project, this was the case when the water authority started

showing interest in the project. For the 'Operatie Steenbreek' project, this is the case whenever a new initiative is started and new actors are called in. In the case of 'Operatie Steenbreek', a distinction could also be made between the partnerships occupied with the general organization of the project and the ones occupied with the actual implementation of gardens (from network governance to societal resilience). For the 'Oliemolenhof' project, the partnerships and power relations changed as a result of a land transaction. Some important powers and corresponding responsibilities were shifted from the municipality to the developer/ investor.

6.3.4 Resources

Funding:

When looking at the investigated projects, it could be noticed that there were always two or more actors co-financing the project. 'Co-financing', as well as for example 'co-designing', are terms that represent different ways of working together, which are quite commonly used in NBS processes with multiple stakeholders. This is also linked to the multifunctionality, which is integral to NBS. This link is most clearly described through the example of the 'Zonnehof' project. For this project, an original design was commissioned by the citizens' initiative and granted for funding by the municipality. Later however, the water authority started showing interest in the square for its potential in regard to water management in the area. These water management measures were later added to the project. Because of this, a new function was basically added to the square. The water authority did a direct investment in the project to help co-finance the project and the water management plans in particular. In the case of the 'Zonnehof' project, the multifunctionality of the area was utilized. This led to many benefits, including extra financial resources through co-financing.

Knowledge and information:

In the investigated projects many different types of knowledge and information have been used. This could be due to the number of actors involved in the projects and possibly also due to the nature of the planned objects. The projects all include climate adaptive measures, which provide extra complexity to the object of planning. As a result, many types of expert knowledge were utilized in the projects, mostly focused on informing the design and implementation phases. Nevertheless, also local knowledge was utilized in the projects. This local knowledge was in most cases knowledge originating from local professionals or businesses, who were able to apply their professional knowledge to their local environment. More "lay" types of knowledge were less prominently mentioned. Especially in regard to climate change and sustainability issues, expert knowledge was more influential than lay knowledge. The analysis on knowledge and information aspects in this thesis does however lack depth. The influence of lay knowledge could therefore be underestimated in this discussion.

Delivery mechanisms:

Within the investigated projects different delivery mechanisms have been applied. In the analysis only the ones that were the most influential for shaping the planning process were taken into account. For all projects, the main delivery mechanism included a financial component. However, the financial components all had a drastically different size and impact. For the 'Operatie Steenbreek' project this included the offer of for example financial discounts, while for the 'Oliemolenhof' this included the purchase of land. These different mechanisms reflect the range of strategies carried out within the projects. The strategy of the 'Operatie Steenbreek' project is in that sense more focused on development in small steps, aiming to make an impact by counting the sum of the small parts. The strategy of the 'Oliemolenhof' on the other hand, is more focused on making a relatively large impact in a more direct manner.

6.3.5 Processes

Discourses:

When looking at the investigated projects, different actors with divergent interests could be identified. Due to time constrains, no full discourse analysis has been done, which focusses on each individual actor in-depth. Nonetheless, the main narratives that shaped the processes were attempted to be described, based on the interviews held with the actors. The discourses found in the projects are in some ways linked to the drivers of the actors involved. Because multiple actors were involved, the projects were shaped by different discourses. In general, social and/or economic discourses were found in combination with environmental, sustainability and climate-related discourses.

Participation, engagement and conflict management:

In the projects, different actors had to work together to get a desired result. Their interests can roughly be divided into two groups, namely the self-interest and the common interest. Every actor has their own interests (e.g. financial gains, promotion or standing up for a certain social group), which can be conflicting with other actors' interests. However, in a multi-stakeholder process, it is often more useful to look for common ground. This is especially the case when there is a high level of mutual dependence between actors. In the 'Zonnehof' and 'Operatie Steenbreek' projects, a relatively low level of hierarchy could be noticed. This resulted in a relatively high level of mutual dependence between the actors. In these projects, there were mutual dependencies that made it necessary for the actors to act more upon the common interests and therefore making compromises in regard to their self-interests. For the 'Oliemolenhof' project, the same applied for the beginning of the project in which common grounds needed to be found between the municipality and the developer/ investor. However, after the land transaction between the two parties, the rest of the process became more hierarchical, due to the leading role of the developer/ investor.

In terms of engagement and participation, it can also be noticed that in the 'Zonnehof' and 'Operatie Steenbreek' projects, citizens played a directing or steering role (Initiating actor at the 'Zonnehof' and landowner at 'Operatie Steenbreek'). This is different from the role that citizens played at the 'Oliemolenhof' project, where a community of local citizens and companies ('De Nieuwe Stad') functioned as an important sounding board or resonance group. So, even though citizens had a voice, their influence was different in comparison to the other two projects.

Monitoring and evaluation:

In terms of evaluation of the projects, a major difference can be noticed between the 'Operatie Steenbreek' project and the other two projects. This difference is best described through the projects' mentality towards uncertainty and complexity. For the 'Operatie Steenbreek' project this mentality could be interpreted as a 'safe-to-fail' mentality, while for the other two projects, a 'fail-safe' mentality would be more appropriate (see also Ahern, 2010). The main difference between the two types of mentalities, is the way in which issues such as climate change are approached. On the one hand, the effects of climate change for a particular place could be estimated to the best knowledge available at that moment, after which plans are made according to those estimates. On the other hand, the effects of climate change could be viewed as something so complex and uncertain, that they cannot be estimated sufficiently. This could result in a more experimental approach, where the right climate adaptive approach for a certain place is found through trial and error. For the 'Operatie Steenbreek' project, it is more important to build a resilient network, which is able to adapt to different situations, than reaching a certain number of climate-proof gardens. The other two projects endorse a more

straightforward strategy and evaluate the project on the basis of certain thresholds and values and by estimating the effects.

6.3.5.1 Governance models

After evaluating the actors and their interactions, the governance approach of the investigated projects could be categorized into a certain cluster of governance models. An estimation based on the findings for the governance dimensions, is used to find the position of each project within the governance models framework. Figure 28 shows the framework of governance models including the estimate positions of each investigated project.

