The (re)imagination of urban biodiversity

How nature-based solutions shape urban planning discourses, practices, and relations in Germany and Italy

PhD candidate | Alessandro Arlati

First supervisor | Prof. Dr. Gernot Grabher
Second supervisor | Dr. habil. Joachim Thiel
External reviewer | Dr. habil. Melanie Nagel

Dissertation, HafenCity University Hamburg

Titel: The (re)imagination of urban biodiversity. How nature-based solutions shape urban planningdiscourses, practices, and relations in Germany and Italy

Author: Alessandro Arlati

Research Field: Urban and Regional Economics

DFG Project: RTG 2725 "Urban future-making: professional agency across time and scale"

First Supervisor: Prof. Dr. Gernot Grabher, Urban and Regional Economics, HCU

Second Supervisor: Prof. Dr. Joachim Thiel, Urban and Regional Economics, HCU

Second (extern) Supervisor: PD Dr. Melanie Nagel, Geo- and Environmental Research Centre, University of Tübingen

Handed in: 31st March 2025

Date of Defence: 2nd July 2025

Imprint

HafenCity University Hamburg

Henning-Voscherau-Platz 1

20457 Hamburg

Publication date: 28th December 2025

https ://nbn-resolving.org/urn:nbn:de:gbv:1373-repos-14783

Acknowledgements

I would like to thank my two supervisors, Prof. Dr. Gernot Grabher and Dr. Joachim Thiel, for their theoretical and methodological support throughout this journey filled with surprises, desperation, and joy. I also want to acknowledge Prof. Dr. Monika Grubbauer and the entire PI team of the Research Training Group "Urban future-making: Professional agency across time and scale" for creating the opportunity to conduct research in a fantastic and inspiring environment. A big thank you also goes to my RTG colleagues, with whom I shared important moments over these three years. I acknowledge the use of Jenny (https://jenni.ai/de/) to identify improvements in the writing style

I encountered many people during this journey, each of whom enriched my experience. A special thanks goes to Dr. Melanie Nagel, who supported me during my final year and with whom I co-authored one of the papers in this dissertation. I would also like to thank my old colleagues and friends for revising the manuscript and patiently helping with my writing.

Last but not least, I would like to thank my partner, Vytautas Bernstein, who has supported me mentally and tolerated my mood swings, as well as my family and friends whom I cannot mention directly here but who were always present when I needed support.

Table of contents

English abstract

In this dissertation, I have investigated the phenomenon of nature-based solutions (NbS) upscaling in the European Union (EU) context as a means to integrate biodiversity into urban planning. Over the past decade, a significant body of scientific and grey literature within urban planning has emerged, emphasizing the imperative of upscaling nature-based solutions in an era characterized by the climate crisis and pervasive future uncertainty. This trend aims to foster rapid and broad institutional change. As part of the Research Training Group "Urban future-making: professional agency across time and scale" at HafenCity University Hamburg, this dissertation contributes to a deeper understanding of NbS upscaling as a collective process. It seeks to define, stabilize, and actualize a specific urban future imaginary grounded in biodiversity. The concept of social imaginary illuminates the inherent tensions among built-environment professionals when deliberating potential urban futures. Each imaginary supports distinct perspectives on problems and appropriate solutions, underscoring their performative capabilities. I propose an analytical framework comprising three discrete yet interconnected perspectives: discourses, practices, and relations.

Through four independent but related publications, I examined the discourses, practices, and relations surrounding NbS upscaling in urban planning within the European Union context. The findings indicate a pronounced inclination towards NbS upscaling for integrating biodiversity into urban planning; however, built-environment professionals seldom address NbS explicitly, opting instead for general references to urban biodiversity. Initially, these professionals appear to constitute a cohesive discourse coalition advocating for the integration of biodiversity into urban planning. Nevertheless, through the analytical lens of discourses, the results reveal a failure by both built-environment professionals and laypersons to translate their discussions into decisions that challenge the established planning systems. The practice lens highlights various 'sites' where built-environment professionals establish novel practices for urban biodiversity, albeit with varying degrees of legitimacy and legal enforceability. However, knowledge exchange among the proponents of these practices is limited, thereby restricting inter-site learning. Finally, the relations lens reveals no significant divergence in political orientations concerning support for urban biodiversity integration into urban planning. Consequently, relations tend to disaggregate rather than aggregate ideas, contributing to discourse polarization through the introduction of novel information and perspectives.

This dissertation underscores the necessity of fundamentally re-evaluating how built-environment professionals conceptualize and perceive urban biodiversity. This re-evaluation should be fostered through continuous dialogue encompassing past experiences, current actions, and future-oriented planning, critically examining which meanings and forms of biodiversity ought to be pursued, while rejecting the inclination towards innovation at any cost. Enhancing public knowledge regarding urban biodiversity and disseminating this information more widely are fundamental steps toward initiating a meaningful discourse on the essence of urban biodiversity and the role built-environment professionals are prepared to assign to it in shaping the city's future.

Deutsche Zusammenfassung

In dieser Dissertation untersuchte ich das Phänomen der Hochskalierung naturbasierter Lösungen (nature-based solutions – NbS) im Kontext der Europäischen Union (EU) als Mittel um Biodiversität in die Stadtplanung zu integrieren. Im Bereich der Stadtplanung hat in den letzten 10 Jahren die wissenschaftliche und graue Literatur stark zugenommen, die nahelegt, dass die Hochskalierung von Lösungen in Zeiten, die von Klimakrise und der Unsicherheit über die Zukunft beherrscht werden, unerlässlich ist, um einen breiteren institutionellen Wandel so schnell wie möglich zu fördern. Als Teil des Graduiertenkollegs „Urban future-making: professional agency across time and scale" an der HafenCity Universität Hamburg fördert diese Dissertation das Verständnis von NbS-Hochskalierung als einen kollektiven Prozess zur Definition, Stabilisierung und Umsetzung einer spezifischen urbanen Zukunftsvorstellung auf der Grundlage von Biodiversität. Das Konzept der sozialen Vorstellungswelt verdeutlicht die Spannungen zwischen Fachleuten aus dem Bereich der gebauten Umwelt bei ihrer Diskussion über mögliche städtische Zukünfte. Jede Vorstellungswelt (imaginary) unterstützt spezifische Vorstellungen darüber, was das Problem ist und was die richtige Lösung sein sollte, und unterstreicht damit seine performative Wirkmacht. Ich schlage einen analytischen Rahmen vor, der sich aus drei verschiedenen, aber miteinander verknüpften Linsen zusammensetzt: Diskurse, Praktiken und Beziehungen.

Ich habe Diskurse, Praktiken und Beziehungen im Zusammenhang mit der Hochskalierung von NbS in der Stadtplanung im EU-Kontext in vier unabhängigen, aber miteinander verbundenen Veröffentlichungen untersucht. Die Ergebnisse zeigen, dass es zwar einen starken Wunsch nach einer Ausweitung von NbS gibt, um die Biodiversität in die Stadtplanung einzubeziehen, dass aber Fachleute aus dem Bereich der gebauten Umwelt selten spezifisch über NbS sprechen; stattdessen neigen sie dazu, sich allgemein auf die Biodiversität in Städten zu beziehen. Auf den ersten Blick scheinen diese Fachleute eine einheitliche Diskurskoalition zu bilden, die die Integration der Biodiversität in die Stadtplanung schätzt. Durch die analytische Linse der Diskurse zeigen die Ergebnisse jedoch, dass sowohl Fachleute aus dem Bereich der gebauten Umwelt als auch Laien ihre Diskussionen nicht in Entscheidungen umsetzen, die die bestehenden Planungssysteme in Frage stellen. Der Blick auf die Praktiken hebt verschiedene ‚sites' hervor, an denen Fachleute aus dem Bereich der gebauten Umwelt neue Praktiken der städtischen Biodiversität einführen, wenn auch mit unterschiedlichem Grad an Legitimität und rechtlicher Durchsetzbarkeit. Das Lernen zwischen diesen ‚sites' ist jedoch aufgrund des geringen Wissensaustauschs zwischen den Trägern solcher Praktiken begrenzt. Abschließend zeigt der Blick auf die Beziehungen, dass es keine signifikanten Unterschiede in den politischen Orientierungen hinsichtlich der Unterstützung der Integration der städtischen Biodiversität in die Stadtplanung gibt. Der Schwerpunkt der Beziehungen liegt also eher auf der Trennung als auf der Verbindung von Ideen, was dazu führt, dass der Diskurs durch die Einführung neuer Informationen und Perspektiven polarisiert wird.

In dieser Dissertation wird auf die Notwendigkeit hingewiesen, die Art und Weise, wie Fachleute im Bereich der gebauten Umwelt urbane Biodiversität verstehen und wahrnehmen, grundlegend zu überdenken. Dies soll durch einen ständigen Dialog zwischen vergangenen Erfahrungen, gegenwärtigen Maßnahmen und zukunftsorientierten Planungen geschehen, der die Frage aufwirft, welche Bedeutungen und Formen von Biodiversität angestrebt werden sollten, und der der Versuchung widersteht, um jeden Preis innovativ zu sein. Die Verbesserung des Wissens über die urbane Biodiversität und die Vermittlung dieses Wissens an eine breitere Öffentlichkeit sind grundlegende Schritte, um eine sinnvolle Diskussion darüber anzustoßen, was urbane Biodiversität ist und welche Rolle Fachleute aus dem Bereich der gebauten Umwelt bereit sind, ihr bei der Planung der Zukunft der Stadt zuzuweisen.

1. Imagining the future of urban biodiversity

Climate change and biodiversity loss are recognised as the most critical challenges of the contemporary urban age (McDonald *et al.*, 2018; Pörtner *et al.*, 2021). Within the realm of urban planning, the conceptualization of 'city of the future' that is capable of adapting to climate change increasingly emphasizes the utilization of nature-based solutions (NbS) as a holistic approach. NbS are considered solutions able to simultaneously address climate change-related issues (Nesshöver *et al.*, 2017; Voskamp *et al.*, 2021; Xie *et al.*, 2022; Castelo *et al.*, 2023) and enhance biodiversity in cities (Xie and Bulkeley, 2020; Kabisch *et al.*, 2022; Pineda-Pinto *et al.*, 2022; Xie *et al.*, 2022). NbS are commonly defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified [...] ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (UN, 2022: 2). Especially within the European Union, experiments with NbS have been conducted to test the potential and limitations of these solutions in the urban context (Frantzeskaki, 2019; Dignum *et al.*, 2020; Sarabi *et al.*, 2021). Motivated by the urgent need for action, international organisations and the urban planning research community highlight the importance of upscaling NbS experiments to maximize their social and environmental benefits, thereby facilitating the desired future urban transformation focused on climate adaptability and increased biodiversity (Cohen-Shacham *et al.*, 2019; IUCN, 2020; Cortinovis *et al.*, 2022; Frantzeskaki *et al.*, 2022; Mahmoud *et al.*, 2022; Adams *et al.*, 2023; Castelo *et al.*, 2023; McPhearson *et al.*, 2023b; Mell *et al.*, 2023). Within transition research, upscaling is understood as the process by which an innovation transmigrates from an experimental phase to widespread acceptance and utilisation by society (Rip and Kemp, 1998). The Multi-Level Perspective (MLP) is considered a suitable conceptual framework for explaining the upscaling of innovations and is widely employed in transition research (Geels, 2004, 2024). Against this background, this dissertation investigates the following research question: *How does the upscaling of nature-based solutions shape visions of urban futures to enhance biodiversity in European cities?*

While some scholars and practitioners deem upscaling NbS experiments necessary to accomplish future urban transformation, significant conceptual and operational criticisms have been raised. Conceptually, the definition of NbS within the urban planning literature remain contentious, creating a precarious terrain that can lead to disagreements about what constitutes an NbS (Seddon *et al.*, 2020; Seddon *et al.*, 2021; Sowińska-Świerkosz and García, 2022). In a similar fashion, the notion of upscaling within transition research is characterized by multiple nuances that impart a degree of ambiguity (Durrant *et al.*, 2018; Lam *et al.*, 2020). Additionally, upscaling is often referred to as a mechanism rather than a process. This conceptualisation implies a certain degree of automatism that accepts upscaling as a natural evolution of the experiment, creating ambiguity concerning the roles and responsibilities of the actors involved before, during, and after the upscaling (Sengers *et al.*, 2021; Sharp and Raven, 2021; Pfotenhauer *et al.*, 2022; Bulkeley, 2023; Schmid and Taylor Aiken, 2023). Operationally, both nature-based solutions and upscaling have been criticised for fostering a form of solutionism; a tendency to frame complex socio-ecological challenges as solvable primarily through the broad adoption of innovative solutions. In this framing, the upscaling of such solutions, often celebrated through optimistic and credible promises of transformative change, tends to be prioritised over other alternatives (Welden *et al.*, 2021; Pfotenhauer *et al.*, 2022). As mentioned, the MLP is the most common framework in transition research to analyse upscaling. However, MLP is criticised to focus mainly on what occurs in the experimental phase (Shove and Walker, 2007; Geels, 2019), risking an overemphasis on short-term commitments in light of a perpetual state of experimentation (Karvonen, 2018; Bulkeley *et al.*, 2019). Lastly, urban planning research frequently

emphasises the importance of examining the politics of NbS upscaling, focusing on the role of specific urban actors in steering NbS upscaling processes by prioritising certain interests and visions (Castán Broto and Bulkeley, 2018; Bulkeley *et al.*, 2022; Tozer *et al.*, 2022a; Tozer *et al.*, 2022b). Recent developments in transition research have included actors and power dynamics, identifying 'intermediaries' as key to facilitating the upscaling of innovations, while 'incumbents' attempt to obstruct it (Wittmayer *et al.*, 2017; Kivimaa *et al.*, 2019; Sovacool *et al.*, 2020). However, transition research does not thoroughly account for how these actors relate to and influence each other, as hierarchies are often overlooked in the MLP (Geels, 2011, 2019; Avelino, 2021; Geels, 2024).

In this dissertation, I build on these critiques within urban planning and transition literature to argue that upscaling NbS should be considered as a process that requires closer attention to three key aspects: 1) the narratives these concepts generate, 2) the approaches deployed, and 3) the actors involved and their roles. I therefore explore these aspects through three analytical lenses: discourses, practices, and relations. First, discourses analyse how specific narratives of NbS upscaling are discussed as 'right' or 'wrong' (Hajer and Versteeg, 2005; Bacchi and Bonham, 2014; Kotsila *et al.*, 2021; Melanidis and Hagerman, 2022). Second, practices refer to the approaches involving an ensemble of routinised tools, rules, and procedures of NbS upscaling that constitute "enduring regimes of activity" (Nicolini, 2011: 605; Welch and Yates, 2018; Xie *et al.*, 2022). Third, relations account for actors' interactions in pursuing or preventing NbS upscaling and the resources and strategies they deploy (Burt, 2004; Vedres and Stark, 2010; Obstfeld, 2017; Wittmayer *et al.*, 2017). The three dimensions of discourses, practices, and relations are empirically connected through the concept of discourse coalition. This is defined as a "group of actors that, in the context of an identifiable set of practices, shares the usage of a particular set of storylines over a particular period of time" (Hajer, 2006: 70). Identified discourse coalitions represent the different views on urban futures generated through the upscaling of NbS. Leaning on the concept of social imaginary (Taylor, 2004; Jasanoff, 2015; Angelo, 2021), I conceptualise NbS upscaling as a *collective process to define, stabilise, and perform a specific urban future imaginary based on biodiversity*. The aim of this dissertation is to investigate how discourses, practices, and relations in urban planning are shaped by the upscaling of NbS. Empirically, I focus on the European Union (EU) context because of its declared intention to become a world leader in NbS research and practice (Faivre *et al.*, 2017; Davies *et al.*, 2021; El Harrak and Lemaitre, 2023), making it a promising research field to explore how urban futures based on the narratives behind NbS upscaling are imagined. The EU Biodiversity Strategy for 2030 recognises the role of cities to reverse biodiversity loss by systematically integrating NbS into an Urban Nature Plan (UNP) as a new urban planning practice (EC, 2020: 13). I analyse how the EU Biodiversity Strategy for 2030 influences the discourses, practices, and relations surrounding NbS upscaling at national and local levels by selecting two European Member States, Germany and Italy, using a comparative analysis approach (Flyvbjerg, 2011).

With this research, I aim to contribute to two current debates: built-environment professionals in future-making and the role of NbS in fostering future urban transformations based on biodiversity. First, built-environment professionals refer to a broad sample of urban actors confronted with defining urban futures in various ways, from political debates to physical transformation (Grubbauer *et al.*, 2024a). This definition originates from the research training group "Urban future-making: Professional agency across time and scale" at HafenCity University Hamburg, where this dissertation is being conducted. This RTG focuses on the actions (or inactions) of these professionals in the face of contemporary threats in an urban environment dominated by uncertainty about the future. Responding to this future-making debate, I draw on the future studies literature that characterises imaginaries based on their performativity, linking the discourse about possible futures with the practices and relations needed to enact those futures through NbS upscaling (Brown *et al.*, 2000;

Hodson *et al.*, 2018; Westman and Castán Broto, 2020; Bulkeley, 2021; Lemes de Oliveira and Mahmoud, 2024).

My second contribution is situated within the extensive literature on NbS, which has witnessed a proliferation of scientific papers and grey literature in recent years. This proliferation denotes an increasing interest in these solutions for addressing contemporary urban challenges (Li *et al.*, 2025). Recognising the risk of their intrinsic conceptual ambiguity, urban planning research cautions against positioning NbS and their upscaling as a panacea for urban challenges (Seddon *et al.*, 2020; Seddon *et al.*, 2021; Melanidis and Hagerman, 2022). Foremost, while the literature extensively discusses the social and economic benefits of NbS upscaling, I engage in the latest debate about the claimed capacity of NbS to foster biodiversity (Xie and Bulkeley, 2020; Pineda-Pinto *et al.*, 2022; Xie *et al.*, 2022; Lemes de Oliveira, 2025). Although the definition of urban biodiversity – the complexity and variety of biological components, including humans, and how these are connected (Müller and Werner, 2010; Nilon *et al.*, 2017) – is highly scientific and challenging to convey to a broader public, urban biodiversity remains the official terminology used in EU policy documents when promoting NbS upscaling in urban planning.

This dissertation is underpinned by the findings derived from four distinct publications. The first publication examines the outcomes of the EU-funded project CLEVER Cities, focusing on experimentation with NbS and their upscaling. The second publication delineates the analytical framework of discourses, practices, and relations for the analysis of NbS upscaling. The third and fourth publications present the empirical analyses of national and local discourses pertaining to NbS upscaling in urban planning, respectively.

The results indicate that while the upscaling of NbS is considered a matter of urgency within both scientific literature and policy arenas, built-environment professionals seldom discuss NbS explicitly. Instead, they predominantly refer to urban biodiversity in general terms. At a first glance, these built-environment professionals appear to constitute a unified discourse coalition advocating for the integration of biodiversity into urban planning. By contrast, the analytical framework of discourses, practices, and relations is employed to facilitate a more nuanced interpretation beyond this initial observation. Through the lens of discourses, the findings reveal that built-environment professionals conceptualize urban biodiversity via three distinct 'framings': the need for innovative and quick solutions (urgent and innovative), biodiversity-based solutions as salvific for humanity (biodiversity for salvation), and curated and aesthetically appealing urban biodiversity (biodiversity as ornamentation). The practices lens was used to identify the experiment, the literature, the national parliaments, and the UNPs as 'site' where built-environment professionals stabilise new practices of urban biodiversity with varying degrees of legitimacy and legal enforceability. Finally, the relations lens served to detect three key relations (legitimacy, influence, agency) that built-environment professionals perform with two distinct goals: unpacking the complexity of the urban biodiversity concept and polarising the discourse by introducing new information and perspectives. The dissertation concludes that a deficiency in effective communication regarding the meanings and forms of urban biodiversity exists or is underestimated by built-environment professionals. Consequently, urban imaginaries based on NbS upscaling should be critically examined and re-envisioned through insights from past experiences, present context, and future visions, rather than focusing narrowly on innovation.

The structure of this dissertation is organized as follows. Section 2 offers a critical discussion of the concepts and approaches relevant to NbS upscaling, drawing upon the established literature in urban planning and transition research. It also delineates the analytical framework predicated on discourses, practices, and relations. Building upon this conceptual foundation, Section 3 presents

the research design, introducing the case study, methodology, and the findings from the four publications that comprise this dissertation. Section 4 proceeds with an in-depth examination of these findings, employing the analytical framework of discourses, practices, and relations previously outlined in Section 2. In conclusion, the dissertation highlights the principal contributions pertinent to the two identified fields of engagement – built-environment professionals in urban future-making and the NbS literature – and proposes future research trajectories for investigating NbS upscaling for urban biodiversity in cities.

