

# Exploring the Disconnect: Understanding the Absence of Soil Ecosystem Services in Urban Land Use Planning

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**Abstract**— Historically, urban planning focused on socio-economic functions to cater to human needs, leading to shortsighted decisions and irreversible transformation of natural landscapes into urbanized areas. The Netherlands faces a challenge with the highest rate of urban land take in the EU, causing a decline in crucial soil ecosystem services (SES). This study investigates the barriers to SES integration in Dutch urban land use planning (ULUP) using policy reviews and interviews. The primary reasons for SES not being integrated into ULUP are agenda setting, actor collaboration, and technology consensus. The research aims to promote sustainable and resilient urban development by shedding light on these obstacles.

**Keywords**— Urban Land Use Planning, Soil Ecosystem Services, Urbanization, Sustainable Land Management

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## 1. Introduction

*“No country has as much land take for urban functions relative to its land area as the Netherlands” (van den Bossche, 2023).*

The urban landscape of the Netherlands faces a distinct challenge: the country has the highest rate of urban land use relative to its total land area in the European Union (EU) (van den Bossche, 2023). The concept of land as a finite resource, akin to oil or lithium, underscores the necessity of sustainable land management (Teixeira da Silva et al., 2018).

This rapid urban expansion has caused a significant decline in crucial soil ecosystem services (SES) (Teixeira da Silva et al., 2018). The unregulated expansion of urban areas has caused the conversion of natural lands into built environments, resulting in considerable environmental deterioration (Liu et al., 2022).

The current landscape reflects that our available land has already been extensively utilized. In the Netherlands, between 2000 and 2018, nearly 70,000 hectares were converted for housing, infrastructure, and other urban functions, equivalent to about ten hectares per day, or roughly the size of a residential block with 20 terraced houses (PBL, 2023).

Historically, urban planning practices focused solely on the socio-economic functions that cities cater to human

needs. However, these approaches often resulted in shortsighted planning decisions, leading to the irreversible transformation of natural landscapes into urbanized areas (Sandil & Kumar, 2022).

Environmental issues have received less attention as a result of this urban expansion. The increasing use of tiles and structures in cities has resulted in soil sealing (Bootsma et al., 2020; Sandil & Kumar, 2022). Particularly, soil sealing, has significantly reduced the availability of SES in urban areas, as depicted in Figure 1. Soil sealing reduces not just water filtration but also the urban heat island effect. The pavements in metropolitan centers absorb and hold more heat, resulting in higher temperatures (Bessembinder, 2023). This can lead to a variety of health problems, especially in vulnerable groups such as the elderly and children (Teixeira da Silva et al., 2018).

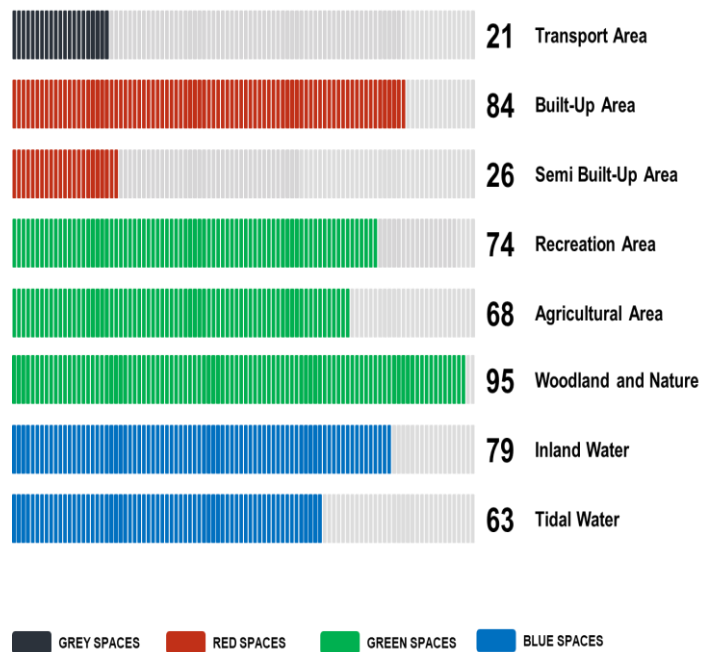
The absence of SES integration within the Dutch urban land use planning (ULUP) has led to critical tipping points (Teixeira da Silva et al., 2018). As human activities shape land use management, standard ecological SES issues such as soil pollution, decreased microbial activity, and poor soil health have been made worse by urbanization (Hertel, 2017; Sandil & Kumar, 2022). Recognizing and valuing SES becomes crucial in addressing challenges pivotal to ULUP and promoting sustainable decisions that tackle soil subsidence, the urban heat island effect, and overall urban well-being.

The progression from blue and green to grey and red areas in Figure 1 vividly depicts the decline in SES, highlighting the complex relationships between various land-use functions and their corresponding ecosystem services. Notably, grey spaces, characterized by a lack of green elements, exhibit the lowest percentage of associated SES (21%), while green spaces rich in vegetation show the highest percentage (95%). Figure 1 portrays how critical it is to address this descent and how obsolete planning approaches need to be reviewed to ensure sustainable urban growth.

Recognizing the vital role of SES within cities, this study delves into the barriers that have hindered the inclusion of these essential services in Dutch ULUP strategies (Liu et al., 2022). SES is defined as the benefits that humans receive from the services that soil provides (Millennium Ecosystem Assessment, 2003). This study categorizes SES into three domains: regulating services (gas and water regulation, climate, floods, erosion, and biological processes such as pollination and disease control), provisioning services (direct or indirect food for humans, freshwater, wood, fiber, and fuel), and cultural services (esthetic, spiritual, educational, and recreational) (Teixeira da Silva et al., 2018). The concept of SES is

becoming more well-known as a meticulous method for analyzing human-environment interactions (Teixeira da Silva et al., 2018), making it a crucial lens for this investigation. By uncovering these obstacles, this research hopes to pave the way for better resilient and sustainable urban development.

Figure 1. Overview Amount of SES in Cities (in %)



Source: Appendix C

The challenges arising from non-integrated SES within ULUP make this research geographically relevant. By integrating SES into ULUP cities can be more sustainable and resilient, addressing both local and global challenges. Furthermore, the long-term repercussions of failing to fully integrate SES in ULUP result in escalated government costs and potential risks to residents' financial and health well-being (Sandil & Kumar, 2022). This emphasizes the study's societal relevance. On a scientific front, this thesis aims to bridge the knowledge gap surrounding the exclusion of SES from ULUP. The outcomes can potentially guide policy decisions, advocate for change, and foster ecologically sound urban planning (Horelli, 2013; Meacham et al., 2016).

With the urgency to integrate SES into ULUP in mind, this research seeks to uncover the reasons behind this omission in the Netherlands. By examining agenda setting, actor collaboration, and technological consensus, the study aims to reveal the obstacles preventing SES integration in ULUP practices. The central research question guiding this study is:

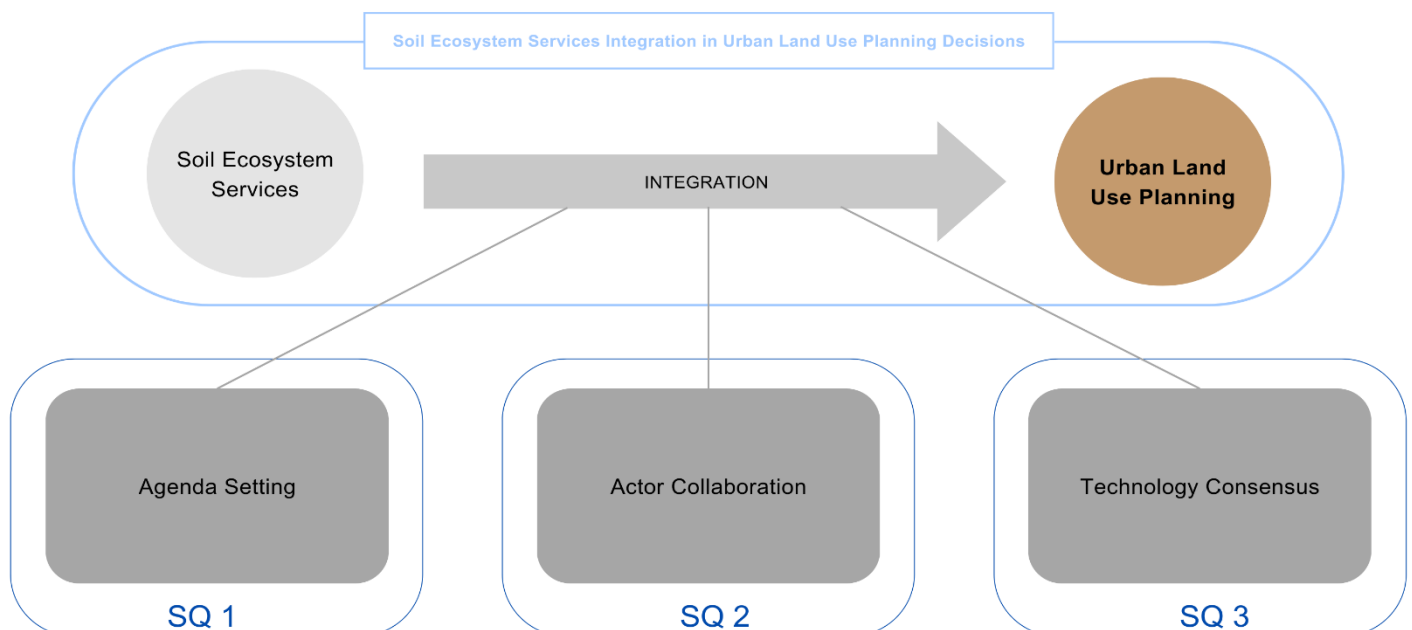
**"Why are soil ecosystem services (SES) not integrated into urban land use planning (ULUP) in the Netherlands?"**

The central question is divided into the following sub questions:

1. *What specific aspects of the agenda setting process within ULUP in the Netherlands create obstacles for the integration of SES?*
2. *How do the dynamics of actor collaboration in the context of ULUP pose obstacles to the integration of SES in the Netherlands?*
3. *How does the absence of technology consensus hinder the integration of SES into ULUP in the Netherlands?*

The thesis consists of 7 parts and has the following outline. This chapter, introduction, contains the aim for the research, the research problem and question, and the relevance. Chapter 2 contains the theoretical framework with relevant existing scientific literature. The concepts are explained and linked, but first the conceptual model is presented. This provides insight into the relationships between the concepts and forms the analytical framework for the empirical research. Chapter 3 discusses the methodology and operationalization, including method and data collection. The choices are justified and the way to analyze the data is explained. Reliability and validity are also discussed. Chapter 4 presents the empirical results. These are analyzed in chapter 5. Chapter 6 consists of a conclusion about the theoretical and empirical results. After answering the main question, a critical reflection on the research is given in chapter 7.