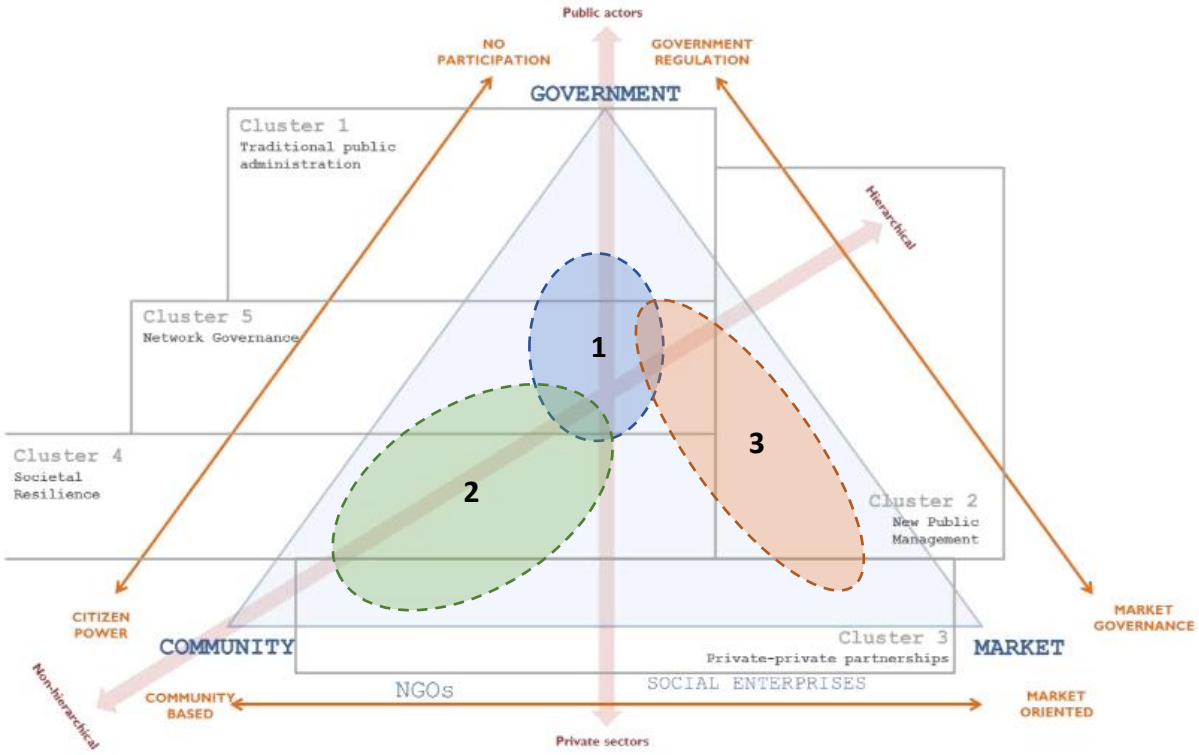


Figure 28 Positioning of the governance approaches within the governance models framework. Source: Nature4Cities (2017), edited by author.

The positioning of the project's governance approaches is depicted by planes drawn into the framework. Plane number 1 resembles the 'Zonnehof' project, plane number 2 resembles the 'Operaties Steenbreek' project and plane number 3 resembles the 'Oliemolenhof' project. Important to note is, that governance approaches do not fall exactly into a cluster. The reason for this is, that the approaches are subject to change. The organization of a project can change due to certain circumstances and can be different in different phases of the planning process. The 'Zonnehof' project's organization for example, changed after the water authority started to show interest in the project. The 'Operatie Steenbreek' project's organization is dependent on the type of activity that is relevant at that moment. The 'Oliemolenhof' project's organization, changed after the landownership shifted from government to market. Another notable aspect is that the different approaches can exist alongside each other and even within a single project. Because of these dynamics, it might seem nonsensical to try to put governance approaches into a static framework. Nevertheless, it is done here for the purpose of comparison. Figure 28 provides a quick overview of the characteristics of the governance approaches relative to each other.

6.4 ENABLING AND RESTRICTING FACTORS

The enabling and restricting factors found for the investigated projects were diverse. Nonetheless, some factors were mentioned in all three projects and in regard to the general course of events in Amersfoort. Most notably, the ability to work in an integral manner was indicated as a crucial aspect. The main underlying factors that impede integral planning are institutional fragmentation and path dependency, which could also be described as the persistence of "sectoral silos". This problem is endorsed by different interviewees from non-state actors, who experienced difficulties with the operating mechanism of the municipality when it comes to integral project planning. The comparisons of this mechanism with a malfunctioning windmill (Interview #2, table 10) and an overcrowded trolley (Interview #7, table 10), are clear metaphors depicting this malfunction. This critical view is not only endorsed by interviewees outside the municipality but was also mentioned by an interviewee from inside the municipality (Interview 6, table 10). This reinforces the image, that there is not a single municipal actor but rather multiple departments who act from their own perspective. In that sense, there could be a lack of some sort of integral project leader within the municipality. Without someone mediating between the departments, the integral process runs the risk of becoming lengthy and unclear, impeding the collaboration with other actors.

A notable aspect of the enabling and restricting factors is, that factors from different governance dimensions seem to be linked to each other. To illustrate this, the example of the persistence of 'sectoral silos' can be taken, considering that this is an institutional factor. From the previous paragraph can be concluded that the persistence of 'sectoral silos' can impede the collaboration between actors and therefore influencing the 'actors and coalitions' dimension. This can, in turn, have an influence on the 'resources' dimension, because the resources that are often brought by actors, might be missed due to a lack of collaboration. As a result, the feasibility of plans might become threatened, possibly leading to discrepancy between short-term action and the long-term goals and therefore influencing the 'processes' dimension. The enabling and restricting factors should therefore not be seen as independent entities, but rather as part of an interconnected system. A change in one dimension could therefore influence the entire system.

6.5 LESSONS FOR NBS PLANNING AND GOVERNANCE

In the investigated projects, different governance approaches were found. The projects were all influenced by different actors, institutions and contexts. Each project revealed different aspects relevant to NBS planning and governance. The 'Zonnehof' project for example showed how the multifunctionality of NBS can be governed within a multi-stakeholder arrangement. The project's result and its collaborative process are made an example of "good practice", which helps promoting NBS in other cities and other regions as well. The 'Operatie Steenbreek' project shows how an adaptive network is build, that does not necessarily have a direct implementation, but tries to equip different actors on different levels with the tools to organize themselves. The overarching approach allows for experimentation and adaptive governance, inspiring an ongoing learning path, which could be used to find solutions "tailored" for local circumstances. The 'Oliemolenhof' project shows that under certain conditions, NBS can have a development value that can lead to more extensive investments in NBS. This shows a potential for the implementation of NBS in relatively large-scale projects, like for example the development of new residential areas or the redevelopment of industrial/ business parks. The investigated projects show a variety of different characteristics and approaches to the planning and governance of NBS. Notable is, that these different forms can exist alongside each other and even within the same project. The governance approach depends on who are involved, what role they play and what context they operate.

7 CONCLUSIONS & RECOMMENDATIONS

In the previous two chapters the empirical findings have been presented and discussed. In the following chapter an attempt is made to come to conclusions and recommendations, based on the these chapters. Firstly, the main findings are presented in section 7.1 in an attempt to answer the research questions. Further, policy recommendations and perspectives for future research are presented in section 7.2 and 7.3 respectively.

7.1 KEY FINDINGS

In the following section, the main findings have been structured according to research questions. First the sub-questions are addressed, after which a concise answer to the main research question is formulated.