2. Integrating biodiversity in the urban age

In the urban age, characterised by a continuous increase in the global population living in urbanised areas (United Nations, 2019), cities have emerged as arenas where futures are both conceptualized and realized. The concept of future(s) is increasingly perceived as complex and challenging, pervaded by uncertainty (Tutton, 2017; Scoones, 2024). The urban planning discipline has traditionally been recognised for its ability to engage with urban matters by anticipating possible futures through visions, strategies, plans, and policies (Allmendinger and Tewdwr-Jones, 2002; McPhearson *et al.*, 2017). Acknowledging climate change and biodiversity loss as critical challenges for future urban development (McDonald *et al.*, 2018; Pörtner *et al.*, 2021), current research trends in urban planning focus on integrating biodiversity into the planning of future urban transformation as an answer to these challenges (Visseren-Hamakers and Kok, 2022; Ibsen *et al.*, 2023). While urban growth and land-use changes have been identified as the primary drivers of biodiversity loss (McDonald *et al.*, 2018: 23; CBD, 2022: 4), researchers in urban biodiversity have observed a remarkably high rate of biodiversity within urban environments, thereby revealing the potential for cities to reverse global biodiversity loss through fundamental shifts in their approaches to this topic (Grimm *et al.*, 2008; Aronson *et al.*, 2017; Schilthuizen, 2018). With the understanding that urban areas are crucial for addressing biodiversity issues, the built environment is now conceptualized as a novel habitat requiring exploration, possessing characteristics distinctly different from non-urban habitats (Schilthuizen, 2018).

Since the early 2000s, urban experimentation has been developed as a concept to address the uncertainty and complexity inherent in planning the future of cities in response to climate change and biodiversity loss. Urban experiments involve the testing of novel solutions within defined and controlled areas, with their transformative potential assessed through the engagement of a diverse array of urban actors, ranging from laypersons to experts (Castán Broto and Bulkeley, 2013; Evans *et al.*, 2016; Bulkeley *et al.*, 2019). Although research and practice concerning urban experiments have proliferated in recent decades, experiments specifically involving natural elements remain infrequent (see for instance Gross and Hoffmann-Riem, 2005). A potential explanation for this is that the concept of biodiversity has traditionally been associated with non-urban contexts. Within the discipline of ecology, biodiversity is defined as the quality and quantity of the variety of biological elements within a given area, with the urban context often disregarded (Shwartz *et al.*, 2014). Recent research investigating experiments with urban biodiversity is situated within the field of transition research (Dignum *et al.*, 2020).

2.1 Nature-based solutions and the need for upscaling

Nature-based solutions (NbS) have emerged as an innovative approach to experiment with biodiversity within urban context (Faivre *et al.*, 2017; van der Jagt *et al.*, 2020; Shahani *et al.*, 2022). NbS experiments are defined as "an innovative alternative to the provision of urban infrastructures and exhibit a sustainability challenge-oriented approach" (Dignum *et al.*, 2020: 8). NbS gained prominence after the International Union for Conservation of Nature (IUCN) recognised their importance in addressing global societal challenges by officially providing the first NbS definition: "Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (Cohen-Shacham *et al.*, 2016: 2). Subsequently, NbS have begun to be considered an alternative to other well-established concepts in urban planning, such as Green Infrastructures (GI), Ecosystem-based Adaptation (EbA), and Ecosystem Services (ES), among others (for an overview, see Nesshöver *et al.*, 2017: 1218–1219). Currently, NbS are understood within urban planning literature as an umbrella concept that encompasses various actions employing nature to concurrently address climate change and biodiversity loss challenges in cities (Nesshöver

et al., 2017; Mahmoud *et al.*, 2022; McPhearson *et al.*, 2023a). The latest definition incorporates new approaches to biodiversity and emphasises integrated ecosystems: "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (UN, 2022: 2).

Given the escalating impacts of climate change and biodiversity loss on human life, built-environment professionals have increasingly expressed an urgent demand for the application of these experiments at the city level, thereby fostering a more fundamental transformation of current urban planning practices. With its origins in innovation studies, transition research has traditionally analysed how (mainly technological) innovations are initially developed in so-called 'niche experiments' before migrating from an experimental embryonic state to widespread acceptance and utilization (Rip and Kemp, 1998; Sengers *et al.*, 2016; von Wirth *et al.*, 2019). The global interest in such transmigration processes is a key factor contributing to the flourishing of transition research. Presently, this transmigration is referred to by various terms within the transition literature, each with subtle distinctions (Durrant *et al.*, 2018; Lam *et al.*, 2020). Within the context of NbS, the concept of upscaling signifies the modification in the scale of application of innovations developed within experiments to the city scale. NbS upscaling is utilized in both urban planning literature (Cohen-Shacham *et al.*, 2019; Fastenrath *et al.*, 2020) and grey literature (IPCC, 2023).

To elucidate the concept of solutions upscaling, Frank Geels, within the transition literature, developed the Multi-Level Perspective (MLP), a flexible middle-range conceptual framework commonly used to observe the upscaling of innovations (Geels, 2004, 2024: 11). The MLP conceptualises institutional change as the interaction between three 'levels': the niche, the regime, and the landscape. Similar to the experiment conceptualisation, niches are understood as protected spaces from "prevailing selection pressures", including market rules and politics, where innovations can develop and thrive (Smith and Raven, 2012: 1025). Regimes represent the level where practices are produced and reproduced, usually characterised by resistance to change (Geels, 2002, 2004). The landscape is an overarching level described as distant, where slow-changing developments as well as external shocks occur (Geels, 2019). The landscape can exert pressure on the regimes to change by supporting the upscaling of niches. In MLP terms, upscaling thus refers to the transmigration of an innovation from the niche to the regime level (Geels and Schot, 2007).

2.2 Conceptual and operational criticisms

Scholars in urban planning and transition research have extensively debated various criticisms and their potential implications when discussing NbS upscaling as a transition pathway. This section categorizes these criticisms into conceptual and operational.

The United Nations' definition of NbS is deemed to be broad and abstract, increasing the risk of creating ambiguity in identifying which solutions can be labelled as NbS (Nesshöver et al., 2017; Hanson et al., 2020; O'Sullivan et al., 2020). This conceptual ambiguity has significant implications. As NbS gain global attention, their use becomes attractive to a broader spectrum of built-environment professionals aiming to enter the nature protection market (e.g. Shell Global, 2021). While promising green sustainable practices, the ambiguity of the NbS definition could allow these actors to hide behind the NbS banner to justify unsustainable actions (Kotsila et al., 2021; Seddon et al., 2021; Melanidis and Hagerman, 2022). Similarly, linked to their claimed ability to address biodiversity in the urban context, some authors in urban planning have questioned the meaning of 'nature' in NbS, whose abstractness contributes to the aforementioned ambiguity (Dushkova and Haase, 2020; Kabisch et al., 2022; Grimm et al., 2023). Indeed, the term 'nature' in NbS is often used abstractly and

hardly considers the specificity of local biological systems (Lemes de Oliveira, 2025). On the same level, the concept of upscaling is considered blurry. Within transition literature, the term 'upscaling' can be found hidden behind a plethora of other terminologies[1] (Durrant et al., 2018; Lam et al., 2020). In all its nuances, upscaling is regarded in transition research as a mechanism rather than a process. This means attributing a level of automatism to upscaling that obscures, if not neglects, the role and responsibility of the built-environment professionals involved in the upscaling (Durrant et al., 2018; Sengers et al., 2021; Adams et al., 2023). Yet, while these nuances are acknowledged by transition research, they are not fully reflected in the everyday language of many built-environment professionals, who still use upscaling to refer to the wider application of innovations (Augenstein et al., 2020; Lambin et al., 2020; UNEP, 2022). Understanding upscaling as a mechanism also implies focusing on the experiment without considering what happens before and after upscaling, spatially and temporally (Hölscher et al., 2019; Sharp and Raven, 2021; Bulkeley, 2023). Indeed, the MLP primarily concentrates on what occurs in the experiment at the niche level and conceptualises regimes as intrinsically and exclusively negative, while the landscape remains distant and unchangeable. This clear division between levels creates a simplistic narrative that views upscaling as a linear pathway, whereby political context and existing routines are not considered part of the upscaling process (Welch and Yates, 2018; Geels, 2019; Tozer et al., 2022a). Additionally, since the MLP was mainly developed for the analysis of technological innovations, applying this framework to study NbS upscaling might not effectively capture the complexity of conducting urban experiments with biodiversity (Dignum et al., 2020; but see Mitić-Radulović and Lalović, 2021).

Operational criticisms refer to the understanding of NbS as solutions biased by a positivistic ontology. Referred to as 'solutionism', this understanding implies the "framing of problem diagnoses in response to readily available […] solutions", deploying narratives of "visionary promises, and other forms of exclusive expertise" to increase the credibility of those solutions (Pfotenhauer et al., 2022: 15). Solutionism thus signifies the provision of an easy, ready-to-use answer to a complex problem. When the chosen solution is considered the most viable, only the individuals who control the access to that solution can profit significantly from its upscaling. Accordingly, other solutions that could benefit other individuals or groups may be discarded. The adoption of a 'solutionist' approach to NbS fosters a discourse of positive transformation, wherein the perceived success of a deployed solution is contingent upon its classification as an NbS (Frantzeskaki, 2019; Jørgensen *et al.*, 2022; Mell *et al.*, 2023). Similarly, upscaling is often shrouded in mysticism, whereby the common perception among built-environment professionals suggesting that credible and positive futures can only be realised through the upscaling of solutions. This creates what Castán Broto and Bulkeley refer to as 'anxiety of upscaling', describing the significance attached to the necessity of achieving success through upscaling (Castán Broto and Bulkeley, 2018: 70; Pfotenhauer *et al.*, 2022). Because an unsuccessful experiment is likely to be abandoned, this understanding has the effect of neglecting failures as a possible source of learning (Karvonen, 2018; Bulkeley *et al.*, 2019; Karvonen and Bylund, 2023). As a matter of fact, NbS upscaling is regarded as directly linked to success, requiring experiments

[1] Mainstreaming, a newer concept often associated with NbS, represents an alternative to upscaling, as discussed in Xie et al. (2022); McPhearson et al. (2023b); Mell et al. (2023). While upscaling etymologically refers to the increase in scale of an experiment, mainstreaming is described as "a process through which these experiments […] are embedded into urban systems such that they reconfigure the flow of power, resources and materials and gain momentum to transform mainstream institutions, infrastructures, and social norms" Xie et al. (2022: 122). However, this term was not yet widely employed in the field of transition research when I began writing this dissertation; therefore, it was not considered in the research. Yet, the theoretical implications of this research can be expanded to the current debate on mainstreaming NbS as well.

involving NbS to be accompanied by wording from the business world, such as showcases or business cases (Cohen-Shacham *et al.*, 2019; Fastenrath *et al.*, 2020; Frantzeskaki *et al.*, 2020; Albert *et al.*, 2021).

Based on these criticisms concerning the upscaling of NbS, scientific debate within urban planning research has highlighted the need to consider politics when NbS are requested to be upscaled (Kotsila *et al.*, 2021; Sarabi *et al.*, 2021; Tozer *et al.*, 2022b; van der Jagt *et al.*, 2023). This element is traditionally only implicitly considered in most urban planning research concerning urban experiments (Castán Broto and Bulkeley, 2018; Pfotenhauer *et al.*, 2022; Karvonen and Bylund, 2023). The consideration of politics is particularly relevant as the interest in NbS upscaling to foster biodiversity in cities has attracted a wide range of built-environment professionals. These professionals are reverting to such 'more sustainable' solutions, raising fundamental questions about which types of solutions aiming to address biodiversity are permitted, by whom, and for what purposes (Bulkeley *et al.*, 2022; Tozer *et al.*, 2022b; Li *et al.*, 2025). Recent developments in transition research suggest adopting a relational approach to conceptualize how different types of built-environment professionals and their relationships play out in transition, offering a more nuanced characterization of those actors who have the capacity to influence the upscaling of innovations (Wittmayer *et al.*, 2017). An actor's ability to influence the upscaling of NbS is determined by their specific role within the urban transition, with various role typologies identified as being foundational. The role of the 'champion' identifies the actor whose interests lie in initiating and promoting innovation (Brown *et al.*, 2013). The 'intermediary' facilitates the process of innovation development (Kivimaa *et al.*, 2019) or hinders it in its 'incumbent' variant (Sovacool *et al.*, 2020). As a key actor in the upscaling of innovations, the intermediary is one of the most studied roles in transition research. However, actors across different levels, as conceptualised by transition research, are often simplified into good and evil, while we have seen that the MLP presents a trivial understanding of hierarchies in attempting to describe NbS upscaling processes (Geels, 2019; Sovacool *et al.*, 2020; Avelino, 2021; Kok, 2023).

2.3 Future transformations through NbS upscaling: discourses, practices, relations

By considering NbS upscaling as a pathway towards future transformations, I draw on the concept of social imaginary (Taylor, 2004; Jasanoff, 2015; Angelo, 2021) to conceptualise NbS upscaling as a *process to collectively define, stabilise, and perform a specific urban future imaginary based on biodiversity*. Imaginaries are characterised by their ability to influence actions, defined as performativity (Oomen *et al.*, 2022). This conceptualisation suggests exploring NbS upscaling according to 1) which debates generate future imaginaries, 2) which approaches for enacting such future imaginaries are proposed or abandoned, and 3) which actors can favour or impede certain future imaginaries. In my second publication composing this dissertation, Navigating urban futures: Exploring NbS upscaling discourses, practices, and relations in reimagining human-nature relationships, I propose an analytical framework composed of three analytical lenses: discourses, practices, and relations. The ontological approach derived by the concept of social imaginary interprets practices mainly through a discursive lens, which means certain critical aspects, such as their material, technological, or emotional components, are not examined. These unexamined dimensions could influence outcomes; for example, the physical deployment of urban projects or stakeholders' emotional responses to biodiversity initiatives might shape urban futures in ways not captured by discourse alone. Similarly, relationships between actors are conceptualized and analysed mainly through their communication. While this method allows for a detailed understanding of how knowledge, ideas, and narratives flow between individuals, it might overlook other important relational dynamics. These could include power imbalances, informal networks, or tangible interactions that also play a role in decision-making processes. While these limitations are

acknowledged, this focused approach is justified by the study's specific goals. By intentionally narrowing its analytical focus, the study provides a nuanced understanding of how language and discourse contribute to shaping imaginaries of urban biodiversity. This focus allows for the identification of recurring narratives, rhetorical strategies, and interpretive frameworks that guide the action of built-environment professionals.

2.3.1 Discourses: multiple ideas of nature-based imaginary

The complexity of defining NbS has sparked debates among built-environment professionals about which solutions are included under the NbS concept (Kotsila *et al.*, 2021; Bulkeley *et al.*, 2022). In discourse theory, the work of Maarten Hajer argues that environmental discourses are inherently political (Hajer, 1995; Bacchi and Bonham, 2014). In Subsection 2.2, I discussed the solutionism character of NbS, according to which alternative solutions might be discarded if they are not labelled as NbS. Because the definition of nature varies according to culture and geography (Ducarme and Couvet, 2020), the framing and communicating of NbS depend heavily on subjective interpretations of what nature means (Hajer and Versteeg, 2005; Lemes de Oliveira, 2025). When confronted with ideas about urban futures based on nature, built-environment professionals are influenced by deeply rooted beliefs about what they perceive as the truth (Haarstad *et al.*, 2023). While analysing subjective thoughts and beliefs is nearly impossible, discourse analysis facilitates the investigation of how actors communicate these thoughts and beliefs to the public.

The conventional definition of 'discourse' denotes an "ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices" (Hajer and Versteeg, 2005: 175). Analytically, discourse analysis reveals different actors' utterances and their strategies for conveying ideas, values, and visions. Commonly shared ideas are referred to as the frame of the discourse. The frame serves two main analytical purposes. First, it allows to illuminate how discourses can influence human consciousness by *selecting* problems, causes, judgments, and remedies related to the issue at stake, and *priming* to "introduce or raise the salience or apparent importance of certain ideas" and advancing them on the agenda (Entman, 1993, 2007: 164). When discussing alternatives, built-environment professionals promote their frames through argumentation (Hajer, 2006). Framing can be used to promote change, which may arise from the frictions between different frames (Dewulf *et al.*, 2011), or to support the status quo (Schmidt, 2010; Dodge and Lee, 2017), demonstrating the concept's ability to illustrate the "exertion of political power" (Entman, 1993: 55). New frames can enter in the discourse at any time and succeed to be taken up if they address fundamental conflicts over meaning (Dodge and Lee, 2017). Second, it allows the assignment of built-environment professionals who adhere to a specific frame into a distinct group with which they can identify, a discourse coalition.

Within the argumentative turn in discourse analysis, discourse coalitions represent a group of actors that share a common interpretation of a social construct (Hajer, 1993). Using the concept of social imaginary developed within future studies means examining how discourse coalitions of built-environment professionals collectively define, stabilise, and perform their imaginaries in a constant engagement with "powerful political narratives [to] capture future promises" (Brown *et al.*, 2000: 9). The potency of the narratives generated by NbS contributes to enhancing positive visions of the future based on success (Jørgensen *et al.*, 2022; Mell *et al.*, 2023), following a general understanding of green as good (Angelo, 2021; Kotsila *et al.*, 2021). Recent urban planning research on NbS has highlighted the potential for mobilising the concept of NbS in strictly political terms. On one hand, framing NbS as solutions able to 'leverage the power of nature' could shift the perspective of the built-environment professionals to consider benefits for biodiversity when implementing NbS. On the other, the ambiguous definition of NbS poses a risk of enabling some of these professionals to

'rebrand' existing solutions, hereby perpetuating unsustainable practices under the NbS labelling (O'Sullivan *et al.*, 2020; Seddon *et al.*, 2021; Melanidis and Hagerman, 2022).

2.3.2 Practices: balancing disruption and resistance for change

Discourses pertaining to NbS and their upscaling do not simply represent a "communication tool" for which future imaginaries are told (Nesshöver *et al.*, 2017: 1225; Kotsila *et al.*, 2021), but can influence the current urban planning practices of biodiversity (Bacchi and Bonham, 2014; Kotsila *et al.*, 2021). The concept of social imaginaries incorporates a performative character, reflecting the extent to which built-environment professionals modify their actions in accordance with their conceptions of the future (Brown *et al.*, 2000; Jasanoff, 2015). Practices within transition research focus on the collective appropriation of new upscaled innovations which become part of the new normal (Shove and Walker, 2010; Welch and Yates, 2018). The linear conceptualisation of transitions, however, risks to neglect what the role of already existing practices may have on the upscaled innovations and the possible frictions that this process can generate (Hargreaves *et al.*, 2013).

The concept of 'practice' refers to the sum of tools, rules, and procedures that individuals produce and reproduce. With its focus on the everyday and life-world, a practice can be referred to as a routinised type of behaviour (Reckwitz, 2002: 249). Practice is not simply about what is done (the 'doings'); it also considers how the doings are communicated (the 'sayings'). In this interplay between the doings and sayings mindsets and interpretations of individuals that deal with a certain practice influence the ways in which a practice is defined and carried out (ibid.: 259). If this conceptualisation highlights the routinisation of practice, it is worth questioning how new practices (i.e. innovations) become routinised. According to Davide Nicolini, practices are "meaning-making, identity-forming, and order-producing activities" (Nicolini, 2011: 602). Practices are not isolated but form "complex nets with dense patterns and mutual references" between them and their context, fostering a continuous adjustment between internal rules and external inputs (Nicolini, 2011: 603). Adjustments occur due to the translation action of individuals or groups carrying a practice, thus implying an act of knowing and organising (Nicolini, 2011, based on Latour). The translation, in fact, includes a work of interpretation between the sender and the receiver, whereby the practice is filtered by one's insights and understandings of the practice (Pyrko *et al.*, 2017). Thus, actors acting as translator are fundamental in the (re)appropriation of a practice. Central to this conceptualisation is the role of power within both the internal and external realms of the practice, which can define the way to proceed (Nicolini and Monteiro, 2016). With power entering into play, so is the division between actors. Accounting for conflictual situations is fundamental "to interrogate practices and their associations in terms of the effects that they produce" (Nicolini and Monteiro, 2016: 14).