Figure 2. Conceptual Model



Source: Author

## 2. Literature Review

In this chapter, a literature review will be done that contributes to the relevant discussion for this research. The concepts central to the research are agenda setting, actor collaboration, and technology consensus. Each concept is closely intertwined with a specific sub-question. Through literature, I aim to clarify how these concepts influence the integration process of SES into ULUP.

Before delving into the specifics of each concept, it is important to establish a foundational understanding. Thus, I introduce the conceptual framework (Figure 2), which serves as a visual representation of the intricate connections between the three concepts central to literature: SES and ULUP. This conceptual model not only provides a roadmap for the research but also highlights the interplay among these elements, guiding the direction of my study.

Agenda setting involves determining which subjects receive attention and coverage and shaping what is discussed and perceived as important (Leffers & Wekerle, 2020). While actor collaboration underscores the collaborative role of actors in shaping well-informed decision-making processes (Gemert, 2016). Moreover, technology consensus introduces innovative tools and methodologies that empower decision-makers with evidence-driven insights (Davies & Laforteza, 2019).

My goal is to shed light on the intricate pathways through which these concepts interact, shaping our understanding of why the integration of SES into ULUP faces

challenges. Drawing upon a comprehensive review of relevant literature, my intention is to deepen the insight and pave the way for a comprehensive analysis in the upcoming chapters.

## 2.1 Public Issue in Agenda Setting

This section delves into agenda setting, one of the three aspects that influence the inclusion of SES in ULUP. Agenda setting plays a pivotal role in the context of ULUP by establishing priorities, targets, and objectives that guide decision-making processes. It shapes the choices that mold land use and environmental management strategies, creating a framework for problem-solving approaches, tactics, resource allocation, and emphasis within the domain of urban development. As a result, a comprehensive grasp of agenda-setting processes is indispensable for understanding the barriers that impede the integration of SES into ULUP.

Agenda setting encompasses the process of drawing attention to problems and weighing alternative solutions that either gain traction or fade into the background for both the public and the elite (Birkland, 2006). The competition among groups to influence agenda determination is fierce, as societal and political institutions cannot address every problem at any given moment (Birkland, 2006). Within the literature, researchers ponder over the factors that lead certain issues to be placed on government agendas while others remain overlooked (Pralle, 2009). Consequently, groups must contend for a place on the agenda for their issues, as the available space is limited. Successfully framing a problem often involves defining associated solutions and shaping the contours of policy debates. Simultaneously, groups also strive to prevent certain issues from gaining traction on the agenda (Birkland, 2006).

To analyze the challenge of integrating SES into ULUP through the lens of agenda setting, this research employs the Multiple Streams Framework (MSF). The MSF is chosen due to its capability to capture the intricate dynamics of agenda setting, as established by prior research (Béland & Howlett, 2016; DeLeo, 2018; Fowler, 2022). Moreover, the MSF elucidates the reasons why certain agendas are acknowledged or overlooked by policymakers (Weible & Sabatier, 2017). The MSF employs three distinct streams in social settings to depict the agenda-setting process:

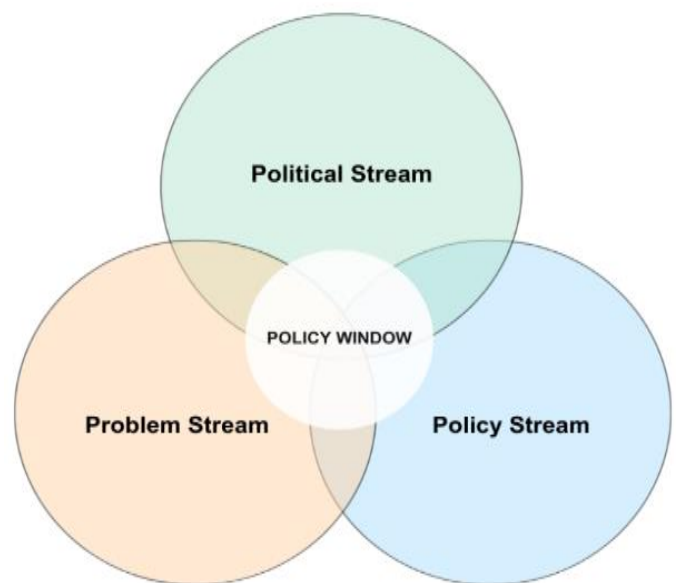
- **Problem Stream:** Identifying and prioritizing societal problems that demand government action. Policymakers use indicators to perceive changes and assess the severity of the challenge. These include the number of road deaths, immunization rates, and car-ride rates (Kingdon, 2011). It is not a direct

recognition of the facts, but a factor with powerful implications (DeLeo, 2017).

- **Policy Stream:** Policymakers provide many strategies and ideas to address policy issues (Zohlnhöfer et al., 2016). The winning proposal considered technological feasibility, value acceptability, and alignment with long-term plans (Kingdon, 2011).
- **Political Stream:** Consists of elements that have an impact on agenda setting. That includes public sentiment, the interaction between organized political forces, government change, and jurisdictional distinctions (Zahariadis, 2015). Here, ideology or preferences play a significant role in how the stream materializes (Herweg et al., 2017).

The interplay of the problem and political streams exerts major influence on agenda setting, while the policy stream centers on policy proposals. Policymakers engage in a competitive presentation of diverse policy alternatives when the political stream undergoes shifts (Kingdon, 2011). As depicted in Figure 3, this interaction facilitates the merging of the three streams to create a policy window (Liu et al., 2022), culminating in the process of agenda setting.

Figure 3. Agenda Setting with the Multiple Streams Framework



Source: Adapted from Liu et al., 2022; Kingdon, 2011

In conclusion, it becomes evident that SES encounters substantial barriers during the agenda-setting phase, subsequently contributing to its non-integration into ULUP. These barriers encompass challenges in framing SES-related issues as prominent and urgent societal concerns within the problem stream. Additionally, the intricate interplay of political forces in the political stream can hinder the elevation of SES on the agenda, particularly when competing issues compete for attention. Moreover, the policy stream's challenges lie in conceptualizing

feasible and acceptable strategies that resonate with long-term urban development plans. Understanding these agenda-setting barriers is essential for addressing the root causes behind the non-integration of SES into ULUP.

### 2.1.1 Agenda Setting for SES in Cities

Agenda setting concerning SES has historically exhibited a stronger emphasis on agricultural and forest lands, often overshadowing urban areas (Visser et al., 2019). Environmental aspects within cities were typically regarded as urban features, primarily serving recreational purposes, according to policymakers and planners (Nieland et al., 2019; Rijk, 2021). In contrast, green spaces in agriculture garnered attention due to their functional role in food production, leading to their prominence in the problem stream. The essential nature of food as a basic necessity, coupled with the increasing dependence of the growing population on it (Burghardt, Morel, & Zhang, 2015), influenced the problem and political streams, pushing for the prioritization of agricultural and forest lands in SES considerations.

A decisive moment in the political stream was marked by the "Lekkerkerk affair" in the Netherlands, inducing a transformative shift in ideology and heightened awareness of risky planning practices. Subsequently, policymakers responded by instituting new laws and regulations (Bannink, 2018). This occurrence marked the commencement of the initial policy window for SES in ULUP. However, the exclusive focus of this policy on chemical variables overshadowed other vital SES-related factors. As a result, certain facets of SES and their broader

significance within ULUP remained insufficiently acknowledged and addressed, particularly within the problem and political streams (Leffers & Wekerle, 2020).

This historical trajectory underscores the challenges and opportunities inherent in integrating SES into ULUP, urging a more inclusive consideration of urban dynamics and their ecological significance within the decision-making framework. And thus, this exploration provides insights into the historical patterns, pivotal incidents, and evolving perspectives shaping the agenda setting for SES in urban contexts.

## 2.2 Planning and Actor Collaboration

The importance of high-quality actor collaboration is evident in governance literature, where networks play a crucial role (Bokhorst et al., 2015). Table 1 offers an overview of actors from various sectors in ULUP, such as government authorities, private developers & business, community organizations & residents, and environmental groups & conservation organizations (Gemert, 2016). ULUP's pursuit of equitable, sustainable, and livable urban spaces (EEA, 2020) makes the participation of these actors crucial for effective decision-making (Rijk, 2021).