To what extent and in what way is the concept of NBS being used and promoted in planning policy and practice in Europe, the Netherlands and Amersfoort?

The concept of NBS is a relatively new concept that is emerging in many European cities. Because of its novelty as well as uncertainty and complexity surrounding the concept (e.g. related to climate change), there is a lack of substantial policies regarding the implementation of NBS. The policies merely require mostly voluntary action or no action at all. Because of the nature of the policies, much room is left open for interpretation at the local scale-level. As a result, many different types of operations are being explored within cities. The different practices are increasingly studied in European cities, which are oftentimes connected to an EU research program. In the Netherlands, often the relatively big cities are used as a breeding ground for NBS case studies, while smaller cities like Amersfoort are not used that often. The use of the term 'nature-based solution', was also not as common in Amersfoort, as it seems to be more prominent in EU policies or in urban policies of relatively big cities connected to EU research programs. In the context of planning policy and practice of NBS, it is more useful to also include NBS-related concepts, such as 'ecosystem services', 'urban green infrastructure' or 'sustainable development'. When including such concepts, it becomes apparent that even in a relatively small city like Amersfoort, many examples of NBS-related policies and practices exist. A reason for this could be that the country of the Netherlands already has experience with using and promoting ecologically-oriented concepts. Because of this history, a specific vocabulary including terms like 'building with nature', 'natural climate buffers', 'natural eco-corridors', and 'allowing natural processes more space', have been emerging in Dutch national policies. These terms refer to national or regional issues and not necessarily to the local scale. Within local policy frameworks in Amersfoort, an entirely different vocabulary is used, with terms like 'climate-proofing' and 'greening' the city. What can be concluded is, that NBS is used as an "umbrella" term by the EU or those involved in EU research but is not literally taken over in the Dutch national policies. At a national scale, Dutch policy-makers are used to their own set of words to describe NBS-related concepts. At a local scale, this set of words is however not that relevant, as they refer to topics on national or regional scale. Therefore, also on a local scale, different terms are used to describe NBS-related concepts. Having this many different terms used at different scales, can cause confusion on what exactly is meant with a certain term.

The investigated policies on EU, national and local level all retain a certain level of vagueness due to the terms that are used. The terms 'climate-proofing' and 'greening' the city are examples of terms used in local policy, with an unclear meaning. What exactly is meant with these terms is open for interpretation. To understand how these terms are interpreted, requires an investigation of practical

examples within the city. The investigated projects in this thesis show different interpretations of what is meant with 'climate-proofing' and 'greening' the city.

In the projects, the main drivers for engaging with NBS-related concept, were in the 'Zonnehof' and 'Oliemolenhof' more related to social and economic reasons, while the 'Operatie Steenbreek' project already had a strong "environmental" motive from the start. In the end however, both social, economic and environmental challenges were addressed through NBS-related concepts. When referring to the types of ecosystem services, primarily cultural and regulatory ecosystem services were targeted in the projects (referring to table 1 in section 2.1.2). The implemented solutions were also not strictly 'green' or 'natural'. The solution can better be described as a combination between green and grey infrastructures. In some cases, technical grey components were preferred over green components, mostly because they were more feasible or better coping with frequent human interaction, without being considered much less sustainable. The configuration of green and grey infrastructures is the result of deliberation between the involved actors.

What enabling and restricting factors to the implementation of NBS could be identified and how do they shape the development and integration of the NBS concept into policy and practice in Amersfoort?

Within the different types of projects and partnerships, different restricting factors to the implementation of NBS can be identified. The way that they influence the development and integration of NBS in policy and practice in Amersfoort, is also diverse. NBS planning and governance is often concerned with a combination of urban planning and environmental management and thus in search of an integral plan that combines different aspects, like infrastructure, build environment, water management, biodiversity etcetera. The ability to work in an integral manner appears to be a crucial aspect in Amersfoort. Two factors that impede this way of working are; institutional fragmentation and path dependency. This problem refers mostly to the municipal apparatus, which seems to be incapable of breaking down the "sectoral silos", making working in an integral manner more difficult. Even though the departments of the municipality should serve a common goal (public interests), they sometimes act more from their own perspectives, which can lead to internal disagreement. This could be problematic, as it contributes to a lengthy and unclear process. Especially in integral multi-actor projects, this can impede the collaboration with other actors.

Uncertainty and complexity are also major factors influencing the implementation of NBS in different ways. The effects of climate change are largely unclear and are context dependent, therefore the solutions invented to mitigate and adapt to these effects are often uncertain as well. It does not seem to be productive to apply generic solutions to a city, because even on neighborhood level different challenges can exist. The first layer of uncertainty already occurs when trying to figure out what the main challenges for each neighborhood are. Then, appropriate solutions need to be found that fit these challenges. There are many uncertainties surrounding the effectiveness of NBS in regard to climate mitigation and adaptation. There are for example no standards that dictate what measures are needed to solve a certain problem. The investigated projects are in that sense partly experimental, as they implemented NBS-related concepts without exactly knowing their results in terms of climate change adaptation and mitigation. The implementations were however made possible because the assumed social, economic or environmental benefits of the solutions were great enough. The consideration to implement NBS is not only determined by their effectiveness in regard to the challenge at hand but is also for a large part shaped by the social, economic and environmental feasibility.

Some enabling factors are more specific to the separate projects but are nonetheless relevant to the upscaling and further development of NBS in policy and practice. The 'Zonnehof' project was for example made into an example of "good practice" in terms of result and process. This can help the promotion of NBS and inspire other municipalities to implement similar projects. The water authority, as a regional organization, plays an important role in this, as they are transferring the gained knowledge to other municipalities in the region and possibly even outside the region. The 'Operatie Steenbreek' project itself can be seen as a marketing mechanism for the promotion of NBS-related concepts, which inspires citizens to take action and make them more aware of environmental issues. The network spreads across different scales, which helps to reach people from different layers of society. A major enabling factor for the development of the project and the use of NBS-related concepts in general, is the political and media attention it got. The political support can help in the sense of resources and legitimacy, while the media attention can help to reach a greater audience.

What institutions and actors are relevant to the implementation of NBS and what governance approaches would be beneficial for developing NBS in a sustainable way?

To understand the implementation of NBS, the actors involved in the projects have been investigated. The actors came from three societal domains, namely the state, the community and the market. The main state actors were the municipality and the water authority, the main community actors were local citizens and interest groups and the main market actors were local professionals and businesses as well as a local developer/ investor. The composition of actors was however different for each project. In the 'Zonnehof' project, the municipality, the water authority and a citizen's initiative worked together in a collaborative process. In the 'Operatie Steenbreek' project, a mix of diverse actors (state, community, market) work together on small grassroots initiatives in a dispersed and polycentric network. In the 'Oliemolenhof' project, the municipality and a developer/ investor worked together in a public-private partnership. These actors and their coalitions are however not static but can change due to changing circumstances (e.g. changing interests, changing activities or changing landownership). Notable is, that these different approaches can exist alongside each other and even within the same project. Despite of the different approaches, it can be noticed that most actors act from a believe that a certain project can contribute to social, economic or environmental sustainability. The governance approach that is applied to realize the project however depends on who are involved, what role they play and in what context they operate.