Given the dependence of practices on internal and external dynamics, Nicolini explores questions regarding the identifiability and distinctiveness of a practice, thereby defining its boundaries (Nicolini, 2009). The concept of the 'site' of the practice serves to define the geographical and temporal discrete location of the practice under analysis in relation to other events and phenomena and a position in a relational sense, a phenomenon part of a larger whole. Thus, site makes practices intrinsically relational, wherein the context is not passive but in continuous exchange with the inside of the practice (Nicolini, 2011). This continuous exchange occurs not only between the site and the external, but also between different sites. In the understanding that knowing is more about tuning and absorbing, Nicolini affirms the necessity to switch site to learn how a practice works, highlighting the "knowing how to interact with different ways of knowing" (Nicolini, 2011: 613).

Hajer's definition of the discourse coalition as a "group of actors that, in the context of an identifiable set of practices, shares the usage of a particular set of storylines over a particular period of time" (Hajer, 2006: 70) further reinforces the performativity of discourses on practices and relations.

Additionally, practice theory highlights the importance of viewing routines not only as imposed resistance to change but as a structure that provides opportunities and space for new practices to be integrated (Welch and Yates, 2018). Hence, understanding NbS and their upscaling as pathways able to influence existing practices means looking at how current regimes react to external pressures by rearranging from the inside to embrace the new practice. While transition research exclusively understands institutional change through disruption, the concept of practice suggests that there is a range of responses between acceptance and rejection (Behagel *et al.*, 2019; Kotsila *et al.*, 2021). Thus, upscaling NbS can be known , translated, and organised by actors in the regime also through a smooth incremental approach that does not need to follow the framing of immediate results and success (Augenstein *et al.*, 2020; Bulkeley *et al.*, 2022; Xie *et al.*, 2022).

2.3.3 Relations: inter-mediating NbS upscaling

As previously mentioned, the performativity of imaginaries influences the future actions of the built-environment professionals. Consequently, an investigation into how these actors relate to one another can elucidate the performance and transformation of discourses and practices. Transition research understands disruptive institutional change through the upscaling of innovations. Recent developments in transition research have focussed on analysing more precisely who is allowing (or hindering) such change. Champions and intermediaries are identified as roles that drive institutional change through upscaling innovations, while incumbent actors resist such changes, acting to preserve the status quo (Wittmayer *et al.*, 2017; Kivimaa *et al.*, 2019; Sovacool *et al.*, 2020). However, the characterisation of intermediaries' and incumbents' roles tends to explain the actions of these actors in a fundamentally positive and negative orientation, respectively (Kivimaa *et al.*, 2019; Avelino, 2021). Recently, transition research has acknowledged the role of power in achieving transition, defined as "the (in)capacity of actors to mobilise means to achieve ends" (Avelino, 2021: 440). In these terms, intermediaries and incumbents attempt to pursue and hinder institutional change can be read according to their ability to perform disruptive actions or to support existing power relations. As different ideas of the future and ways to enact them exist (Brown *et al.*, 2000), actors with the power and interest to promote one imaginary of the future while hindering another require careful examination.

Insights from network theory redirect focus from actors themselves to the relational structures that shape their roles. Social network analysis (SNA) provides a broader set of tools to interpret social phenomena through networks. A network is defined by nodes – usually actors or organisations – described according to their 'position' and edges – usually kinship or working relations but also flows of information. Accordingly, brokers acquire great relevance in SNA due to their position between different networks and their role in bringing about innovations (Obstfeld, 2017). Brokers take advantage of non-existing ties to fill up what Burt calls structural holes (Burt, 2003). An evolution of Burt's thought goes beyond the static positionality of nodes. It looks at the process involving the actors in such a position in connecting previously unconnected nodes to generate novelty from which the newly connected networks can benefit (Obstfeld *et al.*, 2014). The broker is not only a node outside a given network but can simultaneously be located inside one or more existing networks. This position is described analytically as multiple insiders and facilitates internal access to existing resources (Vedres and Stark, 2010). Brokers may also exercise their power to resist innovations; accordingly, behavioural orientations of delay, prevention, or reduction of the degree of change can be observed. The concept of 'tertius' describes the "behavior by which an actor influences, manages, or facilitates interactions between other actors" (Obstfeld *et al.*, 2014: 141; Obstfeld, 2017). The *tertius gaudens* (the third who enjoys) is an actor that seeks profit from connecting (or dividing) other actors. The *tertius iungens* (the third who connects) reflects the willingness to ease coordination and collaboration among actors. Finally, the *conduit* type describes

a situation in which the information is passed between nodes (or networks) without attempting to modify existing relations, which is always dependent on the willingness of the conduit to do so. Notably, the *tertius gaudens* and *iungens,* although depicted as opposing concepts, do not carry inherently positive or negative connotations. However, I have argued that analysing NbS upscaling cannot neglect politics. The traditional attribution of a completely neutral orientation to the champion or intermediary in transition research is thus counterintuitive (Kivimaa *et al.*, 2019). This is because conflicts are expected to arise among actors regarding which solutions should be permitted and what future should be pursued (Grubbauer *et al.*, 2024b).

Once again, Hajer's concept of discourse coalitions offers the possibility to understand networks according to how they communicate. This understanding goes beyond the traditional perspective of nodes connected by kinship or information ties and allows for a wider set of nodes to be represented in a looser fashion. Accordingly, a network can be composed of nodes that do not share kinship or information flows, but their joint agreement on an issue may contribute to the success of that issue. Hence, the discourse coalition concept can be deployed to highlight hidden agendas that could explain how and why new practices are accepted while others are discarded (Hajer, 2006). It appears imperative to consider how NbS practices and the discourses about their upscaling are able to influence existing relations and, in turn, how existing networks can be rearranged and by whom to allow NbS to be integrated into urban planning practices (Woroniecki *et al.*, 2020; Bulkeley *et al.*, 2022; Megyesi *et al.*, 2024).

3. Analysing discourse coalitions in the EU

As argued in Section 2, the discourse coalition concept is useful for integrating the proposed framework's three analytical lenses: discourses, practices, and relations. By definition, discourse coalitions capture a "group of actors that, in the context of an identifiable set of practices, shares the usage of a particular set of storylines over a particular period of time" (Hajer, 2006: 70). As argued previously, analysing NbS upscaling through these lenses requires consideration of the political implications of such coalitions to promote or hinder the upscaling of NbS experiments. Analysing discourse coalitions means understanding how built-environment professionals "develop and sustain a particular discourse, a particular way of talking and thinking about environmental politics" (Hajer, 1995: 13). In political science, the Advocacy Coalition Framework (ACF) is an established framework that centres its analysis on coalitions as "a lens to understand and explain belief and policy change when there is goal disagreement and technical disputes involving multiple actors from several levels of government, interests groups, research institutions, and the media" (Weible and Sabatier, 2007: 123). The ACF identifies coalitions based on policy beliefs, i.e. how the actors composing that coalition share inner and profound understanding of a policy phenomenon (Zafonte and Sabatier, 2004). Similarly, a relatively new methodology called discourse network analysis (DNA) has been developed to analyse policy debates (Leifeld and Haunss, 2012). DNA specifically operationalises the concept of discourse coalitions in discourse analysis using the analytical tools of social network analysis (SNA) to reconstruct how actors' networks debate a specific topic (Leifeld, 2017; Nagel and Bravo-Laguna, 2022).

While the ACF understands coalitions as definite groups seeking stability, DNA advocates for a conceptualisation of discourse coalitions that is more permeable to change, allowing members of a coalition to move to another through learning (Leifeld, 2013: 170). It could be argued that policy beliefs offer a solid but static vision of coalitions, whereas DNA constructs discourse coalitions based on the fluidity of the discourse, independently from the beliefs of each built-environment professional. Accordingly, coalitions can be formed by individuals that have profoundly divergent policy beliefs (e.g. right-wing vs left-wing parties) who can group to support the same policy objective. Another innovative aspect of this methodology is its ability to study and represent policy debates over time, thereby identifying key turning points and showing how the debates have evolved. The networks built through DNA consists of nodes and ties, as in SNA networks. However, in DNA each node can also represent a concept, an abstraction of an individual's argumentation coded from the text at hand. Ties represent patterns of agreement between nodes. DNA offers a wide range of network types to represent discourse coalitions. Through the affiliation network, it is possible to highlight how concepts and actors are related based on the degree of agreement among who utter these concepts. The congruence network represents the agreement level in accepting or rejecting a certain concept. Finally, the conflict network highlights the negative of the congruence network, emphasising conflicts (Nagel, 2016; Leifeld, 2017).

To avoid confusion between the term 'concept' as used in Section 2 (e.g. discourse coalition, NbS, etc.) and 'concept' in DNA terms as a node within the coalition network, I will refer to the latter as 'DNA concept' throughout the text.

3.1 The EU contribution in NbS upscaling: Urban Nature Plans

To analyse how urban future imaginaries based on biodiversity are envisioned and enacted through NbS upscaling, I contextualize my research within the European Union (EU).

The EU[2] has embraced NbS in its research and innovation programs since 2015 and has significantly enhanced their use within EU countries by allocating consistent resources for cities to conduct NbS experiments (Faivre *et al.*, 2017; Wild *et al.*, 2020; Davies *et al.*, 2021). The rapid uptake of the NbS concept in European policies and the notable presence of EU-funded projects dealing with such solutions can be attributed to the narrative that NbS can generate multiple benefits and be integrated into climate mitigation and adaptation actions (Nesshöver *et al.*, 2017; Mendes *et al.*, 2020). The report drafted by Harriet Bulkeley for the European Commission analyses the first five years of EU-funded projects and collects lessons learned on NbS. The report calls for more extensive research into the transformative power of NbS, especially concerning the significance of nature and the role of businesses, as well as potential negative impacts related to gentrification (Bulkeley, 2020). From this starting point, the EU is committed to becoming a leader in the practices and implementation of NbS experiments, thereby fostering biodiversity (El Harrak and Lemaitre, 2023). To achieve this, the EU defines an ecosystem approach, meaning the integration of biodiversity in all policy fields (EC, 2019a: 89–90). The European Green Deal demonstrates this 'environmental ambition' of the EU towards significantly transforming current unsustainable practices for a more efficient economy, where "protect, conserve and enhance the EU's natural capital" is a crucial step (EC, 2019b: 2).

The EU Biodiversity Strategy for 2030 builds upon the European Green Deal's environmental ambitions. The strategy outlines the future of biodiversity for the EU and emphasizes the need to systematically implement NbS as innovations by building a "business case for biodiversity," acknowledging Europe's economy dependence on biodiversity protection and restoration actions (EC, 2020: 2). The protection approach calls for the creation of a "coherent network of protected areas" covering 30% of European land by 2030 to halt unsustainable land use and prevent biodiversity loss (ibid.: 3). Conversely, the restoration approach proposes to increase the ecological value of existing biodiversity areas, thus improving their quality and allowing new habitats to develop with the objective to "maintain a connection between humans and nature" (ibid.: 12). In the urban environment, the strategy acknowledges the importance of green urban spaces for human physical and mental wellbeing through the restoration approach. To achieve this, the strategy recommends that cities with at least 20,000 inhabitants should develop 'ambitious' Urban Nature Plans (UNP)[3] and systematically integrate "healthy ecosystems, green infrastructure and **nature-based solutions**" (EC, 2020: 13; bold in the original). However, the strategy itself admits the relative weakness of such non-binding recommendations in achieving broader implementation of biodiversity protection and restoration. The recently developed Nature Restoration Law represents the culmination of the EU's attempt to enforce the integration of biodiversity into all policy fields, a *unicum* worldwide (European Parliament and European Council, 2024). However, since the Nature Restoration Law was accepted in June 2024, its implications could not be analysed within the framework of this dissertation.

The EU has commissioned a guidance to assist cities in preparing and implementing UNPs by elaborating a series of steps to perform when drafting such a plan (EUROCITIES and ICLEI Europe, 2021). This guidance describes a successful UNP, which should represent "a long-term strategy for the future development of the urban area" along with a precise set of objectives, a clear timeline, budget allocation, and indication of responsibilities among the relevant built-environment

[2] By EU, I mean the entirety of the three main organisations: the EC, EU Parliament, and EU Council.
[3] In the original text, these plans were referred to as Urban Greening Plans (UGP). Given the increasing importance of biodiversity in the EU, the scope of the UGP was broadened to UNP by the EU to encompass nature as a whole. The new name can be found at this link (https://environment.ec.europa.eu/topics/urban-environment/urban-nature-platform_en accessed: 24.03.2025).

professionals[4] (ibid.: 7). A report drafted for the German Environment Agency (UBA) specifically acknowledges the role of NbS in UNPs to overcome existing implementation barriers related to political, organisational, institutional, cognitive, and resource-related challenges (Wilk *et al.*, 2021). Until now, little scientific literature on UNPs in Europe exists. This literature takes an exploratory approach to analyse the compliance of existing urban greening plans with the guidance based on interviews and document analysis (Costadone and Vierikko, 2023) and to assess the quality of recently developed UNPs based on targets, governance, participation, financing, and monitoring criteria (Mahmoud *et al.*, 2025). The results of these investigations revealed fundamental knowledge gaps regarding biodiversity in the urban context, whereas cross-collaboration between different local public authority departments and the inclusion of further urban actors are still hindered by political conflicts of interest.

In the context of this dissertation, I interpret the call for the integration of NbS in urban planning practices, as formulated within the EU Biodiversity Strategy for 2030, as the EU's attempt to construct a future imaginary based on biodiversity through the upscaling of NbS. Based on this background, I present below the four publications that compose this dissertation.

3.2 The four publications

My first publication, chronologically ordered, is titled **Stakeholder Participation in the Planning and Design of Nature-Based Solutions. Insights from CLEVER Cities Project in Hamburg**. This paper focuses on the experimental EU-funded Horizon 2020 project CLEVER Cities[5]. As an innovation action (IA), the funding was intended for both research on experiments with NbS and their implementation. Within the project, a co-creation approach was deployed to foster large actor participation (Mahmoud and Morello, 2021). The project's aim was to co-create NbS in particularly disadvantaged communities to test the cost-efficiency of these solutions in socially and economically weak contexts. Additionally, other local actors were involved for further insights, allowing perspectives from a diverse range of stakeholders to be obtained. The paper specifically analysed the three experiments co-created in the Hamburg case study, highlighting challenges encountered during the co-creation process and the strategies used to overcome them. Within transition research, we conceptualized the different co-created NbS experiments: NbS are the tools through which new urban planning practices are intended to transform. For each of the three experiments, we analysed the roles of different actors and laypersons, and the coalitions they formed to deliver the results promised in the project proposal. The first experiment (CLEVER Corridor) consisted of a series of small interventions with a strategic vision at the neighbourhood level. The main built-environment professionals driving the development of the experiments (the champions) were part of the project team, led by the local public authority and the local urban development agency. A dedicated department was created within the local public authority to direct the interventions of the project locally. Through continuous engagement with laypersons and support from research institutions, the coalition successfully mobilised additional local and supralocal actors. The second experiment (Green Roof and Façade, and Rainwater Management) involved rather technical knowledge for the co-creation of NbS and considered a larger area beyond the project neighbourhood. Consequently, the coalition primarily consisted of experts from various fields, with relatively low layperson engagement. The final experiment (Green Schoolyards) focused on the use of NbS for educational purposes. In this instance, the role of research institutions and local schools was more prominent. Despite the very micro scale of the interventions, the co-creation process involved extensive engagement with

[4] "Citizens, academics, as well as representatives of civil society and economic actors" (p. 7)
[5] https://clevercities.eu/ (accessed: 22.03.2025).

different administrative levels (local public authority, the school administration of the local elementary school, and the Hamburg Ministry of Education).

The results indicated that NbS offered the opportunity to address various societal challenges simultaneously due to a co-creative approach that effectively engaged local and supralocal built-environment professionals at opportune moments. However, such a process is time- and cost-intensive, necessitating long-term cooperation structures for the proper implementation of NbS beyond the experimental phase. The term 'NbS' required translation into German to facilitate communication with laypersons. Nevertheless, it was observed that the 'NbS' label proved more useful in project reports for the EU than in discussions with local built-environment professionals and laypersons. Within the main coalition, the urban development agency played a particularly relevant role, as it was able to include and mediate with a wide range of local built-environment professionals and laypersons. We concluded that "the experimental approach and the co-creation principles that sustain the NbS development effort demand a restructuring of decision-making processes by learning from the aforementioned approaches and becoming common practice" (Arlati *et al.*, 2021: 16).

This initial publication granted me sufficient knowledge about the current EU rhetoric and the dynamics created through EU funding schemes at the local level. The next publications step outside the EU-funded project bubble and elaborate on criticalities, challenges, solutions, and opportunities for NbS upscaling in Europe.

My second publication Navigating urban futures: Exploring NbS upscaling discourses, practices, and relations in reimagining human-nature relationships, serves as the theoretical foundation for this dissertation. An analysis of 41 peer-reviewed papers addressing NbS upscaling in urban contexts revealed a plethora of concepts and synonyms for upscaling, each with slightly different nuances (Durrant *et al.*, 2018; Lam *et al.*, 2020). Most of these terms align with transition research, defining upscaling as the transmigration of innovation from the niche to the regime level (Ehnert, 2022; Geels, 2024). Despite the existence of numerous transition frameworks (namely MLP, TM, SNM, TIS, SES, SETS), the MLP remains the most commonly used conceptual framework for understanding upscaling (Geels, 2019). The analysis of the reviewed papers indicates that upscaling is surprisingly conceptualized not as a process but as a mechanism through which regimes automatically adopt innovations (Sengers *et al.*, 2021; Adams *et al.*, 2023). Furthermore, this conceptualization does not offer a convincing framework for nature-based innovations. The paper further elaborates on the even more ambiguous and complex concept of NbS. As a recent addition to the urban planner's toolkit, NbS represent an appealing type of solution aimed at addressing a wide range of issues, from economic and social to environmental.

Departing from critiques of understanding NbS upscaling as an innovation within transition research, I adopted a governance approach to frame NbS upscaling as a means to enact socio-natural imaginaries, interconnecting discourses, practices, and relations. The concept of discourse coalitions offers an interpretation of the linkages among these three dimensions. Discourses symbolize how urban actors 'communicate the right imaginary'; practices refer to upscaling as the 'new routinisation of imaginaries'; and relations consider the networks capable of 'promoting or hindering such imaginaries'. I concluded that supporting socio-natural imaginaries through NbS upscaling should involve "less the invention of new technology and more the rediscovery of traditional solutions [to reconnect] with the past and opening up to a set of possible future pathways" (Arlati, 2024b: 11).

In my third publication, Mapping conflicts of prioritization: National parliamentary discourses on urban greening and biodiversity implementation in Germany and Italy, I investigated how the urge

for NbS upscaling in the EU documents presented in Sub-section 3.1 influences discourses, practices, and relations in the Member States. As a government of governments, the decisions taken at the EU level can affect how actors, bodies, and institutions share responsibilities for action across different levels of governance (Betsill and Bulkeley, 2006; Scharpf, 2009). This structure is considered highly unstable and generates varying responses among the EU Member States (Auel and Raunio, 2014; Hooghe and Marks, 2018). Accordingly, I adopted a comparative case study approach to investigate these differences in Germany and Italy, following a 'most similar systems design approach' (Bozonelos *et al.*, 2022). These two countries have comparable governance and planning structures regarding environmental issues (ESPON, 2018) while representing the spectrum of the North-South politico-economic divide in Europe (Piattoni and Notermans, 2021). As national parliaments are the appointed institutions to translate EU decisions into national laws (Scharpf, 2009), I deployed DNA of national parliaments verbatim from 2013 to 2023, including the period before and after the EU Biodiversity Strategy for 2030, to observe the evolution of the debates about NbS upscaling.

The results indicated that NbS are not significantly present in these debates. Conversely, there is a general agreement on the importance of promoting biodiversity interventions in urban areas, regardless of political orientation. However, parliamentarians utilize various strategies to postpone decisions (Lamb *et al.*, 2020), often by prioritizing more tangible issues such as mobility.

To spotlight these strategies, I identified five latent conflicts of urban biodiversity to highlight the apparent absence of any conflictual situation concerning urban biodiversity. The *Whose fault is it?* latent conflict describes the tendency of parliamentarians to point to other (usually external to the debate) political actors as the cause of problems. In particular, the EU is the most frequently accused, as parliamentarians do not view EU influences in domestic affairs positively. *For human or for nature?* describes the divergence of opinions regarding the objective of urban biodiversity interventions, namely for human benefit or for nature. Interestingly, I observed that mainly moderate right-wing parties, in the majority, introduce the topic of urban biodiversity in the debate, while left-wing parties tend to agree and integrate it with other elements. *You said Z, but what about X and Y?* refers to the tendency of some parliamentarians to respond to others' statements by introducing new (and often unrelated) issues, destabilizing the discussion towards a non-decision. *Is your future better than mine?* reflects the different imaginaries of urban biodiversity that parliamentarians communicate to others. While everyone agreed on the importance of urban biodiversity, other imaginaries of cities (e.g. smart city or compact city) prevailed because the elements related to these other imaginaries were easier to communicate and closer to a rhetoric of innovation. Finally, the *Immediate action or step-by-step?* latent conflict includes arguments that refer to the urgency of action needed to address current challenges. Usually, coalitions in favour of such arguments were in the opposition, urging the majority for prompt action. With my conceptualization of these strategies as latent conflicts of prioritization, which highlight how urban greening and biodiversity are "intertwined with questions of land use, responsibility, materiality, and ideology", I concluded that, in both Germany and Italy, "the vagueness of the arguments on which actors agree even risks worsening any attempt to implement urban biodiversity due to particular contextual situations and the complexity of the concepts used" (Arlati, 2024a: 122).