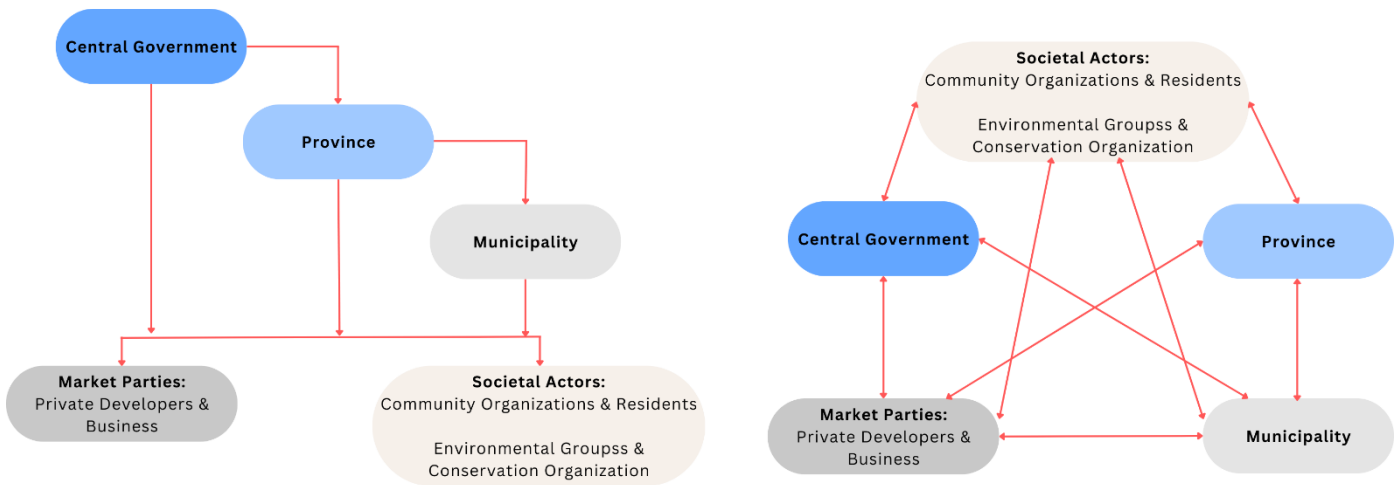
While governments possess unique authority in spatial planning, private sector actors, like developers, contribute financial resources and experience (Nieland et al., 2019). Consequently, actors in the decision-making process harness available resources (van Kann, 2023). Local governments collaborate with private entities to accommodate economic growth (Healey, 1998; Leffers &

Table 1. Actors in Urban Land Use Planning

Actors	Role in Urban Land Use Planning
<b>Government Authorities</b>	Establishing and carrying out zoning laws, rules, and regulations that affect the built environment. They are in charge of supervising the planning procedure, promoting citizen participation, and ensuring conformity to governmental and environmental rules.
<b>Private Developers &amp; Businesses</b>	Influential stakeholders who have made significant investments in real estate development. They designed and executed development projects in line with market needs and regulatory guidelines. They collaborate with government authorities to get planning permission and address public concerns.
<b>Community Organizations &amp; Residents</b>	Crucial stakeholders who represent the desires and requirements of the local community. They offer input and support for matters, such as affordable housing, environmental protection, public facilities, and social justice. Involving them in the process guarantees that the planning decisions are in line with the community's values and goals.
<b>Environmental Groups &amp; Conservation Organizations</b>	They encourage sustainable use of natural resources, green spaces, and biodiversity. Their intent is to promote sustainable development and offer ecological planning strategies and knowledge.

Source: Gemert, 2016; Rijk, 2021

Figure 4. Vertical Networks (left) and Horizontal Networks (right)



Source: Dijk, 2006; Gemert, 2016; Rijk, 2021

Wekerle, 2020). However, this collaboration's implications can prioritize economic order over environmental concerns (Leffers & Wekerle, 2020; Schmierbach et al., 2022).

Actors rely on each other for resources and achieving goals, leading to interactions and the emergence of interaction patterns, forming a web of dependencies that shapes network structures (Klijn & Koppenjan, 2016; Ten Heuvelhof, 2016). Despite this, networks involve actors on an equal footing, not bound by explicit authority relationships (Ten Heuvelhof, 2016). This pattern extends to governmental contexts (Ten Heuvelhof, 2016; Van der Steen et al., 2014).

However, network collaborations also face challenges with boundaries and potential conflicts (Van Broekhoven et al., 2014). Actors from diverse backgrounds coordinate boundaries, blurring them within and between governments (Giersig, 2008). Horizontal policy networks challenge existing political institutions because they are based on the traditional idea of representative democracy. This traditional idea assumes that the exercise of power within a political community is in the hands of elected administrators. If many different parties participate in decision-making in governance networks, it seems as if little room for decision-making is left for the traditional, classic representative democratic bodies (Van Buuren et al., 2010).

Governments bear the responsibility for achieving public value and political goals, but also require the efforts of others to succeed, leading to an increasing emphasis on horizontal network (Van der Steen et al., 2014). Governments, seeking to adapt to complex environments, have transitioned from traditional vertical structures to horizontal networks, driven by effectiveness (see Figure

4). These efforts are driven by effectiveness considerations. By interacting with parties in the environment, a government tries to increase the effectiveness of its policy and steering activities (Koppenjan, 2007). These horizontal networks redefine actor roles and promote a more inclusive, participatory approach (Bevir & Rhodes, 2010). This shift is seen as fostering creativity, inclusivity, and public involvement while diminishing conflicts of interest (Gonzalez & Healey, 2005; Leffers & Wekerle, 2020).

But these networks can be seen as difficult to control by traditional vertical institutions, prompting tension between horizontal governance and vertical institutions (Koppenjan, 2007; Van Buuren et al., 2010). According to Koppenjan (2007), three reactions to the above stress can be distinguished. The first response is the call to restore political primacy, or, in other words, the reconquest of the public domain. This response is about pushing back horizontalization by emphasizing the need for leadership, sharply demarcating responsibilities, formulating clear goals, and more precisely programming, monitoring, and enforcing their implementation. The second response assumes that horizontal forms of governance are unavoidable in a complex society (Leffers & Wekerle, 2020). The aim is to improve the democratic functioning of these horizontal forms of government. The third response is based on the coexistence of horizontal forms of government and vertical institutions of representative democracy. It seems important that the link between vertical democracy and horizontal governance be improved (Koppenjan, 2007).

In conclusion, the transition from traditional vertical networks to horizontal networks, while fostering inclusivity and creativity, brings forth challenges in managing horizontal governance within the existing

framework of representative democracy (Leffers & Wekerle, 2020). The intricate web of actor interdependencies, albeit essential for effective decision-making, can lead to conflicts, power dynamics, and blurred boundaries (Koppenjan, 2007). The evolving landscape of ULUP and the involvement of diverse actors, including governments and private entities, underscore the need for balanced considerations between economic growth, environmental preservation, and equitable urban development.

### 2.2.1 Behaviors Responses of Actors

The decision-making process in the ULUP typically revolves around spatial development, but it also regulates spatial behavior (van Kann, 2023). All actors try to accomplish their objectives and have their own will and policy freedom (Zonneveld, 2021). However, the interactions of actors are influenced and limited by forces and factors in the contextual environment (Ramrez & Selsky, 2016).

Information recipients in collaborative ULUPs may display different responses to SES information. Some people react in accordance with the presented information and are motivated to act when there is a chance to profit by changing the landscape, whereas others choose not. Due to the intervening factors, a different interpretation of the information is used to explain this phenomenon (Opdam et al., 2015). In this study, three types of intervening variables were identified based on the literature:

- *Attitudinal factors:* influence how receivers interpret and process framed information based on their values and beliefs (Vaske & Donnelly, 1999). Actions are often habitual, so information that aligns with values and beliefs is more likely to be considered. If the information does not match the receiver's presuppositions, it may be discarded (Mezirow, 1990; Giddens, 1994).
- *Sender–receiver factors:* involve the willingness and ability of the sender and receiver to comprehend the message. Clarity, credibility, and legitimacy are essential for conveying scientific knowledge across science-practice boundaries (Funtowicz et al., 2002). Clarity refers to the relevance of information to a problem. Information can be attention-grabbing yet not credible because of the source or lack of evidence. Even if the information is salient, if the receiver deems it not credible, it will not affect their decision-making (Opdam et al., 2015).
- *Contextual factors:* are social norms and control beliefs. These factors determine the attitudes that lead to behavior (Elster, 1989). In addition, control beliefs

may prevent action if the receiver doubts their resources and abilities (Ajzen, 1991).

There are three categories of positive responses to distinguish information about the potential advantages of ecosystem services when considering the distinct phases of ULUP processes and the behaviors that are pertinent in these phases (Opdam et al., 2015). The information content, which is frequently a personal response, is aligned with the first category. The second category consists of adhering to the ULUP's common objective and the suggested interventions, showing support during discussions, and endorsing agreements. The third category includes implementation-related activities, such as participating in the process and contributing time and/or money to group interventions (Jaccard et al., 2005; Opdam et al., 2015). There was a chance of receiving no responses in each category. Actors may choose not to respond if they believe the information is not relevant to them (attitudinal factor), if they do not trust the source (sender-receiver factors), or if they believe the suggested intervention in the landscape is outside of their skill set (control beliefs) (Ajzen, 1991; Vaske & Donnelly, 1999; Funtowicz et al., 2002).

In conclusion, the ULUP decision-making process, with its emphasis on spatial development and regulation of spatial behavior, intersects with the complexities of actor' responses to SES information. Within collaborative ULUPs, barriers arise in the form of attitudinal, sender-receiver, and contextual factors that shape actor behaviors (Opdam et al., 2015). These barriers can hinder the effective integration of SES considerations into urban planning processes.

### 2.3 Non-consensus on technology in ULUP

The integration of SES into ULUP faces a significant obstacle due to the lack of consensus on technology. This challenge arises from the absence of collective agreement among actors regarding the most effective technological approaches for planning processes. Historically, the demand for technology to monitor and indicate SES was minimal, resulting in a scarcity of data and knowledge (Sandil & Kumar, 2022). Consequently, a lack of consensus on technology for SES integration within ULUP persists.

A notable data gap exists, characterized by the absence of essential biophysical measures that link ecosystem characteristics to the ultimate ecosystem services (Maes et al., 2012; Portman, 2013). While the consequences of SES degradation might not be immediately evident, their manifestations over time, including urban flooding and water pollution due to reduced water regulation and increased surface runoff from soil sealing, are concerning (Rodríguez-Rojas & Moreno, 2022).