When looking at the characteristics of NBS, the general trends in the organization and governance of NBS-related concepts and the structural influence of enabling and restricting factors, some governance approaches seem to be more beneficial for the development of NBS than others. In general, NBS projects seem to have a high potential in governance arrangements that enable collaboration between actors from different sectors. A less hierarchical role played by the municipality offers possibilities for the local community and market sectors to get involved in the decision-making process. Because of the connectedness of NBS to local conditions, a governance on neighborhood or even street level is in most cases desirable. Polycentric and adaptive networks are capable of creating "tailor-made" solutions, that fit the local conditions. When it comes to relatively big projects like the development of a new residential areas or the redevelopment of (former) industrial/ business parks, NBS has a big potential provided that the entire area is developed as a whole (real-estate including surroundings). NBS-related concepts can be awarded a development value, that can be processed in the exploitation or business plan. This can possibly lead to bigger investments on NBS within urban development projects. In the current economic system such an approach (public-private partnership) is very context dependent. The investor for example needs to take an economic risk, which is usually avoided. In situations where no unnecessary risks are taken, often less room is left for innovative and

experimental approaches such as NBS. Governance approaches that facilitate innovation and experimentation, therefore seems to be more appropriate for the development of NBS.

How are nature-based solutions addressed in urban planning policy and practice and how could they be more effectively promoted at an urban scale?

The development and upscaling of NBS depends on many factors but can partly be steered and more effectively promoted to become a viable planning option for sustainable development. To do so, an understanding of the city as social-ecological system is necessary. This understanding is of great importance to appreciate that NBS projects are often organized on the dividing line between the social system and the ecosystem and therefore concerns both urban and environmental governance. Combining both is however not self-evident in policy and practice. Uncertainty and complexity of the object, process and context of NBS planning, are structural problems that lead to policies on different scale-levels, that lack substance and require non or merely voluntary action. This issue is reflected by the vagueness of the terms used in policies on different scale-levels. As a result, these policies leave much room for interpretation as well as the responsibilities to act on a local scale-level. The implementation of NBS is therefore done in a semi-experimental manner, where different types of solutions are being explored. On a city level, practice is therefore shaped mostly by actors that believe they can contribute to a more sustainable future, be it socially, economically or environmentally. Different strategies can be applied in order to implement NBS-related concepts, but this depends on who are involved, what role they play and in what context they operate. In general, approaches that enable non-hierarchical collaboration between actors from different sectors and that facilitate experimentation and innovation seem to be best fit for the development of urban NBS. A structural challenge in the organization and governance of NBS however seems to be the ability to work in an integral manner. Institutional fragmentation and path dependency seem to be underlying factors that contribute to the persistence of “sectoral silos”, which seems to be a major barrier to integral project planning. Overcoming the structural challenges surrounding the implementation and upscaling of NBS is not a straightforward task, nonetheless some recommendations can be made that can contribute to a more effective promotion of NBS-related concepts. These recommendations are discussed in section 7.2.

7.2 POLICY RECOMMENDATIONS

For the structural challenges discussed in the previous section, no direct or simple solution is applicable. These challenges are highly complex and require much more research to understand all aspects, let alone finding a solution. Therefore, the following recommendations are not an attempt to solve these problems, but more to share ideas on how to deal with these problems in policy and practice. The recommendations are therefore built on the author’s perspective on the findings.

Firstly, to address **“the challenge of dealing with uncertainty and complexity”** the following recommendations can be drawn:

Uncertainty and complexity are mainly knowledge problems. It is therefore important to keep building a knowledge base for NBS on different scale-levels. Currently most research is done at the EU level. However, due to the context dependency of local NBS implementations, a knowledge base should preferably also be developed at local level. The local knowledge could be used to fine-tune local policies in regard to NBS.

To capture local knowledge, research on instances of practice is needed. First, more instances of practice are needed to collect knowledge from. Investment in experimentation with pilot projects,

would be a good first step. To ensure a robust knowledge capture, a certain standard documentation or evaluation system could be helpful. This can make information gathering and knowledge transfer more robust. For this, a European standard could be beneficial, because local knowledge can in that way be compared with cases from across Europe. Such an evaluation system could be added to NBS policies on a local scale, to ensure that new NBS-related projects contribute to the knowledge base.

The concept NBS, which is related to complex issues like climate change mitigation and adaptation, is likely to retain a certain level of uncertainty. Implementing NBS therefore remains an exploration. The actors who are involved in the implementation often believe in the efficacy of the implemented solution. To convince more actors to believe in this efficacy of NBS, the evidence-base of NBS could be expanded. This could be done through investment in research on the effectiveness of NBS on different scale-levels. Also, examples of "good practice" could be more actively shared within cities, to other cities in the region or even outside the region. Local (e.g. municipality) and regional (e.g. water authority or province) actors could play an important role in this.

In project development, natural elements are often seen as a cost-item and investing in NBS can be considered a risk in that regard. To change this, the knowledge and evidence base should be used to show the positive effects of NBS and in that way possibly increase investor confidence. Also, investors and developers should be incentivized to take on a more long-term responsibility for maintenance, as this might increase their willingness to invest in the quality of the surrounding area and possibly also NBS.

Because of the dependency of NBS to local contexts, there should not be an aim to find generic solutions. Even on a city level, different circumstances may require different solutions. Desirably, NBS is tailored to the most local scale-level in order to fit the local circumstances.

Some of the previous recommendations, labeled learning from other cases as something positive for the development of NBS. Learning from others should however be done with caution, to prevent "copy and paste" solutions. Such solutions do not always consider the local environmental conditions and the specific challenges that belong to these conditions. The fact that a certain solution works in one place, does not automatically mean that it also does elsewhere. Even though the environmental conditions and corresponding challenges can differ between neighborhoods, many decision-making factors remain unchanged. The municipality for example acts in all neighborhoods regardless of the environmental conditions. It could therefore be helpful to emphasize the decision-making networks of actors underlying the solution. This requires a look at the governance approaches applied in a certain project, to learn 'how' a project has been realized, instead of simply copying and pasting a solution.

To address **"the challenge of working in an integral manner"**, the following recommendations can be drawn:

As concluded in the previous section, institutional fragmentation and path dependency contribute to the persistence of "sectoral silos", which were most notable in the operation of the municipal apparatus. Institutional fragmentation and path dependency are both complex problems that require much more research into the internal mechanisms of organizations to be able to make statements about the persistence of "sectoral silos". Nonetheless, the manifestation of these problems and the effect on integral project planning such as the implementation of NBS, can be discussed here.