The fourth and last publication, Understanding, communicating, and imagining urban biodiversity in German and Italian cities, presents the analysis of four case-study cities conducted by myself and the political scientist Melanie Nagel regarding the current state of NbS upscaling at the local level in Germany and Italy. The selection followed recent works on case-study research that have examined how European cities are addressing climate change (Salvia *et al.*, 2023). By screening the databases of international networks of cities for biodiversity and those that participated in EU biodiversity-related projects, we selected a sample of one small and one large city in Germany (Heidelberg and

Hannover) and in Italy (Cesena and Firenze). This selection employed a maximum variation cases approach (Flyvbjerg, 2011). Drawing inspiration from urban climate imaginaries (Westman and Castán Broto, 2020), we conceptualised the urge to transform urban futures through NbS upscaling as urban biodiversity-based imaginaries: "collective discourses about desirable futures based on urban biodiversity debated among coalitions of urban actors in the present, informed by past experiences, and that materialise in future-oriented policy documents" (Arlati and Nagel, 2025). Based on this definition, we argued that it is essential to analyse how built-environment professionals and laypersons understand, communicate, and imagine urban biodiversity to grasp how such imaginaries are constructed and how they influence local actions. We primarily deployed DNA of local newspaper articles from 2019 to 2024, covering the period from the European Green Deal draft to the enactment of the Nature Restoration Law. Subsequently, we incorporated the results from DNA with additional interviews to address potential gaps from the data collected from the newspaper articles; additionally, we conducted site visits in each of the four cities to verify the transformations described in the newspaper articles.

As with the third publication, NbS never appeared in the results. Conversely, built-environment professionals referred generically to nature or greening when discussing biodiversity in the urban context among themselves and with laypersons. Consequently, built-environment professionals and laypersons *understand* urban biodiversity in different ways, making it difficult to agree on a specific solution. Furthermore, the interviews revealed a gap in the relationship between different governance levels. Specifically, the German cases considered decisions at the national and regional levels positively, whereas in Italy, these levels were unable to provide a significant impact on local urban planning. The built-environment professionals considered in the analysis deployed different ways to *communicate* urban biodiversity to the public. Generally, there were considerable differences between the German and Italian cases. In Germany, the DNA concepts were more substance-related (e.g. 'urban greening for biodiversity'), while in Italy there was a higher frequency of process-related DNA concepts (e.g. 'participation'). Finally, different *imaginaries* of urban biodiversity translated into different forms of UNP. These forms ranged from political programmes (Firenze) to strategies (Heidelberg and Cesena) and plans (Hannover). The content of each plan followed the EU guidance for drafting a UNP rather differently. The most significant challenges were identified in the collection of data to obtain a picture of the status quo. Considered fundamental by the interviewees for implementing actions, drafting the UNP was retained as a highly complex and resource-consuming task. We concluded that, for a more holistic integration of biodiversity into urban planning, built-environment professionals and laypersons "should rather formulate *reimaginaries* where past, present, and future dialogue, thus avoiding the engagement with new branded concepts and addressing more fundamental cultural gaps " (Arlati and Nagel, 2025).

The results obtained in these four publications are discussed in the following section according to the three analytical dimensions of discourses, practices, and relations. Figure 1 provides an overview of the results.

	DISCOURSES	PRACTICES	RELATIONS
Definition	"[E]nsemble of ideas, concepts and categories through which meaning is given to social and physical phenomena" (Hajer and Versteeg, 2005: 175)	"[M]eaning-making, identity-forming, and order-producing activities [which form] complex nets with dense patterns and mutual references" (Nicolini, 2011: 602-603)	Types of interaction (direct or indirect) between at least two nodes (Obstfeld et al., 2014)
Key concept	Frame "The precise way in which influence over a human consciousness is exerted by the transfer (or communication) of information from a location [...] to that consciousness" (Entman, 1993: 51-52)	Site Geographically and temporally discrete location in relation to other events and phenomena and in relational sense as part of something (Nicolini, 2011: 604)	Tertius "[B]ehavior by which an actor influences, manages, or facilitates interactions between other actors" (Obstfeld et al., 2014: 141)
Operationalisation of the key concept	Selecting Problems, causes, judgments, and remedies related the issue at stake (Entman, 1993: 52) Priming "[M]aking a piece of information [to become] more noticeable, meaningful, or memorable to audiences" (Entman, 2007: 164)	Knowing "Actions, reactions, and interactions are the background in relation to which all of what we do makes sense" (Nicolini, 2011: 604; Pyrko et al. 2017) Organising The knowledge about a certain process allows to organise the practice to enact that process (Nicolini, 2011)	Tertius gaudens The third who enjoys is an actor that seeks profit from connecting (or dividing) other actors Tertius iungens The third who connects reflects the willingness to ease coordination and collaboration among actors Conduit Passing of information between to nodes (or networks) without attempting to modify existing relations (Obstfeld et al. 2014; Obstfeld, 2017)
Interpretation	Urgent and innovative To valorise innovations over non-innovative solutions, using urgency as justification Biodiversity for salvation To view biodiversity as a saviour for its potential to address climate change-related disasters, narrative of humanity dependency on nature Biodiversity as ornamentation To favour biodiversity-based solutions featuring a curated and aesthetically pleasing type of biodiversity	Experiment Learning by doing transcending geographical and temporal boundaries, joint effort focuses on planning for what comes after Literature Advancing research on urban biodiversity that engages with grey literature in a continuous dialogue National parliaments Highly organised sites that can significantly influence both local practices and European decisions UNP Merging of different types of knowledge and necessitates collaboration among built environment professionals	Legitimacy To spread information (usually scientific) about biodiversity in the network Influence To make other built environment professionals and laypersons change their framing actively Agency Sharing responsibilities to motivate and guide local built environment professionals and laypersons to action

Figure 1 - Analytical dimensions, definitions, and interpretations (Author, 2025).

4. When the snow does not stick: Is the NbS upscaling urge really strong?

In this section, I discuss how the urge for NbS upscaling – which I understand as the integration of biodiversity into urban planning – is influencing how built-environment professionals envision the future of cities based on biodiversity. Because NbS heavily relies on the inclusion of different urban actors, who should not be considered a monolithic group but rather a collection of distinct individuals with varying preferences and expertise, I suggest using the concept of "built-environment professionals" to encompass also those actors that are not directly involved in the practical implementation within the city (e.g. planners and architects). This includes individuals or groups linked to the construction of the city of the future in various capacities, such as NGOs, media, and academics (cf. Grubbauer *et al.*, 2024a; González-Arellano and Gandlgruber, 2025). I consider this clarification fundamental, acknowledging that the implementation of urban biodiversity necessitates the negotiation of perspectives from a broad spectrum of urban actors to ascertain which types of solutions are permissible, by whom, and for what purposes (Bulkeley *et al.*, 2022; Tozer *et al.*, 2022b; Li *et al.*, 2025). This analytical approach has yielded a series of unexpected findings that might otherwise have remained unrecognized. Most notably, despite the proliferation of scientific articles and grey literature advocating for NbS and their upscaling as strategies to address climate change and biodiversity loss in urban contexts, the empirical data derived from the case studies analysed do not explicitly reflect the discursive utilization of NbS. The subsequent pages will explore the reasons underlying this discrepancy through a discussion of discourses, practices, and relations, with the objective of comprehending how urban futures centred on biodiversity are shaped by NbS and the necessity to upscale these solutions.

4.1 Discourses: innovation, salvation, and ornamentation

Although NbS and their upscaling are not explicitly debated at the national and local levels, built-environment professionals are increasingly discussing how to integrate biodiversity into urban planning by referring to concepts such as urban greening or urban nature. These actors contribute diverse arguments to the discourse, organized into frames. A frame allows for *selecting* a problems, causes, judgments, and remedies, and for *priming* a piece of information to make it more visible (Entman, 2007; Dewulf *et al.*, 2011). Thus, frames can be used to investigate why and how new concepts enter (or fail to enter) the discourse. I identified three distinct frames through which urban future imaginaries based on biodiversity can be discussed: urgent and innovative, biodiversity for salvation, and biodiversity as ornamentation.

The urgent and innovative frame identifies built-environment professionals discussing the urgencies posed by current climate change and biodiversity loss challenges and the consequent need for a quick response. Discourses developed within this frame understand NbS as an innovative approach to urban biodiversity, aiming to fundamentally change current unsustainable urban planning practices by *selecting* innovative solutions over more traditional ones. The selection of innovations is deemed more favourable due to the necessity to demonstrate rapid change in a situation of urgency. Political scientists have conceptualized the pressure for urgent actions as politics of urgency, describing the dynamics by which cities are asked to act quickly in the name of solutionism (Pfotenhauer *et al.*, 2022; Haarstad *et al.*, 2023). The CLEVER Cities experience analysed in the first publication was nested within the EU's urge to test innovative NbS. The contractual agreement between project partners and the EU placed pressure on delivering successful results against given deadlines, leading to some straightforward decisions that meant abandoning alternative solutions unable to demonstrate sufficient innovative potential. Similarly, discourses on urgency and innovation permeate the parliamentary debates analysed in the third publication. Deployed as

justification for specific decisions, with the conceptualization of the *Immediate action or step-by-step?* latent conflict, I have shown main differences in the actions proposed by the discourse coalitions. The governing coalitions, confident in their leading position, have been observed to tend towards favouring a 'step-by-step' approach, carefully measuring their actions to avoid mistakes and calling for caution. In contrast, the opposition urges immediate action and tends to expose the lacunae in the government's performance, attempting to destabilize the majority coalitions. Concerning urban biodiversity specifically, discourse coalitions composed of right-wing parties have been observed to introduce the discussion on greening solutions first. The discourse coalition of left-leaning parties responded by affirming the need for more urban biodiversity projects and accusing the opposing coalition of hindering progress through inaction. As highlighted in the fourth publication, time is primarily a valuable resource for cities to demonstrate their capacity to respond to current challenges linked to biodiversity loss in cities. While various policy documents at the local level do not emphasize the urgency of action but frame the current situation as difficult and uncertain, interviews revealed the necessity to demonstrate changes within the political mandate of public administration. In such a context, cities struggle to keep pace with the urgency of change and are overwhelmed by the uncertainty of the future (Heidelberg). Especially in the last 12 months of the analysed period, DNA networks have shown the discourse evolving towards an emphasis on implementing new measures as a response to the urgency of current challenges, particularly in the Italian cases (Firenze, Cesena).

The biodiversity for salvation frame portrays NbS as the tool through which to integrate biodiversity into urban planning as a solution to current disasters and crises. Discourses uttered following this frame attribute to urban biodiversity a special, mystified role of saviour, whereby the future of humankind is highly dependent on nature. Accordingly, urban development is the problem and fostering urban biodiversity is the remedy. Built-environment professionals using this frame feel justified for their actions if they consider biodiversity when advertising and defending their positions, characterised by a 'green is good' understanding and considering non-natural solutions less sustainable (Angelo, 2021). In the third publication, the *Is your future better than mine?* latent conflict describes the frictions between discourse coalitions supporting diverse types of future imaginaries. The results show that there is no real conflict between different imaginaries as long as they are based on biodiversity. This general agreement about the goodness of biodiversity, I argue, halts any relevant discussion on the issue at its start and does not allow for further investigation, usually resulting in a change of topic. However, this frame is often challenged by the discourse coalition composed of extremists from right-wing parties (but not exclusively), who depict this framing as overly negative, threatening, and alarmist. The reason for polarization here seems to lie within the ways of communicating such futures rather than the futures themselves. Concerning the local level investigated in the fourth publication, the debate about urban biodiversity intensifies at specific points during the analysed period, notably in relation to the COVID pandemic and natural disasters. In these cases, this frame is used to justify that natural elements are optimal solutions to climate change issues. The multi-dimensionality of urban biodiversity is underscored by the frequency of DNA concepts related to climate change, health, and security issues (Heidelberg and Cesena). However, when it comes to factual implementation, the biodiversity for salvation frame loses its momentum. Analysing the projects of urban biodiversity implemented in the four cities, a correlation was observed between contested projects and a greater presence of urban biodiversity-related DNA concepts, as the problems with raccoons in Heidelberg or the tree-cutting actions in some streets in Firenze suggest.

Finally, biodiversity as ornamentation refers to a novel consideration of the urban as a possible habitat for biodiversity. Based on the concept of 'urbanised nature', Angelo (2021), understands it as "ideas about nature that have been transformed by urbanization", reflecting those discourses that

promote biodiversity in the city as conforming to aesthetic standards in contrast to the 'wild and evil' biodiversity outside the city (ibid.: 24). Thus, when selecting solutions, built-environment professionals prefer a more curated form of intervention that might not sufficiently consider the quantity and quality of biological diversity as required by the definition of biodiversity according to urban biodiversity research (see for instance Nilon and Aronson, 2023). Analysing the dynamic evolution of the debate in the third publication, resistance was noted, particularly in Italy, prior to the drafting of the EU Biodiversity Strategy for 2030. During this time, biodiversity topics were frequently overshadowed by more technological solutions. The *You said Z, but what about X and Y?* latent conflict symbolizes such resistance from the discourse coalition organized around opposition parties by introducing new and unrelated topics to divert attention from the issue at hand, de facto contributing to delaying action. In Germany, sensitivity towards biodiversity in the city entered the debate earlier, as per the white paper "Green in the city" (BMUB, 2018). The latent conflict *For human or for nature?* identified in the parliamentary debates analysed exemplifies this frame, showing the presence of concepts alternating between urban biodiversity interventions for human benefit or for nature. In general, all the latent conflicts identified in the third publication demonstrate how governing coalitions can exploit contentious situations by integrating new perspectives, expanding their existing framings, and minimizing opposition. In my fourth publication, I showed how the local-level debates reflect an understanding of urban biodiversity that primarily embodies an idea of curated and aesthetically appealing nature, while untouched nature belongs to external areas in large parks designated as nature experience areas. However, an increasing number of newspaper articles relate to specific insects, animals, or plants and their behaviours concerning the urban environment, including a broader spectrum of urban actors. This demonstrates a willingness to extend the debate beyond the 'usual suspects' (Frantzeskaki, 2019) and explore new ways of communicating these features, as exemplified by the prominent DNA concept related to native plants and animals in Hannover and Cesena.

4.2 Practices: sites of knowing and organising

Extending the analysis from the discourses dimension, urban planning practices that deploy biodiversity can also be examined to understand the influences of the EU Biodiversity Strategy for 2030 on Member States. The concept of 'site' has proven useful in identifying such practices. A site describes a geographically and temporally discrete location that spotlights the practice under analysis in relation to other events and phenomena (Nicolini, 2011). Practices can be studied through the acts of knowing and organising, during which knowledge is generated (Nicolini and Monteiro, 2016). In this dissertation, I identify four sites where imaginaries are discursively built through knowing and organising: **experiment**, academic and grey **literature**, **national parliaments**, and the **UNP**.

The **experiment** as a site, analysed in the first publication, defines the initial stage for the development of NbS. As an EU-funded activity, the entire experimental process established clear geographical and temporal boundaries for the practice. This experiment was organised according to a co-creation guidance developed specifically for the project: the steps of co-planning, co-design, co-implementation, and co-monitoring were planned from the outset for each intervention by the project team (Mahmoud and Morello, 2021). While the experimental nature of the solutions tested within the experiment was clear to the project team, this was not communicated to external participants, as referring to these solutions as 'only an experiment' would have diminished local interest in participation (see Subsection 4.3). It is important to note that the literature on NbS was not well developed at the time the experiment was conducted, thus the experiment was seen as a knowledge generator. The most interesting finding in this context was that NbS primarily served as a way to communicate project activities to the EU rather than to the participants. Current greening

practices did not need to be relabelled but were 'updated' to incorporate the co-creative aspect introduced by the project structure. The connection with routines appears crucial: the local public authority had to navigate internal bureaucracies to bypass the routinised practices of approval and permission, requiring considerable time and effort. Most limitations arose when unresolved regulations reduced built-environment professionals' scope for action. In this case, the experimental label facilitated some solutions, sparking innovative approaches to routinised practices but remained largely confined within the project. The push for upscaling within the EU intensified as the project was already underway. The mechanistic understanding of NbS upscaling, alongside the 'project' character of CLEVER Cities, discouraged broader reflections about the post-project period. However, built-environment professionals and laypersons sought to establish partnerships for the management and care of the interventions and distribute responsibilities.

Understanding literature (scientific and grey) as a site concerning NbS upscaling is useful here. While the results in the third and fourth publications reveal that little attention is paid to NbS and upscaling, these topics are extensively discussed in literature both worldwide (Section 2) and specifically within the EU (Section 3), in a continuous exchange between scientific work and policy documents. NbS before and NbS upscaling after having received significant attention in the last 10 years in response to increasingly extreme and frequent natural disasters, for which solutions are urgently needed (Section 4.1). While some researchers offer relevant critiques, a correct application of NbS and their upscaling is advocated to revolutionise urban planning for biodiversity in light of sustainability (Frantzeskaki *et al.*, 2022). Due to uncertainty about the future, the literature supports the production of knowledge and solutions from various built-environment professionals. However, the call for broad participation increases the ambiguity between rhetoric and academic work. Academic and grey literature discussing NbS and their upscaling has significant implications for national and local policy documents. An analysis of these documents revealed the presence of the same sources cited as part of the problem and solution framing, with concepts of NbS and upscaling (or their synonyms) repeated to gain credibility.

In the third contribution, my analysis focused on a particular type of site: the national parliaments. These places are characterised by clear geographical and temporal boundaries. Parliaments represent an institutional setting where the acts of knowing and organising acquire a certain degree of solemnity. As representatives of the government working publicly, parliamentary debates follow definite procedures, where speakers must carefully consider what they say and how within the allocated time. As a peculiarity, these procedures remain confined to the place and time of the parliaments. This understanding of parliaments as temporally defined associates this site with the notion of an event as an isolated situation, which is analytically distinct from the practice (Nicolini, 2009: 1405). Nonetheless, each parliamentary session builds logically on previous sessions dominated by the same highly procedural set of practices. It is this continuity that facilitates the generation of knowledge through exchanges between governing coalitions and oppositions. This knowledge does not aim to change the statutory rituals of parliamentary debates but influences practices at other governance levels. In fact, the analysis of policy documents at national and local levels shows the effects of decisions made in parliaments, especially when these decisions are translated into laws. Additionally, non-decisions by parliamentarians also have influences. The latent conflicts identified highlight tensions between the urgency for action and its delays. These conflicts often reflect delays in actions related to urban biodiversity, resulting from prioritisation in policymaking. I argue that urban biodiversity practices are too localised to be thoroughly understood and meaningfully discussed at the national level. Perhaps, due to the non-decisions at the national level, the debates at the local level largely concern cross-collaboration practices in addressing multi-dimensional challenges, where urban biodiversity through NbS can serve as a solution.