Moreover, decision-makers often lack access to data that reflects valid trade-offs, inhibiting the integration of SES into planning processes. Investments in traditional grey infrastructures, such as asphalt and concrete, contribute to soil sealing, a detrimental outcome for SES (Maes et al., 2012; Portman, 2013; Rodríguez-Rojas & Moreno, 2022). Soil sealing disrupts the natural balance of SES by covering soil with impermeable substances, leading to adverse effects on metropolitan areas (Heikoop, 2022). Moreover, urban residents becoming detached from SES and unaware of their vital contributions exacerbates this predicament (Ives et al., 2016).

Furthermore, the lack of governmental initiative in promoting standardized technology for SES assessment, mapping, and valuation exacerbates the challenge (Maes et al., 2012; Landers & Nahlik, 2013). Divergent perspectives have emerged from different disciplines, with ecologists focusing on ecosystem structures and processes, while economists and decision-makers prioritize human welfare outcomes using environment-derived endpoints (Boyd & Banzhaf, 2007). The absence of well-defined criteria and methodologies for SES analysis further hampers research in urban environments (Malheiro et al., 2010).

The challenge is further exacerbated by the dominance of conventional grey solutions in certain urban contexts, which stems from deeply entrenched path dependencies. These dependencies hinder efforts towards sustainable transformations (Davies & Laforteza, 2019). These path dependencies continue to shape the existing ULUP, reinforcing historical cultural norms and planning paradigms that resist change (Malekpour et al., 2015; Wolfram, 2018). This resistance is further fueled by urban growth and economic feedback loops, where fixed route dependencies outweigh the inherent environmental self-correcting mechanisms of the ULUP (Malekpour et al., 2015; Wolfram, 2018).

In conclusion, the non-consensus on technology in ULUP presents a significant barrier to the seamless integration of SES. The absence of a shared understanding among actors regarding the most suitable technological solutions for planning processes, combined with the dominance of traditional grey solutions driven by path dependencies, hinders sustainable transformation efforts (Davies & Laforteza, 2019). These deeply rooted dependencies continue to influence the current ULUP, diminishing the effectiveness of its environmental self-correction mechanisms and leading to negative outcomes like soil sealing and declining SES scores (Rodríguez-Rojas & Moreno, 2022; Heikoop, 2022).

### 3. Methodology

This chapter bridges the theoretical and empirical data of this study. The selected research methodology is described along with the justification for the choices made regarding it. The available data is then discussed.

#### 3.1 Research Context and City Selection

In the Netherlands, urban landscapes reflect a history of human intervention and adaptation to changing needs, as vast natural landscapes are no longer feasible to preserve (Burghardt et al., 2015). The Dutch planning system adopts a plan-led approach, with local land use plans legally binding to ensure that development adheres to set regulations (Jepsen et al., 2015). This system operates under a multilevel governance framework, with the national government, provinces, and municipalities sharing responsibilities on a geographical scale (Teisman et al., 2018).

The "Mooi Nederland" program delves into the spatial complexities brought forth by the "Water Bodem Sturend" national plan—a strategic endeavor that seeks to redefine the Dutch urban landscape's approach to sustainable water and soil management. This program holds particular significance as it aligns with the goals of this study, which aims to uncover the barriers hindering the integration of SES into ULUP (NOVI, 2023). By investigating the intricate interplay between ULUP decisions and SES considerations, the program offers a valuable context through which to examine the alignment of planning decisions with ecological considerations. This initiative materializes as a collaborative effort involving provinces, municipalities, actors, and a participatory society, highlighting the comprehensive approach taken to address complex spatial challenges (NOVI, 2023).

The cities are chosen because of their active participation in the "Mooi Nederland" program, making them ideal candidates for comprehending the intricate interplay between ULUP decisions and SES considerations. The choice of cities—Amsterdam, Dordrecht, Rotterdam, and Zwolle—is thereby strategic and well-informed (Figure 5). Additionally, these cities boast historical significance and a substantial urban presence, rendering them exemplary models within both national and international contexts (Jepsen et al., 2015). Their urban landscapes exhibit a diverse range of characteristics and planning strategies, providing invaluable insights for the study's investigation. The selection of these cities was based on specific criteria to ensure the relevance and representativeness of the case studies (Seawright & Gerring, 2008):

- *Relevance:* The selected cities are of significant size and historical importance and serve as role models



within a national and potentially international context. Their urban characteristics and planning practices make these case studies valuable.

- **Goals:** All four municipalities are part of a national spatial planning program focused on soil and planning that provides a shared context for analysis.
- **Accessibility:** Data availability and language accessibility were considered when selecting municipalities to ensure a comprehensive and insightful study.
- **Time Frame:** The selected urban planning reports are not older than ten years to ensure that the research reflects current practices and developments in urban land-use planning.

At the core of this study lies a comprehensive exploration of the barriers that obstruct the integration of SES into ULUP across diverse municipalities. The central objective is to unveil the underlying challenges that impede the amalgamation of ecological considerations with urban planning decisions. The context provided by the "Mooi Nederland" program serves as an invaluable lens through which to dissect the complexities of the ULUP-SES barrier.

As the study delves into the barrier between ULUP and SES, its primary objective remains to explore the disconnect that exists within municipalities. Navigating

Figure 5. Map of the Netherlands highlighting the four municipalities



Source: Esri, 2023

this analytical journey, the intention is to identify the underlying barriers that have perpetuated this divide, contributing to a comprehensive understanding of the intricate spatial challenges that continue to shape the Dutch urban landscape.

### 3.2 Methods

To answer the research question "**Why are soil ecosystem services (SES) not integrated into urban land use planning (ULUP) in the Netherlands?**" and the sub-questions, qualitative research methods were chosen. According to DiCocco-Bloom & Crabtree (2006), a qualitative study is most suitable for conducting such a study, as this method provides in-depth information. The qualitative research methods used are interviews and the analysis of existing material, namely policy documents (Groeneveld et al., 2015).

#### Method 1: Policy review

In this section, the analysis of existing policy documents is employed as the first research method, aligning with Groeneveld et al.'s concept of utilizing existing material for public administration research (2015). This method focuses on urban planning reports spanning the past decade, offering insights into contemporary ULUP practices and advancements. Through this method, it becomes possible to gather relevant data that addresses the first sub-question within the conceptual framework.

The policy review encompasses the examination of existing plans across three governmental tiers: municipal, regional, and national (Netherlands). SDGs necessitate decisions at national and international levels that must be implemented locally and regionally. The integration of sustainability objectives into local policies demands a strategic approach tailored to each location's unique characteristics (Leuz, 2006). These plans not only guide future government actions but also reflect the current urban landscape. Through the review of ten policy documents (Table 2), a comprehensive understanding of the challenges and obstacles faced by urban planners and decision-makers in integrating SES into ULUP emerges.

This examination serves a dual purpose: to comprehend the barriers to SES integration into ULUP and to analyze the agenda-setting process (Karren & Barringer, 2002). Table 2 provides an overview of the policy documents instrumental in achieving these objectives. Each column of this table serves a distinct role in evaluating the relevance, content, and context of the policy documents:

- **Policy Document:** This column lists the names and identifiers of the policy documents subject to analysis, acting as pivotal sources for understanding SES integration barriers.
- **Date:** Document publication dates are recorded, offering insights into temporal relevance.
- **Significance:** This column assigns a qualitative assessment of a document's importance or influence on urban planning decisions. Ratings such as high, moderate, or low gauge the document's impact within the ULUP context.

- **Focus and Scope:** This column concisely describes the primary topics, goals, and areas of emphasis covered within each document. It contextualizes the thematic relevance of the document to the research topic.
- **Government Level:** This column identifies the specific level of government to which each policy document pertains, be it municipal, regional, or national.

This structured approach imparts clarity and organization to the analysis, facilitating a comprehensive understanding of varying strategies and influences across governmental tiers. This methodical process enables an in-depth exploration of agenda-setting, integration, and barriers concerning SES within ULUP (Saul et al., 2013).

In this policy review, specific terms are employed for coding the agenda-setting of SES into ULUP. The review acknowledges the multi-governmental focus while retaining an emphasis on urban areas. These key terms are selected based on their relevance to SES and ULUP:

- **SES:** Bodem (Soil), Bodemafdekking (Land Cover), Bodemdaling (Subsidence), Bodem Ecosysteemdiensten (Soil Ecosystem Services), Ecosysteem (Ecosystem), Ecosysteemdiensten, Stadsbodem (Urban Soil),
- **ULUP:** Stedelijk (Urban), Steden (Cities), Stad (City)

This methodological framework enables a detailed comparison of policy documents, unveiling patterns, and variations (Saul et al., 2013). The outcomes are summarized in Appendix F. The systematic evaluation aids in identifying factors contributing to agenda-setting,

Table 2. Overview of the 10 plans in policy review

Policy Document	Date	Significance	Focus and Scope	Government Level
<b>Plan A:</b> Omgevingsvisie Amsterdam 2050: Een menselijke metropool	2021	High	It is not only a steering instrument for urban development but also sets an agenda for twenty-first-century city-making	<b>Municipal:</b> Amsterdam
<b>Plan B:</b> Omgevingsvisie 1.0	2021	High	It talks about the choices on how they want to function in their physical domain and what ambitions it has there	<b>Municipal:</b> Dordrecht
<b>Plan C:</b> De Veranderstad. Werken aan een wereldstad voor iedereen.	2021	High	It describes what they want Rotterdam to look like in a few decades and how they want to get there	<b>Municipal:</b> Rotterdam
<b>Plan D:</b> Mijn Zwolle van morgen 2030: Omgevingsvisie	2021	High	It is a vision in which all the current policies and ideas for the future come together for the physical living environment	<b>Municipal:</b> Zwolle
<b>Plan E:</b> Omgevingsvisie Zuid-Holland	2021	Moderate	Improving the living environment with seven innovation ambitions that show where the province wants to go	<b>Regional:</b> Zuid-Holland
<b>Plan F:</b> Omgevingsvisie Provincie Noord-Holland 2050	2019	Moderate	The province strives for a balanced ratio between economic growth and quality of life with eight main themes	<b>Regional:</b> Noord-Holland
<b>Plan G:</b> Omgevingsvisie Gelderland	2014	Moderate	The province strives for a sustainable economic structure and guaranteeing the quality and safety of our living environment.	<b>Regional:</b> Gelderland
<b>Plan H:</b> Programma Water en Bodem Sturend	2022	High	As a cabinet, they want to take water and soil more into account when making spatial planning decisions in the country	
<b>Plan I:</b> Programma Mooi Nederland	2022	High	In order to allocate the scarce space and maintain or improve the quality of the living environment, the national government will take a firmer direction, with water and soil taking the lead in spatial planning	<b>National:</b> Netherlands
<b>Plan J:</b> Nationale Omgevingsvisie (NOVI)	2020	Moderate	In which the government provides a long-term vision for the future development of the living environment in the Netherlands.	

illuminating barriers, and fostering a comprehensive understanding of SES-ULUP integration.