To be able to work in an integral manner, the municipality should attempt to present itself as a united actor instead of separate departments. Instead of stacking the sectoral visions on top of each other, these visions should be integrated for the purpose relevant at that moment. To do so, it could be

helpful to appoint a project manager that is not a representative of one of the departments but is someone who mediates between the different views. The process of mediating might take a long time but could become smoother after the departments start to get used to it.

This project manager should not only mediate but also make sure that the plans are sustainable in design and implementation. The departments should be incentivized to look over the sectoral boundaries. For example, this could be done by reserving financial resources for integral projects. The external communication could become clearer, which might make up for the time lost in the internal mediation process.

When it comes to integral project planning in general, the multifunctional potential of NBS could be utilized more efficiently. The problem in most cases is, that adding functions often means that more actors need to be involved. This might make the planning process more complex, but it could also have some benefits. Firstly, adding functions could contribute to a more efficient land-use. This is something that is for example also being applied to real-estate, where mixed-use buildings are created to fit multiple functions on the same space. Furthermore, having multiple actors often increases the possibilities in terms of resources.

7.3 Recommendations for further research

NBS is an upcoming concept that is being studied from different angles, which is a good thing in terms of the diverse aspects that are being explored. This is important to fill the knowledge and evidence base for NBS, so that it becomes a richer and possibly more attractive concept. Studies on the effectiveness of NBS and the development of robust assessment and evaluation tools are highly desirable in regard to the knowledge and evidence base. However, in some cases the different angels are studied too much in an isolated fashion. Due to the integration of social, economic and environmental aspects as well as the focus on “real-world” solutions of the NBS concept, a more pragmatic stance could be desirable. A focus on research that combines environmental science and social science, could be a direction towards more integral, complete and pragmatic knowledge. Research on the effectiveness of NBS and the tools to assess the effectiveness, should therefore be focused on both social, economic and environmental parameters.

Urban nature and NBS seem to be more and more recognized as contributors to the climate resilience of cities. This feature is however not that often valued in traditional project development. A possible reason for this could be that the value of nature in regard to climate resilience is complicated to measure or that there is simply no willingness to include this. There are still many uncertainties regarding this. Therefore, an exploration of the possibilities to integrate the value of nature and NBS into project development would be an interesting research direction. This could for example contain the value of NBS in finance, management or certain business models.

The role information and knowledge has not been the main focus of this thesis. However, considering the experimental and innovative nature of NBS, information and knowledge seem to be important factors for its success. Further investigation the way that information and knowledge influence the planning process of NBS would be an interesting research direction for further research. Because of the dependency of NBS to the local social and environmental conditions, local and lay knowledge might be very relevant study as well.

8 REFERENCES

Literature:

Ahern, J. (2011). From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. Landscape and urban Planning, 100(4), 341-343.

Ahern, J. (2007). Green infrastructure for cities: the spatial dimension. In. In *Cities of the Future: Towards Integrated Sustainable Water and Landscape Management. IWA Publishing*. 267-283

Albert, C., Aronson, J., Fürst, C., & Opdam, P. (2014). Integrating ecosystem services in landscape planning: requirements, approaches, and impacts.

Albert, C., Schröter, B., Haase, D., Brillinger, M., Henze, J., Herrmann, S., ... & Matzdorf, B. (2019). Addressing societal challenges through nature-based solutions: How can landscape planning and governance research contribute?. Landscape and urban planning, 182, 12-21.

Alberti, M. (2005). The Effects of Urban Patterns on Ecosystem Function. *International Regional Science Review*, *28*(2), 168–192. https://doi.org/10.1177/0160017605275160

Barthel, S., Folke, C., & Colding, J. (2010). Social–ecological memory in urban gardens—Retaining the capacity for management of ecosystem services. *Global Environmental Change*, *20*(2), 255-265.

Bayulken, B., & Huisingh, D. (2015). Are lessons from eco-towns helping planners make more effective progress in transforming cities into sustainable urban systems: a literature review (part 2 of 2). *Journal of Cleaner Production*, *109*, 152-165.

Benedict, M. A., & McMahon, E. T. (2012). *Green infrastructure: linking landscapes and communities*. Island press.

Borsje, B. W., van Wesenbeeck, B. K., Dekker, F., Paalvast, P., Bouma, T. J., van Katwijk, M. M., & de Vries, M. B. (2011). How ecological engineering can serve in coastal protection. Ecological Engineering, 37(2), 113-122.

Burgerinitiatief Zonnehof. (2013). Manifest BIZ! Retrieved from http://www.bizamersfoort.nl/download/manifest.pdf

Chace, J. F., & Walsh, J. J. (2006). Urban effects on native avifauna: a review. *Landscape and urban planning*, *74*(1), 46-69.

Chaffin, B. C., Shuster, W. D., Garmestani, A. S., Furio, B., Albro, S. L., Gardiner, M., ... & Green, O. O. (2016). A tale of two rain gardens: Barriers and bridges to adaptive management of urban stormwater in Cleveland, Ohio. *Journal of environmental management*, *183*, 431-441.

Cohen-Shacham, E., Walters, G., Janzen, C., & Maginnis, S. (2016). Nature-based solutions to address global societal challenges. *IUCN, Gland, Switzerland*, *97*.

Connop, S., Vandergert, P., Eisenberg, B., Collier, M. J., Nash, C., Clough, J., & Newport, D. (2016). Renaturing cities using a regionally-focused biodiversity-led multifunctional benefits approach to urban green infrastructure. *Environmental science & policy*, *62*, 99-111.

Cowan, C., Epple, C., Korn, H., Schliep, R., & Stadler, J. (2010). Working with nature to tackle climate change. In Report of the ENCA/BfN Workshop on "Developing ecosystem-based approaches to climate change–why, what and how". BfNSkripten (Vol. 264, pp. 1-79).

Davies, C., & Lafortezza, R. (2019). Transitional path to the adoption of nature-based solutions. *Land Use Policy*, *80*, 406-409.

Davies, C., & Lafortezza, R. (2017). Urban green infrastructure in Europe: Is greenspace planning and policy compliant?. *Land use policy*, *69*, 93-101.

De Graaf, K. J., Platjouw, F. M., & Tolsma, H. D. (2018). The future Dutch environment and planning act in light of the ecosystem approach. Ecosystem Services, 29, 306-315.

De Groot, R. S., Alkemade, R., Braat, L., Hein, L., & Willemen, L. (2010). Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological complexity*, *7*(3), 260-272.

Dudley, N., Stolton, S., Belokurov, A., Krueger, L., Lopoukhine, N., MacKinnon, K., ... & Sekhran, N. (2010). Natural solutions: Protected areas helping people cope with climate change. Natural solutions: protected areas helping people cope with climate change.