Finally, the UNP can be regarded as a site where new practices can emerge. The UNP is defined as a holistic strategy that integrates biodiversity into urban planning practices to counter the effects of climate change and reverse the trend of biodiversity loss, starting from the urban context. Thus, addressing biodiversity has become an urban matter. Two main coalitions are identified: the local public authority, with the support of specialists, and the oppositions and laypersons who demand focus on other issues. The analysis of local UNPs and interviews revealed the complexity of drafting such plans: the draft of a UNP implies integrating a wider set of existing strategies, regulations, and plans, and merging knowledge and concepts from diverse disciplines such as planning, policy, sociology, medicine, and biology. In many cases, the UNP is defined as a plan for open spaces, including elements beyond biodiversity. Thus, the UNP presents an opportunity for these cities to connect and reimagine existing plans and strategies into new forms of urban planning through biodiversity. The draft of the UNP is expected to follow a methodical approach (Nicolini, 2009), represented by the guidance promoted by the EU (EUROCITIES and ICLEI Europe, 2021). The analysed UNPs bear traces of the suggested stepping-stones but display a wide variety of responses. Heidelberg and Cesena's UNPs take the form of a strategy. At the time of analysis, Firenze had a political programme, a list of good practices to implement. Hannover was the only case with a formal plan. In most cases, the status quo analysis and the definition of a future vision are presented with varying depth, while there is a significant difference in translating the vision into actionable objectives and in the periods considered. Notably, none of the analysed UNPs refer to NbS and their upscaling, while the overarching policy documents, to which these UNPs refer, do. Differences also exist regarding the relationship with policy documents at other governance levels. The two Italian cases are not strongly influenced by the regional level, as this is not maintained to contribute significantly to the issue. Interviews revealed that local public authorities tend to select opportunities that are easier to access for funding. Cesena, a city well-connected to international city networks, demonstrated the necessity to seek additional projects and funding to proceed with their actions in signing the Green City Accord. Instead, the regional and national levels are deemed more supportive in Germany, as confirmed by the biodiversity law in Baden-Württemberg. Interestingly, I observed a correlation between contested projects and a higher presence of urban biodiversity-related DNA concepts, suggesting the influence of urban biodiversity on politics when it intersects with everyday life.

4.3 Relations: knowledge, opinions, responsibilities

Focusing on relations involves analysing the interactions between different actors. This dimension was fundamental to identifying those actors who can be defined as built-environment professionals in the field of urban biodiversity. The 'tertius' plays a unique role in the innovation process by exercising its capacity to create, hinder, or eliminate relations (Obstfeld, 2017). A 'tertius' can either fill a void between networks (structural hole, Burt, 2004) or act from within a network (structural fold, Vedres and Stark, 2010). The tertius can have three orientations: the *tertius gaudens,* the *tertius iungens*, and the *conduit* (Obstfeld *et al.*, 2014: 147). The results from the publications show that built-environment professionals generally agree on an imaginary based on the importance of biodiversity integration in urban planning. This translates at a first glance into the presence of one large discourse coalition. Thus, some of the 'tertius' identified in this research undertake a somewhat counterintuitive action within the network, stimulating existing networks with new flows of information that may split this large discourse coalition into more discourse coalitions. In this dissertation, I have identified three relations of biodiversity: legitimacy, influence, and agency.

Given the complexity of urban biodiversity, the relation legitimacy addresses the ability of a specific actor to function as a reference point in enhancing the understanding of how urban biodiversity functions. Built-environment professionals, including scientists, academics, botanists, and even

doctors, are new entrants in this field, contributing new scientific information and evidence. The complexity of dealing with urban biodiversity has contributed to creating space for these actors to become relevant in urban planning decisions beyond urban planners and architects. Given the high diversity of built-environment professionals in the coalition, this type of relation has the responsibility to explain complex concepts in an accessible manner and facilitate their sharing. Thus, it plays a fundamental role in building or reinforcing relations between nodes that, although part of the same coalitions, were not directly linked (structural fold). The built-environment professional belonging to academia and business in Firenze was selected by the local public authority to drive the development of the UNP. This strategic choice aimed to connect various built-environment professionals from different disciplines in a collaborative effort, recalling the tertius iungens orientation. Similarly, the sharing of information can yield the opposite result, creating fractures within an already stable group by introducing different perspectives. While confrontation can enhance discussion, the analysis in the fourth publication reports two cases of citizens' protests aligning with far-right orientations due to the acquisition of new information in Cesena and Firenze. Starting with a small group, these protests gained supporters and expanded (*tertius gaudens*). They received extensive media coverage due to their somewhat violent reactions, particularly in Firenze.

The **influence** relations type examines how built-environment professionals share their ideas to persuade others to join their cause. In the empirical cases analysed in my third publication, politicians have been found to embody this relation type. While the politicians in the majority group typically navigate different domains in their speeches, the opposition often has limited time to react, focusing on countering the majority's perspective with counterarguments. Interestingly, results show that right-wing parties are responsible for introducing biodiversity-related concepts into the debate. Conversely, left-wing opposition politicians act as *tertius gaudens*, spotlighting related arguments while primarily diverging on housing, equity, and justice issues. Right-wing opposition, however, tends to employ more abrupt tactics, including personal attacks or forcing a sudden change in discourse direction. In this context, this relation type refers to a *tertius gaudens* filling a structural hole as an outsider to the large discourse coalition. The analysis in the fourth publication reveals additional built-environment professionals belonging to this relation type. The NGO in Heidelberg, part of the discourse coalition supporting urban biodiversity, serves as an information conduit between the environmental department and others within the local public authority. However, the analysis shows that relations mediated by this built-environment professional often involve the environmental department too late in discussions to significantly integrate urban biodiversity. The media plays a particular role by highlighting specific events over others. By favouring more sensational and divisive events, the media tends to increase the visibility of conflictual situations.

Finally, the **agency** type refers to specific relations aimed at enhancing awareness to create responsible and proactive built-environment professionals. With this type, I refer to engaging people in addition to merely sharing information and knowledge. The local urban development agency in the first publication exemplifies this relation type by leveraging its past experiences with local built-environment professionals and laypersons (*tertius gaudens*). By engaging these actors, the local urban development agency ensured prompt collaboration from the right individuals or groups, which was also useful for organising future maintenance after the project's completion. The analysis in the fourth publication identifies the Citizens' Council for the Environment (CpA), appointed by the local authority in Cesena, as fulfilling this relation type. The CpA was created to mobilise built-environment professionals and laypersons on a voluntary basis to engage in local public authority decisions on environmental matters (*tertius iungens*). Initially a well-established group, internal dynamics within the CpA and a general disinterest from the local public authority in considering the CpA's suggestions have hindered genuine responsibility for integrating urban biodiversity. An additional built-

environment professional is represented by the insect alliance in Hannover, a loose network of various individuals or groups. Thanks to its commitment, the insect alliance manages the network's communication activities for better biodiversity integration. By employing a unified communication strategy, the insect alliance is readily identifiable as a cohesive group, activating responsibilities among a broad range of connected built-environment professionals (*conduit*).

5. Re-imagining the future of urban biodiversity

In this dissertation, I investigated the process of upscaling nature-based solutions (NbS) in the European Union (EU) context as a means to integrate biodiversity into urban planning (EC, 2020). The EU has assumed a leading role, globally in both the research and implementation of NbS (Davies *et al.*, 2021; El Harrak and Lemaitre, 2023), making it a suitable case for this dissertation. Upscaling solutions has become imperative in times dominated by the climate crisis and uncertainty about the future to urgently foster broader institutional change for future urban transformation (Evans *et al.*, 2016; Castán Broto and Bulkeley, 2018; Ehnert, 2022). Transition research conceptualises upscaling as the adoption of innovations into current practices (Durrant *et al.*, 2018; Lam *et al.*, 2020). The Multi-Level Perspective (MLP) is a conceptual framework that stands out in transition research to outline the expected relationship between the niche, regime, and landscape levels in upscaling (Geels, 2004, 2024).

Drawing on the literature review, I identified a series of conceptual and operational criticisms concerning NbS upscaling. Concerning the first type of criticisms, both NbS and upscaling concepts are described in the urban planning literature as ambiguous. The NbS definition as provided by the United Nation is considered to be non-specific, making it difficult to delineate a boundary between what constitutes an NbS and what does not (O'Sullivan *et al.*, 2020; Seddon *et al.*, 2020; Pineda-Pinto *et al.*, 2022; Lemes de Oliveira, 2025). Upscaling is often referred to in transition literature as a mechanism expected to occur automatically once the solution has matured enough to leave the experimental phase, thus downplaying the importance of examining what happens after upscaling (Sengers *et al.*, 2021; Pfotenhauer *et al.*, 2022; Bulkeley, 2023). Operationally, both NbS and upscaling have been criticized for their solutionism. A solutionist understanding of NbS and upscaling implies that alternative solutions which are not labelled as NbS and cannot be upscaled risk being automatically disregarded (Castán Broto and Bulkeley, 2018; Pfotenhauer *et al.*, 2022; Li *et al.*, 2025). From this perspective, failures do not count as sources of learning (Karvonen and Bylund, 2023). Finally, the conceptualization of NbS upscaling by transition research fails to consider the high politicization typical of environmental issues, whereby built-environment professionals disagree on which types of nature are permitted, by whom, and for what purposes (Bulkeley *et al.*, 2022; Tozer *et al.*, 2022b). Thus, in this dissertation I attempted to answer the following research question: *How does the upscaling of nature-based solutions shape visions of urban futures to enhance biodiversity in European cities?*

To answer this research question, this dissertation advances the understanding of NbS upscaling as a collective process to define, stabilize, and enact a specific urban future imaginary based on biodiversity. The concept of social imaginary (Jasanoff, 2015; Angelo, 2021) highlights the tensions between built-environment professionals when debating possible urban futures. Each imaginary supports specific ideas about what the problem is and what the right solution should be. Thus, the notion of imaginary is regarded as a powerful instrument that urban stakeholders can deploy performatively, thereby shaping actions and inactions. I define these actors more broadly as built-environment professionals (Grubbauer *et al.*, 2024a). I propose an analytical framework composed of three distinct yet interrelated analytical lenses: discourses, practices, and relations. In discourse analysis, a discourse identifies an "ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena" (Hajer and Versteeg, 2005: 175). This ensemble is organised in a 'frame', a set of stable principles that assists individuals within that frame in *selecting* the problem, the justification, and the remedy, while *priming* specific pieces of information over others (Entman, 2007). In practice theory, practices are "meaning-making, identity-forming, and order-producing activities [which form] complex nets with dense patterns and mutual references" (Nicolini, 2011). The concept of 'site' allows for the geographical and temporal identification of a

practice within its broader context and relates it to other practices through acts of *knowing* and *organising* (Nicolini, 2011). In social network analysis, relations consider the types of interaction (direct or indirect) between at least two nodes and how networks are formed (Obstfeld *et al.*, 2014). The 'tertius' identifies the "behavior by which an actor influences, manages, or facilitates interactions between other actors", whereby three orientations of *tertius gaudens*, *tertius iungens*, and *conduit* are identified (Obstfeld *et al.*, 2014: 141). Because my interest lies primarily on investigating how diverse built-environment professionals debate the topics of NbS and urban biodiversity, I take a discursive stance in the analysis of the three dimensions of discourses, practices, and relations. Consequently, the concept of discourse coalition, defined as a "group of actors that, in the context of an identifiable set of practices, share the usage of a particular set of storylines over a particular period of time" (Hajer, 2006: 70), offers the possibility to analyse the interconnections between discourses, practices, and relations discursively.

My dissertation investigated the process of upscaling NbS within the European Union context, focusing on their integration into urban planning. This research was advanced through four independent but interconnected publications that examined NbS upscaling from three distinct perspectives. The first publication draws insights from an EU-funded project, serving as a case study heavily influenced by the EU. The second publication critically analyses the existing literature to establish a robust analytical framework for the dissertation's work. The remaining two publications empirically investigate debates at the national and local levels through case studies, employing discourse network analysis (DNA). A relatively recent methodology in political science, DNA operationalizes the concept of discourse coalitions, enabling the study of diverse debates over time and revealing the evolution of concepts articulated by actors and the networks they form (Leifeld, 2017; Nagel and Satoh, 2019). This made DNA particularly suitable for addressing the dissertation's central research question regarding how NbS upscaling shapes visions of urban futures to enhance biodiversity in European cities.

The application of DNA is not commonly observed within the urban planning discipline; in turn, it is prudent to reflect upon the utilization of this methodology for its further application in this field. Firstly, the DNA methodology necessitates the compilation of a codebook, which comprises a list of concepts with their respective descriptions. The compilation of the codebook requires frequent revisions during the analysis. Codebook preparation and revision present challenges when multiple coders are involved, as exemplified in the fourth publication of this dissertation. In such scenarios, consistent dialogue is essential for ensuring uniform code definition and interpretation. Nevertheless, this initial, albeit demanding, effort is vital for more efficient and precise coding, ultimately facilitating subsequent tasks. Secondly, the selection of source types from which to draw information is a relevant part of the process, specifically parliamentary protocols and newspaper articles in the case of this dissertation. The former comprises longer texts from spokespersons, incorporating both prepared speech elements and frequent improvisation and emotional expression. The latter consists of written texts typically not exceeding 1,000 words. Notably, these are smaller spaces in which to convey messages to considerably different audiences, employing varied styles and rules. Despite these differences, both can significantly influence the decisions and actions of built-environment professionals and laypersons. Parliamentary debates function as the primary communication channel for the government, as well as a control mechanism enhancing the transparency of government work. Newspapers primarily serve a control function while aiming to reach a broader public. Finally, I assert that DNA alone is insufficient. Even though the methodology leverages all quantitative tools from SNA, structuring the analysis solely around DNA in the context of urban biodiversity would inevitably result in a loss of critical information, particularly given the absence of visible coalitions or polarizations. This observation is evident in the third publication,

wherein the framework established by Lamb et al. proved instrumental in interpreting parliamentary discourses as strategic engagements by actors aimed at deferring decisions. This was conceptualized through the analytical tool of latent conflict to elucidate what was underscored in certain decisions. Similarly, the fourth publication encountered the limitation of DNA in providing a comprehensive understanding of communal biodiversity actions, as newspapers tended to depict the extremes of the debate, thus either best practices or high confrontations. In this instance, the methodology was enriched with the results from interviews, site visits, and mapping activities.

The findings derived from the four publications compiled within this dissertation reveal a distinct and substantial discourse coalition centred on the imperative of integrating biodiversity into urban planning. However, through an examination of discourses, practices, and relations, internal dynamics within this coalition were identified, thereby enabling the exploration of divergent future imaginaries.

The analytical dimension of discourses focuses on identifying different 'frames' that discourse coalitions adopt to propose their imaginaries based on urban biodiversity through *selecting* and *priming* NbS upscaling. The urgent and innovative frame highlights the necessity for built-environment professionals to valorise innovations over non-innovative solutions, using urgency as justification. Through biodiversity for salvation, biodiversity is positioned as a saviour due to its potential to address climate change-related disasters, creating a narrative in which human survival depends on biodiversity. Biodiversity as ornamentation reflects the tendency of built-environment professionals to favour biodiversity-based solutions that feature a curated and aesthetically pleasing type of biodiversity. The three frames demonstrate that built-environment professionals employ different strategies to increase sensitivity towards biodiversity topics. However, these frames are limited by their primary focus on human needs in urban biodiversity. The highly scientific nature of urban biodiversity increases the difficulty of communicating biodiversity clearly for both laypersons and built-environment professionals, which causes the discourses to remain superficial. Because urban biodiversity relevance receives thorough support from all, built-environment professionals do not perceive the need for further discussion. Conversely, other topics (e.g. mobility) are prioritised as easier to understand and communicate, while urban biodiversity interventions are delayed or shelved. Consequently, discourses about urban biodiversity fail to translate into decisions that challenge existing systems of practice. Thus, I have observed a 'vicious cycle' where laypersons face knowledge barriers in understanding urban biodiversity interventions, and built-environment professionals struggle to communicate these interventions clearly.

The analytical dimension of practices aims to investigate where and how built-environment professionals build imaginaries based on biodiversity through sites of *knowing* and *organising*. The experiment as a 'site' emphasises learning by doing, transcending geographical and temporal boundaries, where a joint effort from built-environment professionals and laypersons should focus on planning for what follows the experiment. The literature as a 'site' underscores the importance of advancing research on NbS and urban biodiversity that engages with grey literature in a continuous dialogue. The national parliaments are highly organised 'sites' that can significantly influence both local practices and European decisions. The UNP as a 'site' allows for the merging of different types of knowledge and necessitates collaboration among a diverse set of built-environment professionals. The results reveal that integrating practices learned during the experiment into current practices remains arduous when the project structure disappears. The literature discusses NbS, upscaling, and urban biodiversity thoroughly, but influences outside it are not visible in the cases analysed. The parliaments influence practices through their decisions and non-decisions equivalently, whereby urban biodiversity is not significantly discussed and the focus is diverted on other issues. The UNP provides a fertile ground for new practices, but its complex nature makes it challenging for cities to draft an UNP in its complete form. Thus, it appears that none of

these sites truly influences each other, as built-environment professionals are not fully capable of switching between these sites to know and organise. I argue that each site functionally contributes to biodiversity imaginaries, but those sites struggle to be carried forward into other sites and into implementation.

The analytical dimension of relations seeks to spotlight which types of interactions are activated to foster imaginaries of urban biodiversity through NbS upscaling as a relational phenomenon, thereby identifying who belongs to the discourse coalitions and how these coalitions evolve. I have identified three types of relations. The **legitimacy** type represents the relations aimed at representing a trusted centre of sharing information (usually scientific) about biodiversity within the network. The **influence** relations type seeks to actively change the framing of other built-environment professionals and laypersons. The **agency** type focuses on sharing responsibilities to motivate and guide local built-environment professionals and laypersons to take action. These three types of relations reflect the involvement of new built-environment professionals in the integration of biodiversity into urban planning, namely botanists and doctors, politicians and media, and NGOs and laypersons. Due to the high diversity of these actors, finding an effective way to communicate about NbS, upscaling, and biodiversity is imperative. Notably, I observed no significant difference in political orientations regarding support for urban biodiversity integration into urban planning in the examined cases at the national level. Conversely, at the local level it was observed a prominence of politicians belonging to the progressist wing, which was a deciding factor for the selection of the cities to be analysed as case studies, too. The work in these types of relations tends to destabilise the large discourse coalitions' agreement on biodiversity by introducing new information and perspectives into the debate. This destabilisation leads to two opposing results. First, it provides additional knowledge to unpack the complexity of urban biodiversity and fosters more informed discussions for change. Second, it serves to divide supporters and create insecurity, introducing new arguments that result in delays in decision-making.

Investigating how urban futures centred on biodiversity are shaped, and by whom through NbS and the necessity to upscale them, using the analytical dimensions of discourses, practices, and relations, has permitted the advancement of the following conclusions.

Firstly, although the concept of NbS is extensively debated within academic literature and unequivocally mandated by policy actors, it fails to be consistently integrated into local discussions. Instead, terms such as 'urban biodiversity', 'urban green', and 'urban nature' are more frequently employed in the common discourse of built-environment professionals. However, a rigorous analysis of the case studies revealed a significant lack of consensus regarding the precise meaning of these terms, with 'urban biodiversity', in particular, proving to be highly scientific and inherently complex. Due to this intrinsic complexity, both political and public debates in the empirical cases consistently remain superficial, with biodiversity generally perceived as a universally positive concept without deeper, critical examination. This dynamic significantly diminishes the level of discourse concerning urban biodiversity and its effective implementation, whereby NbS are often presented as a ready-to-use promise primarily intended to enhance urban conditions for humans, consequently obscuring their potential contribution to urban natural systems. Consequently, the empirical material strongly indicated limited critical reflection, informed decision-making, and proactive action by built-environment professionals, who instead consistently prioritize other more comprehensible and tractable topics. Similarly, the imperative for upscaling is framed as a necessary action to undertake, yet it conspicuously lacks analytical depth and robust empirical evidence in the practical work of built-environment professionals. While the scientific literature has advanced pertinent critiques of this concept, built-environment professionals still struggle significantly with the practical application of innovative solutions on the ground, as exemplified by the CLEVER Cities experiments in the first

publication, and their systemic adoption within a broader framework, such as the UNP, as critically analysed in the fourth publication.

Secondly, my research aimed to elucidate the identities of built-environment professionals and the dynamic processes they follow in their pursuit of deploying NbS and achieving their upscaling. The analytical tool of discourse coalitions effectively depicted groups comprising a diverse amalgamation of individuals, occasionally encompassing those with overtly divergent political affiliations, including extremist and conservative representatives. The theoretical and empirical work has demonstrated the introduction of new built-environment professionals (like doctors and media) and novel discursive practices (such as the UNP) into biodiversity planning as a critical urban concern. Despite a shared understanding among built-environment professionals regarding the substantial benefits of implementing NbS in support of urban biodiversity, there is a notable and concerning absence of coordinated efforts in decision-making and subsequent action. This is compellingly substantiated by the analysis of parliamentary debates, wherein decisions are frequently postponed due to the emergence of 'latent conflicts', and by the examination of public debates, where deliberate attempts to destabilize existing agreements on biodiversity through the introduction of novel information and alternative perspectives have been clearly observed. The work of built-environment professionals in providing new information serves two primary and often conflicting functions: on one hand, it aims at reducing the inherent complexity of urban biodiversity; on the other hand, it paradoxically serves to create divides between supporters, thereby generating insecurity. The analysis has demonstrably shown how right-wing extremists, but not exclusively, demonstrate their ability to strategically leverage a generally agreeable, yet often misinformed electorate under the banners of sustainability, nature protection, and innovation. Therefore, there is a significant and inherent risk that NbS could be strategically misused as a potent tool to encourage other actors to undertake hazardous and precipitous actions, thereby diverting crucial attention from actual, pressing problems.