- *Context Rating:* The context rating column employs a scale from 0 to 4 to signify the extent of SES focus within each document. This rating reflects the prominence of SES-related content and is further expounded in Appendix E.
- *Framing of SES:* This column describes the framing of SES, identifying whether the emphasis is on economic, environmental, social, or other dimensions.
- *Key Actors Involved:* This column enumerates the primary actors mentioned in each document, shedding light on the actors influencing urban planning decisions.

It is important to note that while the policy review method has inherent advantages, there are limitations that must be acknowledged. These include potential operationalization challenges and the labor-intensive nature of collecting and analyzing existing material (Groeneveld et al., 2015). Additionally, reliance on publicly available documents may not encompass all relevant policies or fully encapsulate policymakers' considerations. The review primarily centers on SES integration barriers, potentially overlooking practical implementation and policy effectiveness. Despite these limitations, the policy review is a valuable avenue for gaining insights into the barriers of SES integration into ULUP.

## Method 2: Semi-Structured Interviews

By interviewing the municipalities, it is possible to obtain data that will answer the second and third subquestions within the conceptual framework. To gain insight into the experiences and opinions of municipalities regarding the barriers to the integration of SES in ULUP, semi-structured interviews were conducted with the selected municipalities. Interviews are seen as a flexible way of gathering information, as a researcher can ask additional questions during the interview to better understand an answer. (Mason, 2017). The selection of interviewees was based on the simplicity of approaching them within the allotted time as well as the information that an informant could provide. In qualitative research, sampling is performed strategically, and statistical representativeness is not the goal. Therefore, the sample does not need to be representative (Mason, 2017).

One-on-one interviews were conducted with key individuals involved in the soil management and decision-making processes within each municipality. These participants were chosen based on their expertise in soil-related matters, ensuring valuable and relevant insights. The interviews delved into their experiences, challenges, and strategies concerning municipalities. To ensure accuracy and reliability, the interviews were recorded

using recording equipment (Mason, 2017). Subsequently, the recordings were transcribed to facilitate analysis (Appendices H to K).

Before conducting the interviews, a topic list was formulated to guide the interview questions and maintain a standardized approach (Appendix G). There is also room for follow-up questions. Ethical principles were strictly adhered to during the interviews (Mason, 2017). The following ethical principles were used during the interview:

- Observations and interviews were processed in such a way that no interviews with the municipality could be recognized.
- Any person who has been interviewed can inspect the final report of the study.
- When asking for an interview, the topics to be discussed are stated.

The transcripts of the interviews were thoroughly analyzed using a code tree, where each response category was meticulously labeled with relevant keywords (Appendix L). The coding process was aligned with the primary themes of the theoretical and conceptual framework. Sub-themes were identified within the main themes, resulting in a comprehensive code tree that facilitated a detailed examination of the data. This meticulous coding approach allowed me to pinpoint the key points and valuable insights that directly addressed the research question (Groeneveld et al., 2015). By adhering to rigorous qualitative analysis, the findings from the semi-structured interviews provided a rich and nuanced understanding of the integration of SES into ULUP from the perspective of the municipalities involved.

While interviews offer valuable advantages in this study, they also come with limitations. The presence of the interviewer can influence participant behavior and responses (Affleck et al., 2013). Moreover, interviews can be time-consuming, and the topics discussed may be influenced by the participants, potentially leading to incomplete information on certain subjects (Groeneveld et al., 2015). To address these challenges, focus was maintained during the interviews, and the responses were categorized into themes for qualitative analysis (Mouter et al., 2015).

### 3.3 Validity and Reliability

#### 3.3.1 The Validity of the Research Results

Ensuring the validity of the research results is crucial. To achieve this, a well-defined research approach was adopted, focusing on accurately measuring the required elements to answer the research question effectively. Careful consideration was given to selecting appropriate methods that aligned with the research subject.

A literature review (Chapter 2), policy review, and interviews were conducted to answer the research question. The literature review uses existing scientific theories and provides insights into the various theoretical debates that are relevant to the research and which can then be interpreted (Bowen, 2009). The use of interviews in combination with the analysis of existing material and a literature review leads to triangulation. Triangulation is about collecting and/or processing information in more than one way (Groeneveld et al., 2015). Triangulation of data produces credibility and minimizes bias (Bowen, 2009). It is a way to prevent the reliability and validity of research from being compromised (Groeneveld et al., 2015). The integration of data from various sources, including spatial data, and the inclusion of diverse perspectives gathered further strengthen the credibility and representativeness of the research outcomes.

#### 3.3.2 The Reliability of the Empirical Results in Relation to the Research Question

The reliability of the results in qualitative research pertains to the consistency with which the data arrive at the same conclusions, provided that the observations are made impartially and without bias (Mason, 2017). This can be achieved through standardization of the methods, meticulous implementation of agreed-upon procedures, and accurate processing of results.

To guarantee the utmost reliability of the results, rigorous measures were implemented throughout the research process (Bowen, 2009). By adhering to these measures, the research achieved a prominent level of reliability, instilling confidence in the credibility and accuracy of the results obtained:

- *Clearly Defined Research Objective:* The research objective was meticulously defined, ensuring a focused and well-structured study.
- *Limited Research Location:* By limiting the research location, the study concentrated on specific areas, reducing potential biases and enhancing the accuracy of the findings.
- *Predefined Interview Approach:* The manner of conducting interviews was carefully agreed upon in advance, ensuring consistency and uniformity in the data collection process.

- *Thorough Coding Protocol:* A comprehensive coding protocol was employed to double-check and validate whether all interviews strictly adhered to the predetermined guidelines, bolstering the reliability of the collected data.

These measures ensure a certain level of reliability. Evaluation of the results leads to the conclusion that all necessary information has been obtained and that no further interviews or observations are required. However, reflection may also indicate the need for additional sampling.

## 4. Results

In this chapter, the results of the study are presented and analyzed with a focus on addressing the central research question: "**Why are soil ecosystem services (SES) not integrated into urban land use planning (ULUP) in the Netherlands?**". To explore this question, the study examined three key aspects that contribute to the obstacles faced in achieving this integration. The subsequent sections will delve into the findings corresponding to each sub question, shedding light on the specific factors that hinder the seamless incorporation of SES into ULUP practices.

### 4.1 What specific aspects of the agenda setting process within ULUP in the Netherlands create obstacles for the integration of SES?

The agenda-setting process within ULUP in the Netherlands reveals crucial obstacles that impede the integration of SES into policy frameworks. These challenges, intricately intertwined with issues of awareness and political prioritization, unveil the complex landscape that surrounds the integration of SES into ULUP.

*"Soil fulfills important functions for humans, plants, and animals. People grow food on it, extract water from it (in Gelderland, even drinking water), live, play, and recreate on it." (Plan G, p. 146).*

This observation from Plan G magnifies the knowledge gap in comprehending the multi-dimensional essence of SES. It is not soil but SES that provides humans with functions such as drinking water. The soil is the carrier of these services, but it is the organisms in the soil that actually provide them. The inherent intricacies and vital functions of SES, such as water purification, carbon sequestration, and habitat provision, remain hidden by the singular focus on physical soil attributes. Such a skewed perspective translates into policies primarily addressing surface-level challenges, neglecting the profound interplay of SES components that underpin urban

resilience and sustainability. These inadequacies have culminated in misguided decisions, not just in the present but also tracing back to the past. Past urbanization endeavors that entailed constructing new infrastructure in natural spaces and sealing soil have culminated in the depletion of SES. The consequences are now glaringly apparent, displayed in land degradation, biodiversity loss, and a noticeable deterioration in overall ecosystem well-being.

The intricacies of Plan A's analysis cast light on the problem of addressing symptoms without unearthing the root causes. While acknowledging the historical anthropogenic stressors on urban soil and groundwater systems, the fixation on contamination and diminishing soil biodiversity often overshadows the pivotal role of SES integration. This compartmentalized approach results in attempts to rectify specific issues without fully grasping their systemic origins. Similarly, Plan C's focus on vulnerabilities in densely populated neighborhoods underscores the dangers of heat stress, flooding, and drought. However, the proposed solutions, primarily centered around bolstering green spaces, may inadvertently overlook the profound influence of underlying SES on enhanced water retention, and buffering against extreme weather events.