Eggermont, H., Balian, E., Azevedo, J. M. N., Beumer, V., Brodin, T., Claudet, J., ... & Reuter, K. (2015). Nature-based solutions: new influence for environmental management and research in Europe. *GAIA-Ecological Perspectives for Science and Society*, *24*(4), 243-248.

Elmqvist, T., Setälä, H., Handel, S. N., Van Der Ploeg, S., Aronson, J., Blignaut, J. N., ... & De Groot, R. (2015). Benefits of restoring ecosystem services in urban areas. *Current opinion in environmental sustainability*, *14*, 101-108.

Ernstson, H. (2013). The social production of ecosystem services: A framework for studying environmental justice and ecological complexity in urbanized landscapes. *Landscape and Urban Planning*, *109*(1), 7-17.

Escobedo, F. J., Kroeger, T., & Wagner, J. E. (2011). Urban forests and pollution mitigation: Analyzing ecosystem services and disservices. *Environmental pollution*, *159*(8-9), 2078-2087.

European Environment Agency. (2011). *Green infrastructure and territorial cohesion: The concept of green infrastructure and its integration into policies using monitoring systems*. Publications Office of the European Union.

European Commission (EC). (2015). Towards an EU research and innovation policy agenda for nature-based solutions &re-naturing cities. Brussels.

Faivre, N., Fritz, M., Freitas, T., de Boissezon, B., & Vandewoestijne, S. (2017). Nature-Based Solutions in the EU: Innovating with nature to address social, economic and environmental challenges. *Environmental research*, *159*, 509-518.

Field, C. B., Barros, V., Stocker, T. F., & Dahe, Q. (Eds.). (2012). *Managing the risks of extreme events and disasters to advance climate change adaptation: special report of the intergovernmental panel on climate change*. Cambridge University Press.

Fischer, J., Gardner, T. A., Bennett, E. M., Balvanera, P., Biggs, R., Carpenter, S., ... & Luthe, T. (2015). Advancing sustainability through mainstreaming a social–ecological systems perspective. Current opinion in environmental sustainability, 14, 144-149.

Frantzeskaki, N., & Tilie, N. (2014). The dynamics of urban ecosystem governance in Rotterdam, The Netherlands. Ambio, 43(4), 542-555.

Gallopin, G. C., Hammond, A., Raskin, P., & Swart, R. (1997). Branch points: Global scenarios and human choice. Stockholm: SEI.

Gartland, L. M. (2012). *Heat islands: understanding and mitigating heat in urban areas*. Routledge.

Gemeente Amersfoort. (2019). Deelprogramma Uitvoering Groenvisie 2019-2022. Onderdeel van programma Klimaatbestendige en Groene Stad. Retrieved from https://hetgroenehuisamersfoort.nl/sites/default/files/Deelprogramma%20Uitvoering%20Groenvisie%202019-2022%20def.pdf

Gemeente Amersfoort. (2016). Groenvisie Amersfoort. Samen Maken We De Stad Groener! Retrieved from http://groenvisieamersfoort.nl/wordpress/wp-content/uploads/2015/01/Groenvisie-Amersfoort-definitieve-versie.pdf

Gemeente Amersfoort. (2013). Structuurvisie Amersfoort 2030. Een nieuwe ruimtelijke sturingsfilosofie voor onze stad. Retrieved from https://www.amersfoort.nl/bericht/structuurvisie-amersfoort-2030-1.htm

Glaser, M., Krause, G., Ratter, B. M., & Welp, M. (Eds.). (2012). Human-nature interactions in the anthropocene: potentials of social-ecological systems analysis. Routledge.

Green, T. L., Kronenberg, J., Andersson, E., Elmqvist, T., & Gomez-Baggethun, E. (2016). Insurance value of green infrastructure in and around cities. *Ecosystems*, *19*(6), 1051-1063.

Gómez-Baggethun, E., & Barton, D. N. (2013). Classifying and valuing ecosystem services for urban planning. *Ecological Economics*, *86*, 235-245.

Gómez-Baggethun, E., De Groot, R., Lomas, P. L., & Montes, C. (2010). The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. *Ecological economics*, *69*(6), 1209-1218.

Gómez-Baggethun E, Gren Å, Barton DN, Langemeyer J, McPhearson T, O'Farrell P, Andersson E, Hamstead Z, Kremer P (2013) Urban ecosystem services. In: Urbanization, biodiversity and ecosystem services: challenges and opportunities. Springer, Dordrecht, pp 175–251

Hall, C. M. (2011). A typology of governance and its implications for tourism policy analysis. Journal of Sustainable Tourism, 19(4-5), 437-457.

Hansen, R., & Pauleit, S. (2014). From multifunctionality to multiple ecosystem services? A conceptual framework for multifunctionality in green infrastructure planning for urban areas. *Ambio*, *43*(4), 516-529.

Horwood, K. (2011). Green infrastructure: reconciling urban green space and regional economic development: lessons learnt from experience in England's north-west region. *Local Environment*, *16*(10), 963-975.

Jackson, W. (2002). Natural systems agriculture: a truly radical alternative. Agriculture, ecosystems & environment, 88(2), 111-117.

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., ... & Zaunberger, K. (2016). Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society*, *21*(2).

Kaczorowska, A., Kain, J. H., Kronenberg, J., & Haase, D. (2016). Ecosystem services in urban land use planning: Integration challenges in complex urban settings—Case of Stockholm. *Ecosystem Services*, *22*, 204-212.

Keesstra, S., Nunes, J., Novara, A., Finger, D., Avelar, D., Kalantari, Z., & Cerdà, A. (2018). The superior effect of nature based solutions in land management for enhancing ecosystem services. Science of the Total Environment, 610, 997-1009.

Klein Overmeen, M. J. C. (2016). Regenwaterberging en - infiltratie Zonnehof Amersfoort (Eindrapportage). Amstelveen/Deventer, Nederland: Wareco Ingenieurs.

Lafortezza, R., Chen, J., van den Bosch, C. K., & Randrup, T. B. (2018). Nature-based solutions for resilient landscapes and cities. *Environmental research*, *165*, 431-441.

Lawrence, A., De Vreese, R., Johnston, M., van den Bosch, C. C. K., & Sanesi, G. (2013). Urban forest governance: Towards a framework for comparing approaches. Urban Forestry & Urban Greening, 12(4), 464-473.

Lele, S., Springate-Baginski, O., Lakerveld, R. P., Deb, D., & Dash, P. (2013). Ecosystem services: origins, contributions, pitfalls, and alternatives. *Conservation and Society*, *11*(4), 343-358.

Lemos, M. C., & Agrawal, A. (2006). Environmental governance. Annu. Rev. Environ. Resour., 31, 297-325.

Lo, A. Y. (2013). The role of social norms in climate adaptation: Mediating risk perception and flood insurance purchase. *Global Environmental Change*, *23*(5), 1249-1257.