Lastly, I would like to critically reflect upon the concept of social imaginary as the foundational theoretical framework for this research. The potency of the imaginary proved exceptionally helpful in conceptualizing the work of built-environment professionals in terms of a fundamentally discursive activity. Given the inherent diversity of built-environment professionals, a pervasive problem of communication between different actors and levels, as well as a distinct lack of mutual referencing among various urban planning tools, appears to be consistently prevalent. My research has identified a 'vicious cycle' where laypersons consistently face significant knowledge barriers in comprehending urban biodiversity interventions, and urban-environment professionals struggle profoundly to communicate these interventions with clarity. Empirical evidence highlights a varied landscape of communication strategies, with policy documents consistently prioritizing 'innovative solutions' and NbS within the overarching European funding framework. The classification of these within the five 'latent conflicts' in parliamentary debates strongly suggests that implicit meanings are as significant as explicit statements, thereby underscoring the intricate and often overlooked relationship between urban biodiversity and other critical urban issues. The concept of NbS and its respective upscaling in the form of the UNP, while envisioned as multi-dimensional and intersectoral, instead remain tools of elitists able to mobilise resources for innovative solutions and remain siloed in the field of their competences without a real integration in the broader urban planning system. Furthermore, the diversity of analysed UNPs, encompassing plans, strategies, and programs, reflects a pragmatic response to often unspecific and ambiguous EU requirements. This highlights a relatively weak exchange of information across different governance levels and unequivocally underscores the necessity for more precise and effective communication protocols. Such crucial improvement could

be significantly facilitated through the mediation of key built-environment professionals who function as crucial intermediaries between policies, politics, nature, and the built environment.

Considering the research conducted in this dissertation, I propose a theoretical and an empirical line of inquiry. A theoretical line of inquiry could focus on deepening the exploration of the increased interest in environmental-related topics among built-environment professionals and laypersons that can be ascribed to right-wing political orientations, commonly known as eco-fascism. This phenomenon describes the tendency of right-wing individuals or groups to support environmental issues to gain visibility and trust from those of other political orientations (Bramwell, 1985; Moore and Roberts, 2022). While eco-fascism is not a new concept, phenomena that can be described accordingly have increased considerably in recent years, given the rise of right-wing extremist movements in Europe. The AfD political party in the German parliament and citizen protests in Cesena and Firenze exemplify this phenomenon. However, eco-fascism could also refer to extremist political positions in general, including far-left parties. Understanding this phenomenon could provide better foresight into future developments in political and public debates, considering network rearrangements between fundamentally opposing political and cultural beliefs.

An empirical line of inquiry could deepen the role of communication in mediating between professionals and laypersons to develop a common understanding of what biodiversity in cities could mean. In this sense, the analysis of local newspaper coverage proved to be somewhat inadequate and unsatisfactory. Most news articles limit themselves to describing specific events without clearly detailing the actions or the actors involved. Additionally, news often follows the principle of scandal, whereby an exceptional case receives higher visibility while other important changes may be overshadowed (for example, see Ehrat, 2010). The power of scandal could be incentivized by current politics in a more or less visible way, thus rendering newspaper articles in official news less reliable. Consequently, research in media and communication has shifted towards alternative sources of data, such as social network platforms, especially Twitter (e.g. Burnap and Williams, 2015). Social network platforms have also been used by official organizations and politicians to expand their communication reach, allowing users to respond in real time and share their opinions. However, given Twitter's recent biased positioning towards the far right, this platform can no longer be considered a valid source. Current research increasingly focuses on including Instagram, LinkedIn, or YouTube (e.g. Rieder *et al.*, 2020) as alternatives for gathering data on specific debates.

While the EU Biodiversity Strategy for 2030 compellingly advocates for innovation, this dissertation posits a circumspect approach to novel conceptualizations (i.e. NbS) and mechanisms (i.e. upscaling), particularly within the current prevailing context of uncertainties, urgencies, and crises. The analysis of NbS upscaling, undertaken through the mobilization of the discourse coalition concept, is selected as it presents the most propitious pathway for elucidating how future imaginaries can shape our tangible reality. Through the elaboration of the roles played by discourses, practices, and relations engendered by the potency of urban imaginaries founded on biodiversity, this dissertation underscores the imperative of comprehending urban future-making via biodiversity planning as a foundational act of re-imagination (Haarstad, 2023: 186). This necessitates an ongoing discourse between historical experiences, contemporary actions, and future-oriented planning, critically interrogating the specific meanings and forms of biodiversity that ought to be pursued (Bulkeley *et al.*, 2022). Perhaps, instead of discussing 'biodiversity in cities', it would be more useful to engage in a debate about the 'biodiversity of cities', following an understanding of the urban as ecosystems rather than artificially created constructs (Schilthuizen, 2018), where socio-ecological relations, both visible and invisible, are understood, communicated, and re-imagined.

6. References

Adams, C., N. Frantzeskaki and M. Moglia (2023) Mainstreaming nature-based solutions in cities: A systematic literature review and a proposal for facilitating urban transitions. *Land Use Policy* 130, 106661. https://doi.org/10.1016/j.landusepol.2023.106661

Albert, C., M. Brillinger, P. Guerrero, S. Gottwald, J. Henze, S. Schmidt, E. Ott and B. Schröter (2021) Planning nature-based solutions: Principles, steps, and insights. *Ambio* 50.8, 1446–61. https://doi.org/10.1007/s13280-020-01365-1

Allmendinger, P. and M. Tewdwr-Jones (eds.) (2002) *Planning futures: New directions for planning theory*, Routledge, London. ISBN 0415270030.

Angelo, H. (2021) *How green became good: Urbanized nature and the making of cities and citizens*, The University of Chicago Press, Chicago. ISBN 9780226739182.

Arlati, A. (2024a) Mapping conflicts of prioritization: National parliamentary discourses on urban greening and biodiversity implementation in Germany and Italy. In M. Grubbauer, A. Manganelli and L. Volont (eds.), *Conflicts in Urban Future-Making: Governance, Institutions, and Transformative Change*. Vol. 1, transcript Verlag, Bielefeld.

Arlati, A. (2024b) Navigating urban futures: Exploring NbS upscaling discourses, practices, and relations in reimagining human-nature relationships. *Futures* 161, 103403. https://doi.org/10.1016/j.futures.2024.103403

Arlati, A. and M. Nagel (2025) Understanding, communicating, and imagining urban biodiversity in German and Italian cities. *npj climate action* 4.1. https://doi.org/ 10.1038/s44168-025-00249-y

Arlati, A., A. Rödl, S. Kanjaria-Christian and J. Knieling (2021) Stakeholder Participation in the Planning and Design of Nature-Based Solutions. Insights from CLEVER Cities Project in Hamburg. *Sustainability* 13.5, 2572. https://doi.org/10.3390/su13052572

Aronson, M.F.J., C.A. Lepczyk, K.L. Evans, M.A. Goddard, S.B. Lerman, J.S. MacIvor, C.H. Nilon and T. Vargo (2017) Biodiversity in the city: key challenges for urban green space management. *Frontiers in Ecology and the Environment* 15.4, 189–96. https://doi.org/10.1002/fee.1480

Auel, K. and T. Raunio (2014) Debating the State of the Union? Comparing Parliamentary Debates on EU Issues in Finland, France, Germany and the United Kingdom. *The Journal of Legislative Studies* 20.1, 13–28. https://doi.org/10.1080/13572334.2013.871482

Augenstein, K., B. Bachmann, M. Egermann, V. Hermelingmeier, A. Hilger, M. Jaeger-Erben, A. Kessler, D.P. Lam, A. Palzkill, P. Suski and T. von Wirth (2020) From niche to mainstream: the dilemmas of scaling up sustainable alternatives. *GAIA - Ecological Perspectives for Science and Society* 29.3, 143–47. https://doi.org/10.14512/gaia.29.3.3

Avelino, F. (2021) Theories of power and social change. Power contestations and their implications for research on social change and innovation. *Journal of Political Power* 14.3, 425–48. https://doi.org/10.1080/2158379X.2021.1875307

Bacchi, C. and J. Bonham (2014) Reclaiming discursive practices as an analytic focus: Political implications. *Foucault Studies*, 179–92. https://doi.org/10.22439/fs.v0i17.4298

Behagel, J.H., B. Arts and E. Turnhout (2019) Beyond argumentation: a practice-based approach to environmental policy. *Journal of Environmental Policy & Planning* 21.5, 479–91. https://doi.org/10.1080/1523908X.2017.1295841

Betsill, M.M. and H. Bulkeley (2006) Cities and the multilevel governance of global climate change. *Global Governance* 12.2, 141–59. https://www.jstor.org/stable/27800607

BMUB (2018) *White Paper: Green Spaces in the City* [WWW document]. URL www.bmub.bund.de/en/service/publications (accessed on 13 January 2024).

Bozonelos, D., J. Wendt, C. Lee, J. Scarffe, M. Omae, J. Franco, B. Martin and S. Veldhuis (2022) *Introduction to comparative Government and Politics* [WWW document]. URL https://open.umn.edu/opentextbooks/textbooks/1435 (accessed on 26 April 2024).

Bramwell, A. (1985) *Blood and soil: Richard Walther Darré and Hitler's "Green Party"*, Kensal Press, Abbotsbrook Bourne End Buckinghamshire. ISBN 0946041334

Brown, N., B. Rappert and A. Webster (2000) *Contested futures: A sociology of prospective techno-science*, Ashgate, Aldershot England and Burlington VT. ISBN 0754612635

Brown, R.R., M.A. Farrelly and D.A. Loorbach (2013) Actors working the institutions in sustainability transitions: The case of Melbourne's stormwater management. *Global Environmental Change* 23.4, 701–18. https://doi.org/10.1016/j.gloenvcha.2013.02.013

Bulkeley, H. (2020) *Nature-based solutions towards sustainable communities: Analysis of EU-funded projects* (Luxembourg) [WWW document]. URL https://op.europa.eu/en/publication-detail/-/publication/9afec646-cbc7-11ea-adf7-01aa75ed71a1/language-en (accessed on 16 December 2023).

Bulkeley, H. (2021) Climate changed urban futures: environmental politics in the anthropocene city. *Environmental Politics* 30.1-2, 266–84. https://doi.org/10.1080/09644016.2021.1880713

Bulkeley, H. (2023) The condition of urban climate experimentation. *Sustainability: Science, Practice and Policy* 19.1. https://doi.org/10.1080/15487733.2023.2188726

Bulkeley, H., S. Marvin, Y.V. Palgan, K. McCormick, M. Breitfuss-Loidl, L. Mai, T. von Wirth and N. Frantzeskaki (2019) Urban living laboratories: Conducting the experimental city? *European Urban and Regional Studies* 26.4, 317–35. https://doi.org/10.1177/0969776418787222

Bulkeley, H., L. Xie, J. Bush, K. Rochell, J. Greenwalt, H. Runhaar, E. van Wyk, C. Oke and I. Cotzee (2022) Cities and the transformation of biodiversity governance. In I.J. Visseren-Hamakers and M.T.J. Kok (eds.), *Transforming Biodiversity Governance*. https://doi.org/10.1017/9781108856348

Burnap, P. and M.L. Williams (2015) Cyber Hate Speech on Twitter: An Application of Machine Classification and Statistical Modeling for Policy and Decision Making. *Policy & Internet* 7.2, 223–42. https://doi.org/10.1002/poi3.85

Burt, R.S. (2003) The Social Structure of Competition. In R.S. Burt (ed.), *Networks in the Knowledge Economy*, Oxford University Press. https://doi.org/10.1093/oso/9780195159509.003.0006

Burt, R.S. (2004) Structural Holes and Good Ideas. *American Journal of Sociology* 110.2, 349–99. https://doi.org/10.1086/421787

Castán Broto, V. and H. Bulkeley (2013) A survey of urban climate change experiments in 100 cities. *Global environmental change : human and policy dimensions* 23.1, 92–102. https://doi.org/10.1016/j.gloenvcha.2012.07.005

Castán Broto, V. and H. Bulkeley (2018) Realigning Circulations. In B. Turnheim, P. Kivimaa and F. Berkhout (eds.), *Innovating Climate Governance*, Cambridge University Press. https://doi.org/10.1017/9781108277679.006

Castelo, S., M. Amado and F. Ferreira (2023) Challenges and Opportunities in the Use of Nature-Based Solutions for Urban Adaptation. *Sustainability* 15.9, 7243. https://doi.org/10.3390/su15097243

CBD (2022) *Decision adopted by the Conference of the Parties to the Convention on Biological Diversity: 15/4*. Kunming-Montreal Global Biodiversity Framework [WWW document]. URL https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf (accessed on 9 January 2025).

Cohen-Shacham, E., A. Andrade, J. Dalton, N. Dudley, M. Jones, C. Kumar, S. Maginnis, S. Maynard, C.R. Nelson, F.G. Renaud, R. Welling and G. Walters (2019) Core principles for successfully implementing and upscaling Nature-based Solutions. *Environmental Science & Policy* 98, 20–29. https://doi.org/10.1016/j.envsci.2019.04.014

Cohen-Shacham, E., G. Walters, C. Janzen and S. Maginnis (2016) *Nature-based solutions to address global societal challenges*, IUCN International Union for Conservation of Nature. https://doi.org/10.2305/IUCN.CH.2016.13.en

Cortinovis, C., P. Olsson, N. Boke-Olén and K. Hedlund (2022) Scaling up nature-based solutions for climate-change adaptation: Potential and benefits in three European cities. *Urban Forestry & Urban Greening* 67, 127450. https://doi.org/10.1016/j.ufug.2021.127450

Costadone, L. and K. Vierikko (2023) Are traditional urban greening actions compliant with the European Greening Plans guidance? *Urban Forestry & Urban Greening* 90, 128131. https://doi.org/10.1016/j.ufug.2023.128131

Davies, C., W.Y. Chen, G. Sanesi and R. Lafortezza (2021) The European Union roadmap for implementing nature-based solutions: A review. *Environmental Science & Policy* 121, 49–67. https://doi.org/10.1016/j.envsci.2021.03.018

Dewulf, A., M. Mancero, G. Cárdenas and D. Sucozhañay (2011) Fragmentation and connection of frames in collaborative water governance: a case study of river catchment management in Southern Ecuador. *International Review of Administrative Sciences* 77.1, 50–75. https://doi.org/10.1177/0020852310390108

Dignum, M., H. Dorst, M. van Schie, T. Dassen and R. Raven (2020) Nurturing nature: Exploring socio-spatial conditions for urban experimentation. *Environmental Innovation and Societal Transitions* 34, 7–25. https://doi.org/10.1016/j.eist.2019.11.010

Dodge, J. and J. Lee (2017) Framing Dynamics and Political Gridlock: The Curious Case of Hydraulic Fracturing in New York. *Journal of Environmental Policy & Planning* 19.1, 14–34. https://doi.org/10.1080/1523908X.2015.1116378

Ducarme, F. and D. Couvet (2020) What does 'nature' mean? *Palgrave Communications* 6.1. https://doi.org/10.1057/s41599-020-0390-y

Durrant, R., J. Barnes, F. Kern and G. Mackerron (2018) The acceleration of transitions to urban sustainability: a case study of Brighton and Hove. *European Planning Studies* 26.8, 1537–58. https://doi.org/10.1080/09654313.2018.1489783

Dushkova, D. and D. Haase (2020) Not Simply Green: Nature-Based Solutions as a Concept and Practical Approach for Sustainability Studies and Planning Agendas in Cities. *Land* 9.1, 1–37. https://doi.org/10.3390/land9010019

EC (2019a) *EU guidance on integrating ecosystems and their services into decision-making*: Part 2/3 (Brussels) [WWW document]. URL https://data.consilium.europa.eu/doc/document/ST-11395-2019-ADD-1/en/pdf (accessed on 16 January 2025).

EC (2019b) Communication from the commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: *The European Green Deal* (Brussels) [WWW document]. URL https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF (accessed on 23 November 2023).

EC (2020) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: *EU Biodiversity Strategy for 2030* (Brussels) [WWW document]. URL https://eur-lex.europa.eu/resource.html?uri=cellar:a3c806a6-9ab3-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF (accessed on 28 November 2023).

Ehnert, F. (2022) Review of research into urban experimentation in the fields of sustainability transitions and environmental governance. *European Planning Studies*, 1–27. https://doi.org/10.1080/09654313.2022.2070424

Ehrat, P.J. (2010) *Power of Scandal: Semiotic and Pragmatic in Mass Media*, University of Toronto Press. ISBN 978-1442641259

El Harrak, M. and F. Lemaitre (2023) *European Roadmap to 2030 for research and innovation on nature-based solutions* [WWW document]. URL https://networknature.eu/sites/default/files/uploads/networknatureeuropean-ri-roadmap-nbs.pdf (accessed on 7 July 2023).
Entman, R.M. (1993) Framing: Toward Clarification of a Fractured Paradigm. *Journal of Communication* 43.4, 51–58. https://doi.org/10.1111/j.1460-2466.1993.tb01304.x
Entman, R.M. (2007) Framing Bias: Media in the Distribution of Power. *Journal of Communication* 57.1, 163–73. https://doi.org/10.1111/j.1460-2466.2006.00336.x
ESPON (2018) *COMPASS* – Comparative Analysis of Territorial Governance and Spatial Planning Systems in Europe. [WWW Document]. URL https://archive.espon.eu/sites/default/files/attachments/1.%20COMPASS_Final_Report.pdf (accessed on 7 August 2023).
EUROCITIES and ICLEI Europe (2021) *Urban Greening Plans* - DRAFT: Guidance for cities to help prepare an Urban Greening Plan [WWW document]. URL https://environment.ec.europa.eu/topics/urban-environment/urban-nature-platform_en (accessed on 3 April 2024).
European Parliament and European Council (2024) *Regulation (EU) 2024/1991 of the European Parliament and of the Council of 24 June 2024 on nature restoration and amending Regulation (EU) 2022/869 (Text with EEA relevance): EU Nature Restoration Law.* Official Journal of the European Union.
Evans, J., A. Karvonen and R. Raven (eds.) (2016) *The experimental city*, Routledge Taylor & Francis Group, London. ISBN 9781138299672
Faivre, N., M. Fritz, T. Freitas, B. de Boissezon and S. Vandewoestijne (2017) Nature-Based Solutions in the EU: Innovating with nature to address social, economic and environmental challenges. *Environmental research* 159, 509–18. https://doi.org/10.1016/j.envres.2017.08.032
Fastenrath, S., J. Bush and L. Coenen (2020) Scaling-up nature-based solutions. Lessons from the Living Melbourne strategy. *Geoforum* 116, 63–72. https://doi.org/10.1016/j.geoforum.2020.07.011
Flyvbjerg, B. (2011) Case study. In N.K. Denzin and Y.S. Lincoln (eds.), *The Sage handbook of qualitative research*, Sage, Los Angeles, California. ISBN 978-1071836743
Frantzeskaki, N. (2019) Seven lessons for planning nature-based solutions in cities. *Environmental Science & Policy* 93, 101–11. https://doi.org/10.1016/j.envsci.2018.12.033
Frantzeskaki, N., I.H. Mahmoud and E. Morello (2022) Nature-Based Solutions for Resilient and Thriving Cities: Opportunities and Challenges for Planning Future Cities. In I.H. Mahmoud, E. Morello, F. Lemes de Oliveira and D. Geneletti (eds.), *Nature-based Solutions for Sustainable Urban Planning*, Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-89525-9
Frantzeskaki, N., P. Vandergert, S. Connop, K. Schipper, I. Zwierzchowska, M. Collier and M. Lodder (2020) Examining the policy needs for implementing nature-based solutions in cities: Findings from city-wide transdisciplinary experiences in Glasgow (UK), Genk (Belgium) and Poznań (Poland). *Land Use Policy* 96, 104688. https://doi.org/10.1016/j.landusepol.2020.104688
Geels, F.W. (2002) Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy* 31.8-9, 1257–74. https://doi.org/10.1016/S0048-7333(02)00062-8
Geels, F.W. (2004) From sectoral systems of innovation to socio-technical systems. *Research Policy* 33.6-7, 897–920. https://doi.org/10.1016/j.respol.2004.01.015