*"Furthermore, the urban soil and groundwater system has historically been burdened by human activity and is no longer in prime condition. The soil is locally contaminated, for instance, with lead or PFAS, and the soil biodiversity is poorer than before." (Plan A, p. 115).*

*"In these neighborhoods, the population density is high, and we observe the highest vulnerability to heat stress, waterlogging, and drought." (Plan C, p. 84).*

It is within Plan F that the second barrier emerges – the asymmetry in political will to seamlessly intertwine SES within policy discourse. While policy documents acknowledge the pivotal role of nature and biodiversity in nurturing a wholesome living environment, the transition from mere acknowledgment to tangible implementation remains a formidable challenge. The term "nature-inclusive" gestures towards the aspiration of SES integration, yet the absence of intricate strategies exposes the uphill task of translating intent into actionable policy measures. This divide accentuates the struggle to bridge the gap between policy rhetoric and effective on-the-ground execution.

*"For a healthy living environment, the presence of nature and biodiversity is a requirement. To maintain biodiversity in North Holland, future*

*developments (urbanization, agriculture, climate measures) should be as nature-inclusive as possible." (Plan F, p. 11).*

Furthermore, an additional factor that hinders political will is the array of multifaceted challenges confronting modern cities. The urgent demands of addressing climate change, rising salinization, land subsidence, and evolving spatial needs tend to exert immense pressure on policymakers. These crises often garner more attention, overshadowing the gradual and intricate benefits offered by SES. The long-term nature of SES contributions, combined with their often-concealed dynamics, renders them less conspicuous in a landscape dominated by short-term objectives and visible outcomes.

*"Climate change, increasing salinization, land subsidence, and changing land use (including subsurface) require adjustments and choices in the soil and water system, which in many cases have an impact on spatial planning" (Plan E, p. 41-42).*

In summary, the exploration of the agenda setting process within ULUP in the Netherlands unveils a panorama marked by complexities. The intricate interplay of awareness gaps and shifting political dynamics results in policies that inadequately harness the potential of SES.

## **4.2 How do the dynamics of actor collaboration in the context of ULUP pose obstacles to the integration of SES in the Netherlands?**

Navigating the intricate web of actor collaboration within the realm of ULUP in the Netherlands reveals a landscape riddled with obstacles that disturb the integration of SES. The dynamics of collaboration, or rather the lack thereof, stand as a formidable challenge on the path towards incorporating SES into planning strategies.

### **4.2.1 Lack of Vertical Actor Collaboration**

A significant barrier to the successful integration of SES into ULUP stems from the absence of effective vertical collaboration between different tiers of government authorities. This disconnect is particularly evident in the disjointed coordination between local municipalities and higher-level governmental bodies. The lack of clear directives flowing down from higher levels impedes the ability of municipalities to effectively address the challenges of SES integration. Each municipality finds itself grappling with the complexities of integrating SES into ULUP independently, often relying on individual interpretations of relevance and methodologies. The national government has yet to provide a comprehensive methodological framework or a step-by-step plan for the integration of SES into ULUP. Consequently, the lack of

vertical collaboration results in a situation where each governmental entity charts its own course, leading to a fragmented landscape of disparate practices and policies.

*"We expect the ministry to say, This is the method to work towards that, and you have to take these steps... we are going to facilitate that" (Interviewee A).*

Moreover, the need for a unified approach becomes even more apparent when considering the significance of avoiding redundant efforts and ensuring a coherent process. Regrettably, the absence of vertical collaboration hampers the sharing of acquired data or knowledge, leaving potentially valuable insights isolated within specific levels of government. This inadvertently perpetuates the possibility of duplicated research efforts, squandering both time and resources and hindering SES integration.

In addition, the lack of a comprehensive framework for SES integration places municipalities in a demanding situation, requiring them to navigate the complexities of integration with limited guidance and coordination. This circumstance underscores the expectation of a more structured approach guided by a central authority. The absence of mechanisms to prevent duplicate efforts across municipalities undermines optimal resource utilization and the dissemination of best practices.

*"When it comes to developing an instrument for integral assessment of soil health and housing quality, for example, you expect the ministry to say, well, this is the method to work towards that and you have to take these steps. This research is necessary for that, and we are going to facilitate that. Then...the ministry ensures that the wheel is not reinvented everywhere. That they keep an overview in this and that they therefore provide guidelines to municipalities to work towards that integrated policy according to a specific step-by-step plan" (Interviewee A).*

Additionally, the intersection of financial constraints with the absence of legislative integration amplifies the challenges faced by municipalities. Over time, municipalities have seen their responsibilities expand while their budgets have contracted. This financial constraint compels municipalities to make tough decisions about resource allocation, often prioritizing areas stipulated by law and relegating the incorporation of SES to a secondary role. Moreover, fully researching and integrating SES into ULUP can be financially restrictive, creating an additional barrier. This financial reality impedes their ability to effectively address the complex challenge of SES integration. The modern landscape

demands comprehensive and nuanced responses, but the financial limitations imposed on municipalities worsen the issue.

*"And the municipality simply has to pay the money to the state but receives less money. So, the burden for most municipalities will increase. This year came the most cut to the municipal budget, where the government had to give up a lot of budgets for the physical aspect of the city. So, we have little budget ourselves and no structural budget because it is not embedded in law and regulations. And the world is becoming more and more complicated, also with poor soil degradation and biodiversity. So, you have more and more problems with more assignments to do, but you have less and less money" (Interviewee C).*

#### 4.2.2 Lack of Horizontal Actor Collaboration

Under the surface of the ULUP landscape, another facet comes to light: the lack of horizontal collaboration among municipalities. This dynamic adds further complexity to the integration of SES into ULUP strategies. Exploring the nuances of inter-municipal collaboration unveils a landscape where limited cooperation poses formidable hurdles to the holistic infusion of SES into planning strategies.

The observed lack of collaboration between municipalities manifests as a hindrance to the holistic integration of SES into ULUP. On closer inspection, the implications of this collaboration gap become clearer, impacting the efficient infusion of SES into ULUP strategies. As discussed earlier, this lack of collaboration goes beyond a simple knowledge gap. It leads to each municipality embarking on separate research paths, often duplicating efforts and inefficiently utilizing resources. Even existing collaborative platforms, such as the one organized by VNG, remain untapped when it comes to SES integration. This reality nudges municipalities towards isolated explorations of SES intricacies.

*"But I am not yet aware of a network within municipalities where vital soil is one of the most important spearheads. To my knowledge that is" (Interviewee D).*

Internally, the ramifications of limited collaboration resonate even more profoundly. Within municipalities, modest coordination between departments responsible for soil management and planning exacerbates the obstacles to SES integration. This internal disconnect adds complexity to holistically integrating SES into ULUP. The soil department, emphasizing soil health and ecological sustainability, finds itself at odds with the

planning department's focus on economic development and growth. Such conflicting priorities result in disjointed actions and decisions within ULUP, obstructing effective SES integration efforts.

This lack of collaboration reaches further within municipal departments themselves, weaving a narrative of internal dissonance. Within the intricate fabric of the soil and planning departments, individual teams often hold contrasting goals and perspectives. These internal disparities manifest as roadblocks to effective SES integration. The interplay of differing viewpoints, stemming from diverse backgrounds, knowledge gaps, and varying interests, fosters a landscape of fragmented strategies. This approach falls short of effectively addressing the challenge of SES integration. Even attempts to bridge these internal gaps might inadvertently kindle resistance within teams.

*“There are already so many problems in the city and I did not really see a possibility of how we could also add that. Also, the requirements that are set in area development, where cover the existing soil with sand, leaves no permeability. So, then you actually know in advance that that will never be biologically something and that biologically will never become anything” (Interviewee A).*

*“Because they think we don't have 10,000 species in Dordrecht...due to their lack of knowledge about nature” (Interviewee B).*

*“In my opinion, it does not go beyond meeting the legal obligations you need. If you conduct a project, go through a schedule, you comply with the Soil Quality Act, and that is just where it ends” (Interviewee B).*

Further delving into this complex framework, the challenge of inadequate staffing within smaller municipalities surfaces. The weight of overwhelming workloads on employees prioritizes tasks, rendering limited time and energy for the intricate endeavor of SES integration. The backdrop of this challenge adds a layer of complexity to the narrative, underscoring the need for not just collaborative efforts but also sufficient resources.

*“There are often one or two people who are all environmental, residential and environmental planners...and they have so many tasks...there is almost a lack of manpower to really put so much time and energy into it” (Interviewee D).*

In conclusion, the canvas of horizontal actor collaboration within ULUP reveals a landscape marred by divisions and misalignments. The absence of cooperation between

municipalities and departments presents hurdles in resource optimization, knowledge sharing, and strategy development.

### *4.3 How does the absence of technology consensus hinder the integration of SES into ULUP in the Netherlands?*

The integration of SES into ULUP encounters substantial obstacles due to the absence of a consensus on technology. This section scrutinizes the challenges stemming from this void and dissects the fragmented approaches that impede the seamless amalgamation of SES into planning frameworks.

#### **4.3.1 Focus on Chemical Aspects in ULUP**

The historical emphasis on prioritizing the human living environment has inadvertently underscored a human-centric approach to planning. While this strategy might have appeared effective in earlier times, it has unwittingly given rise to fresh complexities. These complexities are propelled by the rapid expansion of the population, escalating economic requirements, and the constrictions imposed by spatial limitations. This orientation towards human-centric planning, although fruitful in historical contexts, now contributes to obstacles that obstruct the seamless integration of SES into ULUP.

This human-centric approach has reoccurred in the very essence of urban planning, manifesting in a notable challenge that hinders the integration of SES into ULUP. This challenge, rooted in historical necessity, emerged from a singular focus on the chemical aspects of soil within urban areas. This emphasis, while historically valid, aimed to research and ensure the quality of drinking water for humans. However, this approach inadvertently overshadowed the broader ecological functions and services that soil inherently provides. Within this context, the intricate interplay of biological aspects in soil, integral to SES, remains inadequately addressed. The historical backdrop of grappling with pollution challenges and subsequent remediation efforts, primarily driven by the pursuit of safe drinking water, has predominantly shaped the prevailing narrative surrounding soil management. Consequently, this historical precedent forms an entrenched barrier to comprehensively integrating SES considerations into ULUP.