Maes, J., & Jacobs, S. (2017). Nature-based solutions for Europe's sustainable development. *Conservation Letters*, *10*(1), 121-124.

Matthews, T., Lo, A. Y., & Byrne, J. A. (2015). Reconceptualizing green infrastructure for climate change adaptation: Barriers to adoption and drivers for uptake by spatial planners. *Landscape and Urban Planning*, *138*, 155-163.

MEA (2005) Millennium assessment report. Ecosystems and human well-being: synthesis. Island Press, Wahsington, DC

MacKinnon, K., Sobrevila, C., & Hickey, V. (2008). Biodiversity, Climate Change and Adaptation; Nature-Based Solutions from the World Bank Portfolio. *Washington: The International Bank for Reconstruction and Development/THE WORLD BANK*.

Nature4Cities. (2018). D1.1 –NBS multi-scalar and multi-thematic typology and associated database (Version 10–Rev.3). Retrieved from https://docs.wixstatic.com/ugd/55d29d_8813db2df690497e80740537b6a8a844.pdf

Nature4Cities. (2017). D1.2 –NBS Implementation Models Typology (Version 6–Rev.0). Retrieved from https://docs.wixstatic.com/ugd/55d29d_bf62bb2029dc4b68a339ab2c10107dad.pdf

Nature4Cities. (2018b). D1.3 – NBS Project Observatory specifications (Version 7 – Rev.3). Retrieved from https://docs.wixstatic.com/ugd/55d29d_b566470fa7df4960a5fb4ac6e6567bb4.pdf

Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., ... & Krauze, K. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of the Total Environment*, *579*, 1215-1227.

Noss, R. F. (1991). Landscape connectivity: different functions at different scales. Landscape linkages and biodiversity. Island Press, Washington, DC, USA, 27-39.

Pauleit, S., Zölch, T., Hansen, R., Randrup, T. B., & van den Bosch, C. K. (2017). Nature-based solutions and climate change–four shades of green. In *Nature-Based Solutions to Climate Change Adaptation in Urban Areas* (pp. 29-49). Springer, Cham.

Primmer, E., Jokinen, P., Blicharska, M., Barton, D. N., Bugter, R., & Potschin, M. (2015). Governance of ecosystem services: a framework for empirical analysis. *Ecosystem services*, *16*, 158-166.

Potschin-Young, M., Haines-Young, R., Görg, C., Heink, U., Jax, K., & Schleyer, C. (2018). Understanding the role of conceptual frameworks: Reading the ecosystem service cascade. *Ecosystem services*, *29*, 428-440.

Raskin, P., Chadwick, M., Jackson, T., & Leach, G. (1996). The sustainability transition. Beyond conventional development (No. SEI-POLESTAR--1). Stockholm Environment Inst.(Sweden).

Salbitano, F., Borelli, S., Conigliaro, M., & Yujuan, C. (2016). *Guidelines on urban and peri-urban forestry*. FAO.

Seastedt, T. R., Hobbs, R. J., & Suding, K. N. (2008). Management of novel ecosystems: are novel approaches required?. *Frontiers in Ecology and the Environment*, *6*(10), 547-553.

Sekulova, F., & Anguelovski, I. (2017). The Governance and Politics of Nature-Based Solutions.

Suding, K. N., Gross, K. L., & Houseman, G. R. (2004). Alternative states and positive feedbacks in restoration ecology. *Trends in ecology & evolution*, *19*(1), 46-53.

Taylor, P. D., Fahrig, L., Henein, K., & Merriam, G. (1993). Connectivity is a vital element of landscape structure. Oikos, 571-573.

Uittenbroek, C. J., Janssen-Jansen, L. B., Spit, T. J., Salet, W. G., & Runhaar, H. A. (2014). Political commitment in organising municipal responses to climate adaptation: the dedicated approach versus the mainstreaming approach. *Environmental Politics*, *23*(6), 1043-1063.

Uittenbroek, C. J. (2016). From policy document to implementation: Organizational routines as possible barriers to mainstreaming climate adaptation. *Journal of Environmental Policy & Planning*, *18*(2), 161-176.

van den Bosch, M., & Sang, Å. O. (2017). Urban natural environments as nature-based solutions for improved public health–a systematic review of reviews. *Environmental research*, *158*, 373-384.

Vandergert, P., Collier, M., Kampelmann, S., & Newport, D. (2016). Blending adaptive governance and institutional theory to explore urban resilience and sustainability strategies in the Rome metropolitan area, Italy. *International Journal of Urban Sustainable Development*, *8*(2), 126-143.

van der Jagt, A. P., Elands, B. H., Ambrose-Oji, B., Gerőházi, É., Møller, M. S., & Buizer, M. (2017a). Participatory governance of urban green spaces: trends and practices in the EU. NA, 28(3).

van der Jagt, A., Dorst, H., Raven, R. & Runhaar, H. (2017b). Nature of innovation for urban sustainability. Naturvation. Copernicus Institute for Sustainable Development Utrecht University

Wild, T. C., Henneberry, J., & Gill, L. (2017). Comprehending the multiple 'values' of green infrastructure–Valuing nature-based solutions for urban water management from multiple perspectives. *Environmental research*, *158*, 179-187.

Websites:

ANP. (2007). Amersfoort nu ook “groenste stad van Europa.” Retrieved from https://www.nu.nl/algemeen/1245420/amersfoort-nu-ook-groenste-stad-van-europa.html

De Nieuwe Stad. (n.d.). De Nieuwe Stad. Retrieved September 8, 2019, from https://www.denieuwestad.nl/over/de-nieuwe-stad/

De Eem vs. De Rijn. (n.d.). Retrieved September 19, 2019, from https://verhaal140.wordpress.com/tag/aardrijkskunde/

European Commission (EC). (2017, January 9). Nature-Based Solutions | Environment - Research and Innovation - European Commission. Retrieved September 4, 2019, from https://ec.europa.eu/research/environment/index.cfm?pg=nbs

Gemeente Amersfoort. (n.d. -a). Amersfoort in Cijfers. Retrieved September 12, 2019, from https://amersfoortincijfers.nl/jive

Gemeente Amersfoort. (n.d.). Steenbreek openbare ruimte. Retrieved September 8, 2019, from https://www.amersfoort.nl/wonen-en-verhuizen/to/steenbreek-openbare-ruimte-.htm

Het Groene Huis. (n.d.). Netwerk Operatie Steenbreek Amersfoort. Retrieved September 8, 2019, from https://www.hetgroenehuisamersfoort.nl/netwerk-operatie-steenbreek-amersfoort

Lekker in je tuin. (n.d.). Klimaatvriendelijke voorbeeldtuin Engweg. Retrieved September 8, 2019, from https://www.lekkerinjetuin.nl/voorbeeldtuin-engweg/