Geels, F.W. (2011) The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions* 1.1, 24–40. https://doi.org/10.1016/j.eist.2011.02.002
Geels, F.W. (2019) Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective. *Current Opinion in Environmental Sustainability* 39, 187–201. https://doi.org/10.1016/j.cosust.2019.06.009
Geels, F.W. (2024) *Advanced introduction to sustainability transitions*. Elgar advanced introductions, Edward Elgar Publishing, Cheltenham UK and Northhampton MA USA. ISBN 978-1-0353-2970-0
Geels, F.W. and J. Schot (2007) Typology of sociotechnical transition pathways. *Research Policy* 36.3, 399–417. https://doi.org/10.1016/j.respol.2007.01.003
González-Arellano, S. and B. Gandlgruber (eds.) (2025) *Cities as Anticipatory Systems*, Springer Nature Switzerland, Cham. ISBN 978-3-031-78161-2
Grimm, N.B., S.H. Faeth, N.E. Golubiewski, C.L. Redman, J. Wu, X. Bai and J.M. Briggs (2008) Global change and the ecology of cities. *Science* 319.5864, 756–60. https://doi.org/10.1126/science.1150195
Grimm, N.B., Y. Kim, J.R. Sauer and S.R. Elser (2023) Nature-based solutions and climate change resilience. In T. McPhearson, N. Kabisch and N. Frantzeskaki (eds.), *Nature-Based Solutions for Cities*, Edward Elgar Publishing. https://doi.org/10.4337/9781800376762.00010
Gross, M. and H. Hoffmann-Riem (2005) Ecological restoration as a real-world experiment: designing robust implementation strategies in an urban environment. *Public Understanding of Science* 14.3, 269–84. https://doi.org/10.1177/0963662505050791
Gross, M. and W. Krohn (2005) Society as experiment: sociological foundations for a self-experimental society. *History of the Human Sciences* 18.2, 63–86. https://doi.org/10.1177/0952695105054182
Grubbauer, M., K. Manderscheid and J. Thiel (2024a) Understanding professional agency in urban future-making: Acting in the face of uncertainty. In M. Grubbauer, A. Manganelli and L. Volont (eds.), *Conflicts in Urban Future-Making: Governance, Institutions, and Transformative Change*, Majuskel Medienproduktion GmbH,Wetzlar.
Grubbauer, M., A. Manganelli and L. Volont (eds.) (2024b) *Conflicts in Urban Future-Making: Governance, Institutions, and Transformative Change*. Vol. 1, Majuskel Medienproduktion GmbH,Wetzlar. ISBN 978-3-8394-7467-9
Haarstad, H. (2023) Climate imaginaries for urgent urban transformations. In H. Haarstad, J. Grandin, K. Kjærås and E. Johnson (eds.), *Haste: The slow politics of climate urgency*, UCL PRESS, London. ISBN 978-1-80008-328-8
Haarstad, H., J. Grandin, J. Krzyżak and E. Johnson (2023) Why the haste? Introduction to the slow politics of climate urgency. In H. Haarstad, J. Grandin, K. Kjærås and E. Johnson (eds.), *Haste: The slow politics of climate urgency*, UCL PRESS, London. ISBN 978-1-80008-328-8
Hajer, M.A. (1993) Discourse Coalitions and the Institutionalization of Practice. In F. Fischer and J. Forester (eds.), *The Argumentative Turn in Policy Analysis and Planning*, Duke University Press. https://doi.org/10.1215/9780822381815-003
Hajer, M.A. (1995) *The politics of environmental discourse: Ecological modernization and the policy process*, Clarendon, Oxford. ISBN 9780191599408
Hajer, M.A. (2006) Doing discourse analysis: coalitions, practices, meaning. In M. den van Brink (ed.), *Words matter in policy and planning: Discourse theory and method in the social sciences*. Netherlands geographical studies, Koninklijk Nederlands Aardrijkskundig Genootschap, Utrecht. ISBN 9789068093858

Hajer, M.A. and W. Versteeg (2005) A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. *Journal of Environmental Policy & Planning* 7.3, 175–84. https://doi.org/10.1080/15239080500339646

Hanson, H.I., B. Wickenberg and J. Alkan Olsson (2020) Working on the boundaries—How do science use and interpret the nature-based solution concept? *Land Use Policy* 90, 104302. https://doi.org/10.1016/j.landusepol.2019.104302

Hargreaves, T., N. Longhurst and G. Seyfang (2013) Up, Down, round and round: Connecting Regimes and Practices in Innovation for Sustainability. *Environment and Planning A: Economy and Space* 45.2, 402–20. https://doi.org/10.1068/a45124

Hodson, M., J. Evans and G. Schliwa (2018) Conditioning experimentation: The struggle for place-based discretion in shaping urban infrastructures. *Environment and Planning C: Politics and Space* 36.8, 1480–98. https://doi.org/10.1177/2399654418765480

Hölscher, K., N. Frantzeskaki and D. Loorbach (2019) Steering transformations under climate change: capacities for transformative climate governance and the case of Rotterdam, the Netherlands. *Regional Environmental Change* 19.3, 791–805. https://doi.org/10.21203/rs.3.rs-2876567/v1

Hooghe, L. and G. Marks (2018) Cleavage theory meets Europe's crises: Lipset, Rokkan, and the transnational cleavage. *Journal of European Public Policy* 25.1, 109–35. https://doi.org/10.1080/13501763.2017.1310279

Ibsen, P., D. Kucera, S. Piper and G.D. Jenerette (2023) Urban Climate and the Biophysical Environment. In C.H. Nilon and M.F. Aronson (eds.), *Routledge Handbook of Urban Biodiversity*, Routledge, London. https://doi.org/10.4324/9781003016120-5

IPCC (2023) Summary for Policymakers. In Lee, Hoesung: Romer, José (ed.), *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Geneva, Switzerland. https://doi.org/10.59327/IPCC/AR6-9789291691647.001

IUCN (2020) *Guidance for using the IUCN Global Standard for Nature-based Solutions*: first editions [WWW document]. URL https://iucn.org/resources/publication/iucn-global-standard-nature-based-solutions-first-edition (accessed on 23 October 2023).

Jasanoff, S. (2015) Future imperfect: science, technology, and the imaginations of modernity. In S. Jasanoff and S.-H. Kim (eds.), *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*, The University of Chicago Press, Chicago and London. ISBN 9780226276526

Jørgensen, G., O. Fryd, A.A. Lund, P.S. Andersen and L. Herslund (2022) Nature-based climate adaptation projects, their governance and transitional potential-cases from Copenhagen. *Frontiers in Sustainable Cities* 4. https://doi.org/10.3389/frsc.2022.906960

Kabisch, N., N. Frantzeskaki and R. Hansen (2022) Principles for urban nature-based solutions. *Ambio* 51.6, 1388–401. https://doi.org/10.1007/s13280-021-01685-w

Kabisch, N., H. Korn, J. Stadler and A. Bonn (2017) *Nature-Based Solutions to Climate Change Adaptation in Urban Areas*, Springer International Publishing, Cham. ISBN 978-3-319-53750-4

Karvonen, A. (2018) The City of Permanent Experiments? In B. Turnheim, P. Kivimaa and F. Berkhout (eds.), *Innovating Climate Governance*, Cambridge University Press. https://doi.org/10.1017/9781108277679.014

Karvonen, A. and J. Bylund (2023) Small measures, large change: the promise and peril of incremental urbanisation. In H. Haarstad, J. Grandin, K. Kjærås and E. Johnson (eds.), *Haste: The slow politics of climate urgency*, UCL PRESS, London. ISBN 978-1-80008-328-8

Kivimaa, P., W. Boon, S. Hyysalo and L. Klerkx (2019) Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda. *Research Policy* 48.4, 1062–75. https://doi.org/10.1016/j.respol.2018.10.006

Kok, K.P. (2023) Politics beyond agency? Pluralizing structure(s) in sustainability transitions. *Energy Research & Social Science* 100, 103120. https://doi.org/10.1016/j.erss.2023.103120

Kotsila, P., I. Anguelovski, F. Baró, J. Langemeyer, F. Sekulova and J. JT Connolly (2021) Nature-based solutions as discursive tools and contested practices in urban nature's neoliberalisation processes. *Environment and Planning E: Nature and Space* 4.2, 252–74. https://doi.org/10.1177/2514848620901437

Lam, D.P.M., B. Martín-López, A. Wiek, E.M. Bennett, N. Frantzeskaki, A.I. Horcea-Milcu and D.J. Lang (2020) Scaling the impact of sustainability initiatives: a typology of amplification processes. *Urban Transformations* 2.1. https://doi.org/10.1186/s42854-020-00007-9

Lamb, W.F., G. Mattioli, S. Levi, J.T. Roberts, S. Capstick, F. Creutzig, J.C. Minx, F. Müller-Hansen, T. Culhane and J.K. Steinberger (2020) Discourses of climate delay. *Global Sustainability* 3, 1–5. https://doi.org/10.1017/sus.2020.13

Lambin, E.F., H. Kim, J. Leape and K. Lee (2020) Scaling up Solutions for a Sustainability Transition. *One Earth* 3.1, 89–96. https://doi.org/10.1016/j.oneear.2020.06.010

Leifeld, P. (2013) Reconceptualizing Major Policy Change in the Advocacy Coalition Framework: A Discourse Network Analysis of German Pension Politics. *Policy Studies Journal* 41.1, 169–98. https://doi.org/10.1111/psj.12007

Leifeld, P. (2017) Discourse Network Analysis: Policy Debates as Dynamic Networks. In J.N. Victor, A.H. Montgomery and M. Lubell (eds.), *The Oxford handbook of political networks*, Oxford University Press, New York, NY. https://doi.org/10.1093/oxfordhb/9780190228217.013.25

Leifeld, P. and S. Haunss (2012) Political discourse networks and the conflict over software patents in Europe. *European Journal of Political Research* 51.3, 382–409. https://doi.org/10.1111/j.1475-6765.2011.02003.x

Lemes de Oliveira, F. (2025) Nature in nature-based solutions in urban planning. *Landscape and Urban Planning* 256, 105282. https://doi.org/10.1016/j.landurbplan.2024.105282

Lemes de Oliveira, F. and I.H. Mahmoud (2024) Desirable futures: Human-nature relationships in urban planning and design. *Futures* 163, 103444. https://doi.org/10.1016/j.futures.2024.103444

Li, M., R.P. Remme, P.M. van Bodegom and A.P. van Oudenhoven (2025) Solution to what? Global assessment of nature-based solutions, urban challenges, and outcomes. *Landscape and Urban Planning* 256, 105294. https://doi.org/10.1016/j.landurbplan.2025.105294

Mahmoud, I.H., G. Dubois, C. Liquete and M. Robuchon (2025) Understanding collaborative governance of biodiversity-inclusive urban planning: Methodological approach and benchmarking results for urban nature plans in 10 European cities. *Urban Ecosystems* 28.2. https://doi.org/10.1007/s11252-024-01656-5

Mahmoud, I.H. and E. Morello (2021) Co-creation Pathway for Urban Nature-Based Solutions: Testing a Shared-Governance Approach in Three Cities and Nine Action Labs. In A. Bisello, D. Vettorato, D. Ludlow and C. Baranzelli (eds.), *Smart and Sustainable Planning for Cities and Regions*. Green Energy and Technology, Springer International Publishing, Cham, pp. 259–276. ISBN 978-3-03-057764-3.

Mahmoud, I.H., E. Morello, F. Lemes de Oliveira and D. Geneletti (eds.) (2022) *Nature-based Solutions for Sustainable Urban Planning*, Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-89525-9

McDonald, R.I., M.L. Cobert, M. Hamann, R. Simkin and B. Walsh (2018) *Nature in the urban century: A global assessment of where and how to conserve nature for biodiversity and human wellbeing* [WWW document]. URL

https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_NatureintheUrbanCentury_FullReport.pdf (accessed on 14 June 2022).
McPhearson, T., D.M. Iwaniec and X. Bai (2017) Positive visions for guiding urban transformations toward sustainable futures. *Current Opinion in Environmental Sustainability* 22, 33–40. https://doi.org/10.1016/j.cosust.2017.04.004
McPhearson, T., N. Kabisch and N. Frantzeskaki (eds.) (2023a) *Nature-Based Solutions for Cities*, Edward Elgar Publishing. ISBN 9781800376762
McPhearson, T., N. Kabisch and N. Frantzeskaki (2023b) Towards mainstreaming nature-based solutions for achieving biodiverse, resilient, and inclusive cities. In T. McPhearson, N. Kabisch and N. Frantzeskaki (eds.), *Nature-Based Solutions for Cities*, Edward Elgar Publishing. https://doi.org/10.15488/14525
Megyesi, B., A. Gholipour, F. Cuomo, E. Canga, A. Tsatsou, V. Zihlmann, R. Junge, D. Milosevic and R. Pineda-Martos (2024) Perceptions of stakeholders on nature-based solutions in urban planning: A thematic analysis in six European cities. *Urban Forestry & Urban Greening* 96, 128344. https://doi.org/10.1016/j.ufug.2024.128344
Melanidis, M.S. and S. Hagerman (2022) Competing narratives of nature-based solutions: Leveraging the power of nature or dangerous distraction? *Environmental Science & Policy* 132, 273–81. https://doi.org/10.1016/j.envsci.2022.02.028
Mell, I., S. Clement and F. O'Sullivan (2023) Mainstreaming Nature-Based Solutions in City Planning: Examining Scale, Focus, and Visibility as Drivers of Intervention Success in Liverpool, UK. *Land* 12.7, 1371. https://doi.org/10.3390/land12071371
Mendes, R., T. Fidélis, P. Roebeling and F. Teles (2020) The Institutionalization of Nature-Based Solutions—A Discourse Analysis of Emergent Literature. *Resources* 9.1, 6. https://doi.org/10.3390/resources9010006
Mitić-Radulović, A. and K. Lalović (2021) Multi-Level Perspective on Sustainability Transition towards Nature-Based Solutions and Co-Creation in Urban Planning of Belgrade, Serbia. *Sustainability* 13.14, 7576. https://doi.org/10.3390/su13147576
Moore, S. and A. Roberts (2022) *The rise of ecofascism: Climate change and the far right*, Polity, Cambridge UK and Medford MA. ISBN 978-1509545377
Müller, N. and P. Werner (2010) Urban Biodiversity and the Case for Implementing the Convention on Biological Diversity in Towns and Cities. In N. Müller, P. Werner and J.G. Kelcey (eds.), *Urban Biodiversity and Design*, Wiley. https://doi.org/10.1002/9781444318654.ch1
Nagel, M. (2016) *Polarisierung im politischen Diskurs*, Springer Fachmedien Wiesbaden, Wiesbaden. ISBN 978-3-658-11224-0
Nagel, M. and C. Bravo-Laguna (2022) Analyzing multi-level governance dynamics from a discourse network perspective: the debate over air pollution regulation in Germany. *Environmental sciences Europe* 34.1, 62–80. https://doi.org/10.1186/s12302-022-00640-0
Nagel, M. and K. Satoh (2019) Protesting iconic megaprojects. A discourse network analysis of the evolution of the conflict over Stuttgart 21. *Urban Studies* 56.8, 1681–700. https://doi.org/10.1177/0042098018775903
Nesshöver, C., T. Assmuth, K.N. Irvine, G.M. Rusch, K.A. Waylen, B. Delbaere, D. Haase, L. Jones-Walters, H. Keune, E. Kovacs, K. Krauze, M. Külvik, F. Rey, J. van Dijk, O.I. Vistad, M.E. Wilkinson and H. Wittmer (2017) The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *The Science of the total environment* 579, 1215–27. https://doi.org/10.1016/j.scitotenv.2016.11.106
Nicolini, D. (2009) Zooming In and Out: Studying Practices by Switching Theoretical Lenses and Trailing Connections. *Organization Studies* 30.12, 1391–418. https://doi.org/10.1177/0170840609349875

Nicolini, D. (2011) Practice as the Site of Knowing: Insights from the Field of Telemedicine. *Organization Science* 22.3, 602–20. https://doi.org/10.1287/orsc.1100.0556
Nicolini, D. and P. Monteiro (2016) The Practice Approach: For a Praxeology of Organisational and Management Studies. In A. Langley and H. Tsoukas (eds.), *The SAGE Handbook of Process Organization Studies*, SAGE Publications Ltd, 1 Oliver's Yard, 55 City Road London EC1Y 1SP. https://doi.org/10.2307/j.ctt46nrzt.12
Nilon, C.H. and M.F. Aronson (eds.) (2023) *Routledge Handbook of Urban Biodiversity*, Routledge, London. ISBN 9781032492131
Nilon, C.H., M.F.J. Aronson, S.S. Cilliers, C. Dobbs, L.J. Frazee, M.A. Goddard, K.M. O'Neill, D. Roberts, E.K. Stander, P. Werner, M. Winter and K.P. Yocom (2017) Planning for the Future of Urban Biodiversity: A Global Review of City-Scale Initiatives. *BioScience* 67.4, 332–42. https://doi.org/10.1093/biosci/bix012
O'Sullivan, F., I. Mell and S. Clement (2020) Novel Solutions or Rebranded Approaches: Evaluating the Use of Nature-Based Solutions (NBS) in Europe. *Frontiers in Sustainable Cities* 2. https://doi.org/10.3389/frsc.2020.572527
Obstfeld, D. (2017) *Getting new things done: Networks, brokerage, and the assembly of innovative action*, Stanford Business Books an imprint of Stanford University Press, Stanford, California. ISBN 978-0804760508
Obstfeld, D., S.P. Borgatti and J. Davis (2014) Brokerage as a Process: Decoupling Third Party Action from Social Network Structure. In D.J. Brass, G. Labianca, A. Mehra, D.S. Halgin and S.P. Borgatti (eds.), *Contemporary Perspectives on Organizational Social Networks*. Research in the Sociology of Organizations. Vol. 40, Emerald Group Publishing Limited. https://doi.org/10.1108/S0733-558X(2014)0000040007
Oomen, J., J. Hoffman and M.A. Hajer (2022) Techniques of futuring: On how imagined futures become socially performative. *European Journal of Social Theory* 25.2, 252–70. https://doi.org/10.1177/1368431020988826
Pfotenhauer, S., B. Laurent, K. Papageorgiou and A.J. Stilgoe (2022) The politics of scaling. *Social studies of science* 52.1, 3–34. https://doi.org/10.1177/03063127211048945
Piattoni, S. and T. Notermans (2021) Introduction to 'Italy and Germany: Incompatible Varieties of Europe?'. *German Politics* 30.3, 301–18. https://doi.org/10.1080/09644008.2021.1888932
Pineda-Pinto, M., N. Frantzeskaki and C.A. Nygaard (2022) The potential of nature-based solutions to deliver ecologically just cities: Lessons for research and urban planning from a systematic literature review. *Ambio* 51.1, 167–82. https://doi.org/10.1007/s13280-021-01553-7
Pörtner, H.-O., R.J. Scholes, J. Agard, E. Archer, X. Bai, D. Barnes, M. Burrows, L. Chan, W.L. Cheung, S. Diamond, C. Donatti, C. Duarte, N. Eisenhauer, W. Foden, M.A. Gasalla, C. Handa, T. Hickler, O. Hoegh-Guldberg, K. Ichii, U. Jacob, G. Insarov, W. Kiessling, P. Leadley, R. Leemans, L. Levin, M. Lim, S. Maharaj, S. Managi, P.A. Marquet, P. McElwee, G. Midgley, T. Oberdorff, D. Obura, B. Osman Elasha, R. Pandit, U. Pascual, A.P.F. Pires, A. Popp, V. Reyes-García, M. Sankaran, J. Settele, Y.-J. Shin, D.W. Sintayehu, P. Smith, N. Steiner, B. Strassburg, R. Sukumar, C. Trisos, A.L. Val, J. Wu, E. Aldrian, C. Parmesan, R. Pichs-Madruga, Roberts,, Debra C., A.D. Rogers, S. Díaz, M. Fischer, S. Hashimoto, S. Lavorel, N. Wu and H. Ngo (2021) *IPBES-IPCC co-sponsored workshop report on biodiversity and climate change* [WWW document]. URL https://www.ipbes.net/sites/default/files/2021-06/20210609_workshop_report_embargo_3pm_CEST_10_june_0.pdf (accessed on 30 October 2023).
Pyrko, I., V. Dörfler and C. Eden (2017) Thinking together: What makes Communities of Practice work? *Human relations; studies towards the integration of the social sciences* 70.4, 389–409. https://doi.org/10.1177/0018726716661040