*“We come from a very long history of pollution,... and worked hard to clean it up” (Interviewee D).*

*“Because it is a necessity, we have historically prioritized the living environment for humans in the Netherlands, particularly in Rotterdam. We focus on putting people first and doing everything around it. The Netherlands was a pioneer in spatial planning in the 1990s, particularly*

*compared to other countries and the world, despite being a small country with limited resources. We approach spatial planning by designating a location and function, deeming it necessary for economic activity, living, and some nature. This approach has been successful in the past, but the country's rapid population growth, both in terms of the number of children and migration, has led to an increased demand for space. Additionally, we want to maintain an economic powerhouse, and it is clear that the economy and companies require space to function effectively. As the population and economic activity grows, so too does the need for space" (Interviewee C).*

#### 4.3.2 Knowledge Gap Hindering Integration

Beneath the surface of challenges arising from the historical emphasis on chemical aspects lies a profound knowledge gap that can be traced back to the predominant focus of research efforts. The landscape of soil studies has, for a considerable period, revolved around an almost exclusive concentration on chemical parameters. While this approach has undoubtedly yielded valuable insights into soil quality and composition, it has inadvertently cast a shadow over the intricate and multifaceted nature of SES. The limited scope of research, primarily centered on chemical attributes, has generated a gap in understanding the holistic interactions and dynamic relationships that underpin SES. This gap, although not immediately evident, presents a significant and formidable barrier to the seamless integration of SES into ULUP.

*"A lot of soil studies have been done, but unfortunately, it is not yet standard practice to look at some other things in addition to the chemical parameters... How can we ensure that soil meets all the tasks in the city and what knowledge do we need for this?" (Interviewee A).*

The ramifications of this knowledge gap reappear throughout the domain of urban planning and policy formulation. The prevailing understanding, while valuable, tends to paint only a partial picture of the intricate web of ecological interactions that shape soil functionality. Such a constrained perspective inherently limits the extent to which SES can be woven into ULUP. The complex interplay of biological, ecological, and hydrological elements that contribute to the multifaceted nature of SES remains relegated to the shadows, unexplored, and often underestimated. Consequently, when attempting to align SES with ULUP, the disparity between the prevailing chemical-centric perspective and the holistic comprehension required for effective integration becomes glaringly apparent.

This disparity, while rooted in research emphasis, extends beyond academia into the practical realms of urban planning. The planning process demands a comprehensive and interconnected understanding of the interdependencies within ecosystems, soil, and the services they provide. Yet, the historical trajectory of research has inadvertently cultivated a gap between the knowledge domains essential for SES integration. The absence of a unified framework that bridges the gap between chemical, biological, and ecological perspectives hampers the development of cohesive planning strategies. This lack of cohesion impedes the creation of policies that adequately account for the complexities of SES, leaving planning initiatives fragmented and often ill-equipped to address the multifaceted challenges posed by contemporary urban environments.

*"Dordrecht... had to deal with new plantings in a neighborhood but did not catch on. Then we looked at what is in the subsoil" (Interviewee B).*

In conclusion, the historical focus on chemical aspects within soil studies has unwittingly sown the seeds of a knowledge gap that obstructs the effective integration of SES into ULUP. This gap, resulting from the limited scope of research emphasis, creates a disparity between the prevailing chemical-centric perspective and the holistic understanding required for comprehensive SES integration. The consequences of this disparity ripple through both academic research and practical planning efforts, hindering the development of strategies that can seamlessly incorporate the diverse dimensions of SES into the urban planning landscape.

## 5. Discussion

The challenges identified within the Dutch context regarding the integration of SES into ULUP are not isolated occurrences but rather reflections of global dynamics that shape urban planning and sustainability efforts across the EU and beyond, as discussed in sections 4.1, 4.2, and 4.3. Urban areas worldwide grapple with reconciling economic growth, population expansion, and environmental stewardship. The challenges highlighted in the Dutch case study are symbolic of the intricate dynamics that shape urban planning and sustainability endeavors globally. As urbanization accelerates, discussions concerning SES integration into ULUP resonate across continents, sparking a discourse on shared obstacles. This discussion delves into key dimensions from sections 4.1, 4.2, and 4.3, illuminating their universal relevance and exploring their intersection with global urbanization trends and sustainability goals.



## 5.1 Addressing Awareness and Understanding

The integration of SES into ULUP faces not only local but also global barriers, with challenges identified in the Dutch context reflecting broader trends. Around the world, rapid urbanization often creates a detachment between urban dwellers and the ecological systems underpinning their well-being (Ives et al., 2016). As urban areas expand, the imperative to preserve ecological functions can be overshadowed by the pursuit of economic growth and visible urban development (Visser et al., 2019). Bridging the awareness gap regarding the significance of SES presents a challenge shared by numerous cities worldwide. Urban planners and policymakers globally face the task of communicating the intricate connections between ecosystems and human well-being amidst pressing development needs.

In the pursuit of integrating SES into ULUP, a critical global hindrance is the lack of knowledge and awareness among policymakers about the ecological intricacies underpinning urban systems (Nieland et al., 2019; Rijk, 2021). This challenge transcends specific regions or countries; it is a shared barrier resonating across diverse urban contexts worldwide. Policymakers often grapple with complex urban challenges, prioritizing economic growth and social development while ecological dimensions remain inadequately understood or overlooked.

This lack of awareness among policymakers perpetuates barriers to integrating SES into ULUP. Urban planning decisions prioritize short-term gains without fully considering long-term ecological implications (Rijk, 2021). As urban areas expand and face pressures of population growth and resource utilization, the absence of comprehensive SES understanding hinders effective policy formulation balancing urban development with environmental sustainability (Burghardt, Morel, & Zhang, 2015).

The issue of agenda setting, rooted in local dynamics, carries global implications for SES integration into ULUP. As cities worldwide balance urban growth with ecological equilibrium, factors influencing agenda setting become crucial. The international relevance of agenda-setting challenges lies in their role in shaping urban development trajectories across diverse cultural, social, and economic contexts (Leffers & Wekerle, 2020). Understanding how certain issues gain prominence while others are marginalized on the agenda setting strategies for overcoming global barriers to SES integration. The competition among diverse issues for policy attention is relentless (Weible & Sabatier, 2017). Limited resources necessitate prioritizing certain matters over others.

Consequently, barriers to integrating SES into ULUP are not unique to specific cities but reflect challenges urban planners encounter internationally. Factors determining SES considerations on agenda setting involve public sentiment, political dynamics, and alignment with broader policy objectives (Fowler, 2022). Thus, agenda-setting dynamics are both a local concern and a global issue influencing urban development and SES integration into ULUP across diverse contexts.

## 5.2 Balancing Short-Term Demands and Long-Term Sustainability

The challenge of integrating SES into ULUP is further compounded by the intricate task of balancing short-term urban development demands with long-term sustainability goals (Nieland et al., 2019). Urbanization often brings pressing needs for infrastructure, housing, and economic growth, pressuring decision-makers to prioritize immediate development objectives. However, this urgency sometimes overshadows the equally important imperatives of ecological preservation, environmental resilience, and future generations' well-being (Burghardt, Morel, & Zhang, 2015).

As cities expand, competition for limited land resources intensifies, creating a complex environment for urban planners (Rijk, 2021). The interplay of short-term economic gains, population growth, and infrastructure development often overshadows ecological integration. The global dimension of this challenge is evident as cities worldwide grapple with the same dilemma: how to meet immediate urbanization needs while safeguarding ecological foundations and ensuring long-term city viability. The tension between short-term economic incentives and long-term sustainability aspirations is not limited by geographical boundaries; it recurs across diverse urban contexts. Balancing these competing demands resonates throughout the EU and extends to urban areas across continents.

## 5.3 Collaborative Governance Challenges

Fragmented collaboration observed in Dutch governance structures is not unique to the Netherlands but a reflection of persistent governance challenges in diverse urban settings. Urban planning complexity involves multiple actors with diverse agendas, leading to fragmented decision-making, communication breakdowns, and coordination gaps (Giersig, 2008). This phenomenon spans continents, highlighting the necessity of fostering collaboration mechanisms that bridge governmental tiers and engage actors for holistic SES integration into planning processes.

A significant barrier to successful SES integration into ULUP arises from the lack of effective vertical collaboration between different government tiers. This

disconnect is particularly evident in the disjointed coordination between local municipalities and higher-level governmental bodies. The absence of clear directives from higher levels hampers municipalities' ability to address SES integration challenges effectively (Koppenjan, 2007). Each municipality tackles SES integration complexities independently, relying on individual interpretations of relevance and methodologies. The national government has not provided a comprehensive methodological framework or step-by-step plan for SES integration into ULUP. Thus, a lack of vertical collaboration results in each governmental entity charting its own course, leading to a fragmented landscape of disparate practices and policies.

Limited collaboration among policymakers hindering SES integration into ULUP is not confined to the Netherlands. It resonates globally across the urban landscape. Policymakers worldwide from various departments, agencies, and government levels often struggle to harmonize perspectives and align goals. Governance fragmentation and a lack of cohesive collaboration hinder effective strategies for SES integration into ULUP (Leffers & Wekerle, 2020). This obstacle is not limited to the Netherlands; it mirrors broader challenges urban planners face worldwide.

#### 5.4 Knowledge Gaps and Technological Constraints

The challenge stemming from historical emphasis on specific research areas, resulting in a knowledge gap, is not unique to the Netherlands; it is a global phenomenon known as path dependencies. These continue to shape existing ULUPs, reinforcing historical cultural norms and planning paradigms (Malekpour et al., 2015). Urban growth and economic feedback loops amplify this resistance, as established routines outweigh inherent environmental self-correction mechanisms within ULUP (Wolfram, 2018).