Lekker in je tuin. (n.d.-b). Voorbeeldtuinen Amersfoort. Retrieved September 8, 2019, from https://www.lekkerinjetuin.nl/voorbeeldtuinen/

NAIAD. (n.d.). CORDIS | European Commission. Retrieved September 4, 2019, from https://cordis.europa.eu/project/rcn/206403/factsheet/en

NATURVATION. (n.d.). Urban Nature Atlas. Retrieved September 4, 2019, from https://naturvation.eu/atlas

Oppla. (n.d.). Marketplace | Oppla. Retrieved September 4, 2019, from https://oppla.eu/marketplace

RTV Utrecht. (2018, June 15). Amersfoort kiest komende jaren voor groen en duurzaam | RTV Utrecht. Retrieved September 9, 2019, from https://www.rtvutrecht.nl/nieuws/1780091/amersfoort-kiest-komende-jaren-voor-groen-en-duurzaam.html

Stichting Steenbreek. (n.d.). Organisatie Stichting Steenbreek. Retrieved September 8, 2019, from https://www.operatiesteenbreek.nl/over-ons/

UNaLab. (n.d.). Home Page | UNaLab. Retrieved September 4, 2019, from https://www.unalab.eu/

UNdata. (2019, May 17). UN, City population - Google Public Data Explorer. Retrieved September 23, 2019, from https://www.google.com/publicdata/explore?ds=z5567oe244g0ot_

VIC Activating Landscapes. (n.d.). Oliemolenhof, Amersfoort. Retrieved September 8, 2019, from https://www.viclandscapes.nl/oliemolenhof-amersfoort/

Waterschap Vallei enVeluwe. (n.d.). Zonnehof maakt Amersfoort klimaatbestendiger. Retrieved September 6, 2019, from https://www.vallei-veluwe.nl/toptaken/waterverhalen/zonnehof-maakt/

ANNEX. INTERVIEW GUIDELINE

Dear (…respondent…),

Thanks again for your time to give this interview. Before we start, I would like to ask if it is OK if I record this conversation. I would also like to emphasize that the information you provide will be treated confidentially. If you prefer to remain anonymous, then of course I will comply.

1. **Introduce topic:**

As indicated earlier, I am working on my master's thesis for the study spatial planning at Utrecht University. The topic of the thesis is the so-called concept of "nature-based solutions", which are quite literally solutions that are in some way inspired by nature. “Nature-based solutions” are being used more frequently as an alternative sustainable development strategy. My research focuses primarily on the way in which “nature-based solutions” can be integrated into urban policy. The concept of "nature-based solutions" can be seen as an umbrella term for ecologically oriented urban development concepts, such as "eco-system services" and "green infrastructure". I have chosen to take Amersfoort as the case for the investigation. That is why I would like to ask you some questions about your associations with “nature-based solutions”.

2. **Background of respondent**

- To begin, I would like to know more about your work and your background. Could you tell me something about that?
- In what way are you involved with NBS (or UGI/ESS)?

3. **Project specific questions**

I would like to start with some questions about project X and then more about Amersfoort in general.

<u>Urban challenge:</u>

- What societal problem (climate adaptation, water management, heat stress) has been attempted to be solved with the help of (…project A…)?

<u>Solutions:</u>

- To what extent did ecosystem processes contribute to solving this problem?
    - In what way have ecosystems been influenced by project X?
- What were the (expected) results relative to the societal challenge?
    - What kind of ecosystem services did you hope to create or strengthen with project X?

<u>Uncertainty & Assessment:</u>

- To what extent was there certainty in advance about the outcome / success of the project?
    - What caused the uncertainty / certainty?
    - Have possible long-term results been taken into account?
    - Have possible results on different geographic scales been taken into account?
    - How are the results assessed or monitored?

<u>Multi-stakeholder & trade-offs:</u>

- Could you indicate what the most important actors/stakeholders were for this project?

- Was there a quick consensus about the objectives and expected outcomes between the various parties or did many compromises have to be made?
    - What did these trade-offs entail?
    - In what way was there collaboration with other parties?
- How is the project funded?
    - What happens when the financing (subsidy) stops?
    - How is it maintained?

4. "nature-based solutions" in Amersfoort (RO1 part 1):

- What are important projects and policies in Amersfoort in regard to NBS? And why?
- Which social challenges do you think are the most relevant when it comes to nature-based solutions in Amersfoort?
- How well established is NBS in Amersfoort (as well as related concepts of UGI, ESS, biodiversity and the general sustainability discourse)?
    - Has it always been this way, or did you experience a change over time?
- Do you think that NBS (as well as UGI/ESS) is being promoted sufficiently to make an impact on the city?

5. Actors/ stakeholders for "nature-based solutions" in Amersfoort (RO1 part 2)

- What kind of role do you or does your organization play in the promotion and implementation of NBS?
- What other actors/stakeholders are most important when working with NBS?
- What is your experience with collaborating with other actors/stakeholders?
    - Are there many synergies between parties? Or many conflicts?
        - Could you specify how synergies are established?
        - Could you specify how these conflicts are resolved?
- What attitude do you think the municipality should adopt when it comes to the implementation and promotion of nature-based solutions in Amersfoort?
    - What position, do you think, should non-municipal actors take? Why?

6. Institutional – and policy frameworks for "nature-based solutions" (EU, NL, local) (RO1 part2)

- What EU, NL or local policies do you deal with when working with NBS?
    - How do they support/restrict your work with NBS?
- Are there, in your view, any policy reforms needed that would benefit promotion or implementation of NBS? If yes, how would that take shape?

7. Barriers of NBS (RO2):

There are many possible barriers that could influence the implementation and upscaling of nature-based solutions. I will now present some of them to you. Please indicate whether the barrier is relevant and how this barrier manifests itself in the situation in Amersfoort / project.

Dimensions	Sub-aspects	Potential enabling/restricting factors
Institutional framework	Policies, Planning and regulations, Ownership, Access and use rights	Inadequate regulations, Unsupportive legal frameworks (permits/ property rights), Path dependency, Institutional fragmentation
Actors and coalitions	Primary actors, Other actors, Partnerships, Power analysis	Insufficient collaboration, Unclear objectives and goals, Unclear leadership and role
Resources	Funding, Knowledge and information, Delivery mechanisms	Inadequate financial resources, uncertainty about costs/benefits, lack of knowledge or knowledge transfer
Processes	Discourses, Participation, engagement and conflict management, Monitoring and evaluation	The disconnect between short-term actions and long-term goals, The discontinuity between short-term actions and long-term plans, Uncertainty regarding implementation process and effectiveness of the solutions

8. Concluding questions

- Before we end this interview, I would like to ask you what you see as the main driver and barrier for the implementation and promotion of nature-based solutions
- What should happen based on your experience to ensure an effective and sustainable implementation of nature-based solutions in the future
- Is there anything else you would like to add before we finish the interview?

Thank you very much for your time and your valuable information.