The knowledge gap arising from historical research emphasis is not confined to the Netherlands but represents a global trend emerging from the need to address specific challenges like pollution and remediation (Heikoop, 2022). In cities around the world, historical circumstances and imperatives have molded research priorities and subsequent planning practices. The challenge lies in transcending these historical legacies and incorporating evolving ecological insights into urban planning strategies. Recognizing that traditional research may have formed the basis for understanding particular aspects of urban ecosystems, cities must embrace interdisciplinary approaches leveraging advancements in technology, data analytics, and ecological understanding (Rodríguez-Rojas & Moreno, 2022). By doing so, they can bridge the gap

between historical perspectives and contemporary ecological imperatives, creating a stronger foundation for SES integration into ULUP.

#### 5.5 Policy Recommendations

Drawing insights from the challenges identified in this research, two key policy recommendations emerge, guiding cities in their efforts to integrate SES into ULUP.

The first policy recommendation revolves around fostering interdisciplinary collaboration and knowledge exchange among policymakers, researchers, and practitioners. The challenges linked to SES integration into ULUP are not isolated to specific regions; they reflect global dynamics. Recognizing this, cities should establish platforms facilitating regular interactions and knowledge sharing among diverse actors. By nurturing cross-disciplinary dialogues, cities can bridge the gap between ecological insights and urban planning strategies. This could involve forming urban planning task forces or working groups that unite ecologists, urban planners, economists, and social scientists to collectively tackle the complex SES integration challenges. Furthermore, promoting collaborative research initiatives and joint projects can facilitate translating scientific knowledge into practical planning solutions, ensuring seamless integration of ecological considerations into decision-making processes.

The second policy recommendation focuses on embedding SES considerations into broader urban resilience strategies. Urban areas face mounting pressures from climate change, population growth, and resource limitations. In this context, integrating SES into urban resilience strategies becomes paramount. Cities can align SES integration endeavors with existing urban resilience frameworks, such as climate adaptation plans or sustainable development agendas. By doing so, cities can leverage ecosystems' inherent resilience to enhance their adaptability to environmental changes while simultaneously promoting social cohesion and community well-being. For example, urban greening initiatives enhancing SES can be folded into climate adaptation projects, offering multiple benefits in flood mitigation, temperature regulation, and community engagement. This approach not only addresses SES integration challenges but also contributes to a more comprehensive and holistic urban development strategy.

In conclusion, these policy recommendations underscore the need for collaborative approaches and strategic alignment with broader urban objectives. By fostering interdisciplinary collaboration and integrating SES into urban resilience strategies, cities can navigate the intricate challenges posed by urbanization, ecological sustainability, and community well-being. These

recommendations serve as guiding principles for cities worldwide as they strive to create more sustainable and resilient urban environments.

### 5.6 Limitations of Research

While the findings and insights presented in this research offer valuable contributions to understanding the obstacles to SES integration into ULUP, several limitations exist that warrant consideration. These limitations pertain to generalizability and methodological constraints.

A notable limitation of this research is the extent to which the findings can be applied to other cities and urban contexts. The study primarily focused on interviews with actors from larger municipalities, potentially overlooking the unique challenges faced by smaller urban areas. The absence of perspectives from smaller municipalities and other planning actors, limits the applicability of identified barriers and potential solutions to a broader range of urban settings.

Methodological limitations also impact the depth and breadth of this research. A significant constraint stems from the qualitative nature of the study. While qualitative research methodologies like interviews, document analysis, and literature reviews provide nuanced insights into stakeholder perceptions and experiences, they may not fully capture the entire spectrum of challenges and perspectives surrounding SES integration into ULUP. Incorporating quantitative data could broaden the research's scope, enabling a more comprehensive understanding of specific barriers' prevalence and intensity.

Furthermore, it is essential to acknowledge the potential for bias in stakeholder perspectives. Interviews conducted solely with policymakers offer insights from their professional roles, institutional affiliations, and personal viewpoints. However, the lack of input from other planning actors like community members and private developers may limit the holistic representation of the complex urban landscape, potentially resulting in an incomplete understanding of the challenges involved.

In conclusion, while this research provides valuable insights into barriers to integrating SES into ULUP, it is crucial to recognize and acknowledge its limitations. The specific contextual nature of the findings, coupled with the qualitative approach and dynamic urban environments, underscores the necessity for ongoing research and a nuanced understanding of the intricate challenges in achieving sustainable and ecologically integrated urban development.

## 6. Conclusion

The central question explored in this study "**Why are soil ecosystem services (SES) not integrated into urban land use planning (ULUP) in the Netherlands?**"—offers a nuanced understanding of the intricate factors obstructing the integration of soil ecosystem services into urban land use planning in the Dutch context. The investigation into agenda setting, actor collaboration, and technology consensus has yielded insights that illuminate the complex dynamics encompassing governance challenges, awareness gaps, conflicting priorities, and methodological constraints.

The agenda setting serves as a significant stumbling block to the holistic integration of SES into ULUP. A pivotal challenge arises from the limited awareness and understanding among policymakers regarding the intricate ecological underpinnings of urban systems (Ives et al., 2016). The urgency to address immediate urbanization needs often supersedes long-term ecological imperatives, leading to policies that prioritize economic growth and development over environmental preservation. This information gap perpetuates hurdles in formulating effective policies that reconcile urban expansion with ecological sustainability.

Actor collaboration emerges as another pivotal hurdle in the journey towards SES integration. Fragmented collaboration within Dutch governance structures presents another significant obstacle. Urban planning's intricacies involve diverse actors with disparate agendas, culminating in fragmented decision-making, communication gaps, and coordination challenges (Koppenjan, 2007; Giersig, 2008). This phenomenon resonates globally, highlighting the challenges encountered by urban settings worldwide. The disconnection between various government tiers and the absence of clear directives from higher levels impede municipalities' ability to address SES integration effectively. Consequently, varying strategies contribute to a disjointed landscape of practices and policies.

Furthermore, the lack of consensus on technology forms yet another barrier to SES integration. Methodological limitations, including the absence of standardized technology for SES assessment and mapping, pose additional challenges (Maes et al., 2012; Landers & Nahlik, 2013). The lack of a comprehensive methodological framework or step-by-step plan from the national government results in varied interpretations and practices across municipalities. This absence of standardized criteria and methodologies hampers SES analysis in urban environments and impedes the formulation of effective strategies.

The stumbling blocks of a limited agenda setting, challenges in actor collaboration, and non-consensus on technology intertwine to hinder the integration of SES into ULUP. This study not only contributes to the understanding of the challenges hindering SES integration into ULUP but also sets the stage for further exploration in the realms of interdisciplinary collaboration within municipalities and the practical outcomes of existing policies. These recommended avenues of research can collectively propel the journey towards a more effective integration of SES into ULUP, thus contributing to the sustainable and resilient development of urban environments.

In conclusion, the complex challenges impeding the seamless integration of soil ecosystem services into Dutch urban land use planning emanate from the convergence of governance intricacies, limited awareness, conflicting priorities, and methodological constraints. These challenges, rather than being unique to the Netherlands, resonate across the global urban planning landscape. The insights gleaned from this research underscore the necessity for collaborative, interdisciplinary approaches that account for contextual nuances. By embracing these approaches, a pathway can be paved toward more cohesive and sustainable urban development, encompassing the vital contributions of soil ecosystem services.

## 7. Reflection

In conducting this research on the integration of SES into ULUP, several aspects of the methodology and research execution were found to be successful, while others presented challenges. This reflection highlights the positive aspects and areas for improvement and considers alternative methods that could enhance the validity of the research.

### What Went Well:

- *Data Collection:* The combination of policy review and interviews provided a comprehensive understanding of the current state of SES integration in ULUP. Policy review enabled me to examine official policy documents, while interviews with municipalities offered valuable insights into the challenges. By collecting data via these two methods my research has gained a more holistic understanding of the obstacles to integrate SES in ULUP.
- *In-Depth Insights:* The qualitative nature of my research allowed me to gain a thorough understanding of the perceptions, practices, and attitudes of municipalities towards SES and planning. This in-depth understanding provided me with a nuanced perspective on the factors that influence the integration of SES.
- *Addressing Multiple Perspectives:* To gain a more comprehensive understanding, the study involved multiple municipalities from diverse regions and urban settings, resulting in a range of perspectives on integrating SES. This helped ensure that the results were not limited to a specific location but had wider applicability.
- *Knowledge and Connections:* The internship provided an excellent opportunity to improve my familiarity and abilities in the domain of urban land-use planning and SES. Collaborating closely with professionals in the field allowed me to acquire valuable perspectives on current practices, hurdles, and emerging trends. Furthermore, the internship provided valuable networking opportunities, enabling me to establish ties with experts and practitioners in the industry. These connections may prove beneficial for future research collaboration and professional development.

### What Did Not Go Well:

- *Sample Size:* The study was confined to a select number of municipalities owing to resource and time constraints. Although the selected municipalities provide valuable insights, a broader sample size

would have enhanced the generalizability of the findings.

- *Potential Bias:* The potential for bias in interviews with municipal representatives should be considered, as respondents may have provided socially desirable responses or presented only a partial view of the situation. To gain a more holistic perspective, interviews with other actors, such as environmental NGOs, could have been helpful.

#### **Alternative Approaches or Methods:**

- *Case Studies:* Analyzing the success stories of specific municipalities with the successful integration of SES through detailed case studies can provide valuable lessons and best practices. This approach allowed us to identify the key factors contributing to effective integration.
- *Longitudinal Analysis:* Long-term data collection enables us to track changes in the integration of SES over time, offering a more comprehensive understanding of the progress and challenges that arise during various stages of integration.

The methodological approach and research execution of this study have provided valuable insights into the challenges of integrating SES into ULUP. The combination of policy review and interviews offers a comprehensive understanding of the current state of integration. However, limitations, such as sample size and potential bias, must be considered when interpreting the findings. In future research, incorporating case studies and longitudinal analyses could enhance the reliability and relevance of research on this critical topic. Ultimately, recognizing the importance of SES in ULUP and promoting sustainable management is crucial for creating resilient and thriving urban environments in the future.

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