Reckwitz, A. (2002) Toward a Theory of Social Practices. *European Journal of Social Theory* 5.2, 243–63. https://doi.org/10.1177/13684310222225432
Rieder, B., Ò. Coromina and A. Matamoros-Fernández (2020) Mapping YouTube. *First Monday*. https://doi.org/10.5210/fm.v25i8.10667
Rip, A. and R. Kemp (1998) Technological change. In S. Rayner (ed.), *Human choice and climate change*, Battelle Press, Columbus, Ohio. ISBN 1574770462
Salvia, M., F. Pietrapertosa, V. D'Alonzo, P. Clerici Maestosi, S.G. Simoes and D. Reckien (2023) Key dimensions of cities' engagement in the transition to climate neutrality. *Journal of environmental management* 344, 118519. https://doi.org/10.1016/j.jenvman.2023.118519
Sarabi, S., Q. Han, A.G. L. Romme, B. de Vries, R. Valkenburg, E. den Ouden, S. Zalokar and L. Wendling (2021) Barriers to the Adoption of Urban Living Labs for NBS Implementation: A Systemic Perspective. *Sustainability* 13.23, 13276. https://doi.org/10.3390/su132313276
Scharpf, F.W. (2009) Legitimacy in the multilevel European polity. *European Political Science Review* 1.2, 173–204. https://doi.org/10.1017/S1755773909000204
Schilthuizen, M. (2018) *Darwin comes to town: How the urban jungle drives evolution*, Picador, New York, N.Y. ISBN 1250127823
Schmid, B. and G. Taylor Aiken (2023) A critical view on the role of scale and instrumental imaginaries within community sustainability transitions research. *Area*. Advance online publication. https://doi.org/10.1111/area.12884
Schmidt, V.A. (2010) Taking ideas and discourse seriously: explaining change through discursive institutionalism as the fourth 'new institutionalism'. *European Political Science Review* 2.01, 1. https://doi.org/10.1017/S175577390999021X
Scoones, I. (2024) *Navigating uncertainty: Radical rethinking for a turbulent world*, Polity, Cambridge UK and Hoboken NJ USA. ISBN 978-1-5095-6008-0
Seddon, N., A. Chausson, P. Berry, C.A.J. Girardin, A. Smith and B. Turner (2020) Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences* 375.1794, 20190120. https://doi.org/10.1098/rstb.2019.0120
Seddon, N., A. Smith, P. Smith, I. Key, A. Chausson, C. Girardin, J. House, S. Srivastava and B. Turner (2021) Getting the message right on nature-based solutions to climate change. *Global change biology* 27.8, 1518–46. https://doi.org/10.1111/gcb.15513
Sengers, F., F. Berkhout, A.J. Wieczorek and R. Raven (2016) Experimenting in the city: Unpacking notions of experimentation for sustainability. In J. Evans, A. Karvonen and R. Raven (eds.), *The experimental city*, Routledge Taylor & Francis Group, London. https://doi.org/10.4324/9781315719825-2
Sengers, F., B. Turnheim and F. Berkhout (2021) Beyond experiments: Embedding outcomes in climate governance. *Environment and Planning C: Politics and Space* 39.6, 1148–71. https://doi.org/10.1177/2399654420953861
Shahani, F., M. Pineda-Pinto and N. Frantzeskaki (2022) Transformative low-carbon urban innovations: Operationalizing transformative capacity for urban planning. *Ambio* 51.5, 1179–98. https://doi.org/10.1007/s13280-021-01653-4
Sharp, D. and R. Raven (2021) Urban Planning by Experiment at Precinct Scale: Embracing Complexity, Ambiguity, and Multiplicity. *Urban Planning* 6.1, 195–207. https://doi.org/10.17645/up.v6i1.3525
Shell Global (2021) *Ensuring high quality nature-based carbon credits* [WWW document]. URL https://www.shell.com/energy-and-innovation/new-energies/nature-based-solutions.html (accessed on 27 July 2023).

Shove, E. and G. Walker (2007) Caution! Transitions Ahead: Politics, Practice, and Sustainable Transition Management. *Environment and Planning A: Economy and Space* 39.4, 763–70. https://doi.org/10.1068/a39310
Shove, E. and G. Walker (2010) Governing transitions in the sustainability of everyday life. *Research Policy* 39.4, 471–76. https://doi.org/10.1016/j.respol.2010.01.019
Shwartz, A., A. Turbé, L. Simon and R. Julliard (2014) Enhancing urban biodiversity and its influence on city-dwellers: An experiment. *Biological Conservation* 171, 82–90. https://doi.org/10.1016/j.biocon.2014.01.009
Smith, A. and R. Raven (2012) What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy* 41.6, 1025–36. https://doi.org/10.1016/j.respol.2011.12.012
Sovacool, B.K., B. Turnheim, M. Martiskainen, D. Brown and P. Kivimaa (2020) Guides or gatekeepers? Incumbent-oriented transition intermediaries in a low-carbon era. *Energy Research & Social Science* 66, 101490. https://doi.org/10.1016/j.erss.2020.101490
Sowińska-Świerkosz, B. and J. García (2022) What are Nature-based solutions (NBS)? Setting core ideas for concept clarification. *Nature-Based Solutions* 2, 100009. https://doi.org/10.1016/j.nbsj.2022.100009
Taylor, C. (2004) *Modern Social Imaginaries*. Public Planet Books, Duke University Press. ISBN 978-0-8223-8580-6
Tozer, L., H. Bulkeley, A. van der Jagt, H. Toxopeus, L. Xie and H. Runhaar (2022a) Catalyzing sustainability pathways: Navigating urban nature based solutions in Europe. *Global Environmental Change* 74, 102521. https://doi.org/10.1016/j.gloenvcha.2022.102521
Tozer, L., H. Bulkeley and L. Xie (2022b) Transnational Governance and the Urban Politics of Nature-Based Solutions for Climate Change. *Global Environmental Politics* 22.3, 81–103. https://doi.org/10.1162/glep_a_00658
Tutton, R. (2017) Wicked futures: Meaning, matter and the sociology of the future. *The Sociological Review* 65.3, 478–92. https://doi.org/10.1111/1467-954X.12443
UN (2022) *Resolution adopted by the United Nations Environment Assembly on 2 March 2022: 5/5. Nature-based solutions for supporting sustainable development* (Nairobi) [WWW document]. URL https://wedocs.unep.org/items/2aeda9ba-6bcb-44c7-a60f-a5a89c412f21 (accessed on 23 May 2023).
UNEP (2022) *Nature-based Solutions: Opportunities and Challenges for Scaling Up* (Nairobi) [WWW document]. URL https://www.unep.org/resources/report/nature-based-solutions-opportunities-and-challenges-scaling (accessed on 26 July 2023).
United Nations (2019) *World Urbanization Prospects: The 2018 Revision* (ST/ESA/SER.A/420) (New York) [WWW document]. URL https://population.un.org/wup/assets/WUP2018-Report.pdf (accessed on 13 January 2025)
van der Jagt, A., L. Tozer, H. Toxopeus and H. Runhaar (2023) Policy mixes for mainstreaming urban nature-based solutions: An analysis of six European countries and the European Union. *Environmental Science & Policy* 139, 51–61. https://doi.org/10.1016/j.envsci.2022.10.011
van der Jagt, A.P., R. Raven, H. Dorst and H. Runhaar (2020) Nature-based innovation systems. *Environmental Innovation and Societal Transitions* 35, 202–16. https://doi.org/10.1016/j.eist.2019.09.005
Vedres, B. and D. Stark (2010) Structural Folds: Generative Disruption in Overlapping Groups. *American Journal of Sociology* 115.4, 1150–90. https://doi.org/10.1086/649497
Visseren-Hamakers, I.J. and M.T.J. Kok (eds.) (2022) *Transforming Biodiversity Governance*. ISBN 978-1-108-47974-5
von Wirth, T., L. Fuenfschilling, N. Frantzeskaki and L. Coenen (2019) Impacts of urban living labs on sustainability transitions: mechanisms and strategies for systemic change through

experimentation. *European Planning Studies* 27.2, 229–57. https://doi.org/10.1080/09654313.2018.1504895
Voskamp, I.M., C. de Luca, M.B. Polo-Ballinas, H. Hulsman and R. Brolsma (2021) Nature-Based Solutions Tools for Planning Urban Climate Adaptation: State of the Art. *Sustainability* 13.11, 6381. https://doi.org/10.3390/su13116381
Weible, C.M. and P. Sabatier (2007) A Guide to the Advocacy Coalition Framework. In F. Fischer, G. Miller and M.S. Sidney (eds.), *Handbook of public policy analysis: Theory, politics, and methods*. Public Administration and Public Policy, CRC/Taylor & Francis, Boca Raton. ISBN 9781315093192
Welch, D. and L. Yates (2018) The practices of collective action: Practice theory, sustainability transitions and social change. *Journal for the Theory of Social Behaviour* 48.3, 288–305. https://doi.org/10.1111/jtsb.12168
Welden, E.A., A. Chausson and M.S. Melanidis (2021) Leveraging Nature-based Solutions for transformation: Reconnecting people and nature. *People and Nature* 3.5, 966–77. https://doi.org/10.1002/pan3.10212
Westman, L. and V. Castán Broto (2020) Urban Climate Imaginaries and Climate Urbanism. In V. Castán Broto, E. Robin and A. While (eds.), *Climate Urbanism*, Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-53386-1_6
Wild, T., H. Bulkeley, S. Naumann, Z. Vojinovic, C. Calfapietra and K. Whiteoak (2020) *Nature-based solutions: State of the art in EU-funded projects*. Independent Expert Report (Luxembourg: Publications Office of the European Union). [WWW document]. URL https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/nature-based-solutions-state-art-eu-funded-projects_en (accessed on 24 February 2025).
Wilk, B., I. Schauser and A. Vetter (2021) *Tackling the climate and biodiversity crises in Europe through Urban Greening Plans: Recommendations for avoiding the implementation gap* (Dessau-Roßlau) [WWW document]. URL http://www.umweltbundesamt.de/publikationen (accessed on 14 January 2025).
Wittmayer, J.M., F. Avelino, F. van Steenbergen and D. Loorbach (2017) Actor roles in transition: Insights from sociological perspectives. *Environmental Innovation and Societal Transitions* 24, 45–56. https://doi.org/10.1016/j.eist.2016.10.003
Woroniecki, S., H. Wendo, E. Brink, M. Islar, T. Krause, A.-M. Vargas and Y. Mahmoud (2020) Nature unsettled: How knowledge and power shape 'nature-based' approaches to societal challenges. *Global Environmental Change* 65, 1–12. https://doi.org/10.1016/j.gloenvcha.2020.102132
Xie, L. and H. Bulkeley (2020) Nature-based solutions for urban biodiversity governance. *Environmental Science & Policy* 110, 77–87. https://doi.org/10.1016/j.envsci.2020.04.002
Xie, L., H. Bulkeley and L. Tozer (2022) Mainstreaming sustainable innovation: unlocking the potential of nature-based solutions for climate change and biodiversity. *Environmental Science & Policy* 132, 119–30. https://doi.org/10.1016/j.envsci.2022.02.017
Zafonte, M. and P. Sabatier (2004) Short-Term Versus Long-Term Coalitions in the Policy Process: Automotive Pollution Control, 1963-1989. *Policy Studies Journal* 32.1, 75–107. https://doi.org/10.1111/j.0190-292X.2004.00054.x

7. Appendix: Related Papers

sustainability

MDPI

Article

Stakeholder Participation in the Planning and Design of Nature-Based Solutions. Insights from CLEVER Cities Project in Hamburg

Alessandro Arlati [1,*], Anne Rödl [2], Sopho Kanjaria-Christian [3] and Jörg Knieling [1]

[1] Department of Urban Planning and Regional Development, HafenCity University Hamburg, Henning-Voscherau-Platz 1, 20457 Hamburg, Germany; joerg.knieling@hcu-hamburg.de
[2] Institute of Environmental Technology and Energy Economics, Hamburg University of Technology, Eissendorfer Straße 40, 21073 Hamburg, Germany; anne.roedl@tuhh.de
[3] Free and Hanseatic City of Hamburg, District of Harburg, Harburger Rathausplatz 4, 21073 Hamburg, Germany; sophio.konjaria-christian@harburg.hamburg.de
* Correspondence: Alessandro.arlati@hcu-hamburg.de

Abstract: Cities are essential players in responding to the present complex environmental and social challenges, such as climate change. The nature-based solution (NbS) concept is identified in the scientific discourse and further recognized by the European Commission as a part of the solution to address such challenges. Deploying NbS in urban contexts requires the cooperation of different public and private stakeholders to manage those processes. In this paper, the experiences of establishing and managing NbS-related processes following a co-creation approach in the city of Hamburg within the framework of an EU-funded research project (CLEVER Cities) are described and analyzed. The paper identifies and discusses the main emerging factors and challenges from (1) a procedural and methodological perspective and (2) concerning the different roles of the diverse stakeholders involved. This discussion is grounded in the context of existing regulations and novel concepts for citizens' participation in urban decision-making processes. As research results, the article defines the leading players involved in the process and their roles and interrelationships, along with recommendations for future policy agendas in cities when dealing with NbS planning.

Keywords: stakeholder participation; nature-based solutions; multi-level governance; co-creation; urban living lab; sustainable urban development; urban planning

Citation: Arlati, A.; Rödl, A.; Kanjaria-Christian, S.; Knieling, J. Stakeholder Participation in the Planning and Design of Nature-Based Solutions. Insights from CLEVER Cities Project in Hamburg. *Sustainability* **2021**, *13*, 2572. https://doi.org/10.3390/su13052572

Academic Editor: Israa H. Mahmoud

Received: 4 December 2020
Accepted: 23 February 2021
Published: 27 February 2021

1. Introduction

Climate change poses cities complex environmental and social challenges. After an era of mainly favoring economic growth to the detriment of natural capital, the dual objective of addressing both elements entered European cities' political agendas [1] (p. 121). The inherent complexity of dealing with environmental and social demands requires a paradigm shift in policy-making [2].

In the 2010s, the concept of nature-based solutions (NbS) emerged in the political agendas of cities that are committed to becoming more "resilient, invest into green infrastructure and integrate nature-based solutions to improve microclimate, limit urban heat island phenomenon and improve air quality" [3] (p. 93). Given the fact that NbS are "designed to address various societal challenges in a resource-efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits" [1] (p. 121), it appears that the simultaneity of addressing challenges related to the three pillars of sustainability is one of the main objectives that can be reached through NbS. Furthermore, Frantzeskaki et al. [4] argue that NbS can be potent tools to mitigate the effects of extreme weather events and provide additional adaptation strategies for urban settlements. The European Commission has also largely adopted the NbS concept [5], such as in the Horizon 2020 Funding Programme [6]. IUCN [7] has recently published criteria for

verification, design, and scaling up of NbS to support national governments, local governments, planners, businesses, or organizations. Among the IUCN-defined criteria, the fifth states that, NbS should be based on inclusive, transparent, and empowering governance processes [7] (p. 14). This implies using the existing regulatory framework concerning participatory processes and eventually stimulating the finding of novel tools towards conducting a transparent and open process of co-creation. In this context, co-creation means allowing stakeholders to collaborate in the process of solution design, implementation, and monitoring [3,8]. In this sense, the co-creation of NbS is understood as a combination of various expertise from different scientific fields and the local knowledge of civil society representatives [9].

Kemp and Loorbach [10] argue that working towards sustainable development requires simultaneous communication between different governance levels. As also Frantzeskaki et al. [11] (p. 23) state, it is necessary to involve a wide range of stakeholders in decision-making processes at every level to create collective action for a more sustainable approach to shaping cities. Hence, decision-making processes within the field of sustainable development occur by participative momenta of exchange among composite governmental and non-governmental stakeholder constellations. This is reflected in the need to establish an everyday discourse based on the broad participation that includes both practitioners and laypersons. In this context, cities' governance structures may contain elements that can hinder or encourage participation depending on their hierarchies/political structures and processes, and they might require modifications.

This article was developed in the framework of the European-funded H2020 project CLEVER Cities, which deploys NbS to address urban challenges and social inclusion in cities [12]. CLEVER Cities' activities focus on the impacts of NbS on social cohesion, citizen security, environmental justice, and human health. Accordingly, the development of NbS happens through the active participation of local stakeholders following a co-creation logic called the Co-Creation Pathway [3]. This pathway is described in more detail in Section 2. The idea behind the Co-Creation Pathway is the broader concept of Urban Living Labs (ULL), which are conceived here as forums of innovation where resources and agencies are moving towards governed sustainable development [13] with the long-term objective of achieving resilient and climate-responsive cities [3].

By discussing how the co-creation process of NbS—including planning, design, and implementation phases—happened for the case study of Hamburg, the paper aims to answer the following question: which stakeholders should be involved in the co-creative process of the planning and design of NbS and which roles do they play in the different phases? The article explores which types of stakeholders contributed to the definition of the NbS and discusses their roles in the three Urban Living Labs (ULL) that were part of the CLEVER Cities project. Insights are provided into the tools and methods that supported the co-creation process's goals and facilitated stakeholders' inclusion. As an outcome, the article defines recommendations for future policy agendas in cities when dealing with NbS.

2. Materials and Methods

This section illustrates the methodology delineated for answering the research question and a brief introduction to the CLEVER Cities project area.

2.1. Methodology

The Co-Creation Pathway elaborated within the CLEVER Cities project by Morello et al. [14] describes a five-phase concept of co-creation to be applied in the development of NbS—namely, (i) urban innovation partnership (UIP) establishment, (ii) co-design, (iii) co-implementation, (iv) co-monitoring, and (v) co-development. Within the local project area, stakeholders are engaged to form partnerships (i) to go through the entire process from (ii) to (v). The first phase considers the establishment of a UIP. Morello et al. [14] (p. 90) describe the UIP as a "city-wide or district-focused informal alliance" between various local authorities and community groups, businesses, and academics to

promote NbS to foster urban regeneration. Ideally, this alliance formation follows the quadruple helix concept [15], which denotes the neo-institutional networks between the government, business sector, academia, and civil society that have the task of steering and facilitating the co-creation process in the project area.

During the co-design phase (ii), the UIP members organize workshops to jointly design nature-based interventions that help to solve local, social, environmental, and economic challenges. To guide the co-design process effectively, the methodological approach Theory of Change (ToC) [16] represents the primary reference for the definition of the NbS. The method consists of a systematic process that brings the attendees to address local challenges through the conception of a long-term vision. It is then necessary to work backward by setting out the overall, intermediate, and short-term outcomes and outputs to achieve the defined vision [17] (p. 12; adapted from [16]).

The second phase's solutions are operationalized in the third phase (co-implementation phase) by involving and working closely with citizens and other relevant stakeholders. The fourth phase of the pathway comprises the co-monitoring process, in which the interventions' impact, durability, and quality are evaluated. The involvement of citizens is expected in all four phases.

The final phase, co-development, describes the UIP members' and citizens' joint efforts to maintain the interventions and eventually replicate them in other parts of the city (upscaling). The presented Co-Creation Pathway results in introducing shared governance arrangements [18] that facilitate and guide the transition process with multi-level [19,20] and multi-stakeholders approaches [21].

At the time this paper was written (November 2020), the CLEVER Cities project is between phase two (ii), co-design, and phase three (iii), co-implementation. Hence, only the first two phases (namely, UIP establishment and co-design) are discussed here, including the descriptions of tools, methods, and procedures. Additionally, stakeholders' participation in NbS planning, design, and implementation is analyzed for the Hamburg case study's practical example. Therefore, a stakeholder analysis was conducted to depict the stakeholders' constellation and their characteristics in the NbS planning process—namely, providing resources and goals and taking on decision-making power and roles. The analysis was performed based on stakeholder categorization adapted from Dente [22]. Furthermore, their relations were investigated and represented on a power-interest matrix [23]. The complete analysis can be seen in Konjaria-Christian et al. [24]. The analysis provided insights into how stakeholders were interrelated in the context of the co-creative design of NbS projects and allowed identifying elements of success and failure in stakeholder participation. Based on these experiences, the paper identifies and discusses the main positive factors and challenges from (1) a procedural and methodological point of view and (2) concerning stakeholders' experiences. This discussion is grounded in the context of existing regulations and novel concepts for citizens' participation in urban decision-making processes.

2.2. General Description of the Project Area

The Free Hanseatic City of Hamburg (FHH) is one of the three city-states in the Federal Republic of Germany, with almost 1.9 million people, and has recently experienced rapid population growth [25]. The pilot area of CLEVER Cities in Hamburg is located in the district council of Hamburg–Harburg in the urban district of Neugraben–Fischbek (NF), located in the south-west of Hamburg, close to the border to the Federal State of Lower Saxony. It is the largest urban district among the 17 urban districts of Harburg in terms of surface and inhabitants [26]. The project area stretches from the center of the neighborhood of Neugraben to the new development area of Vogelkamp in the east and from the Fischbek–Falkenberg district school and old village structure to the Sandbek residential area in the west. The project area includes both existing settlements and new development areas. Additionally, the project area is surrounded by two nature reserves: Fischbeker Heide and Fischbeker Moor (Figure 1).

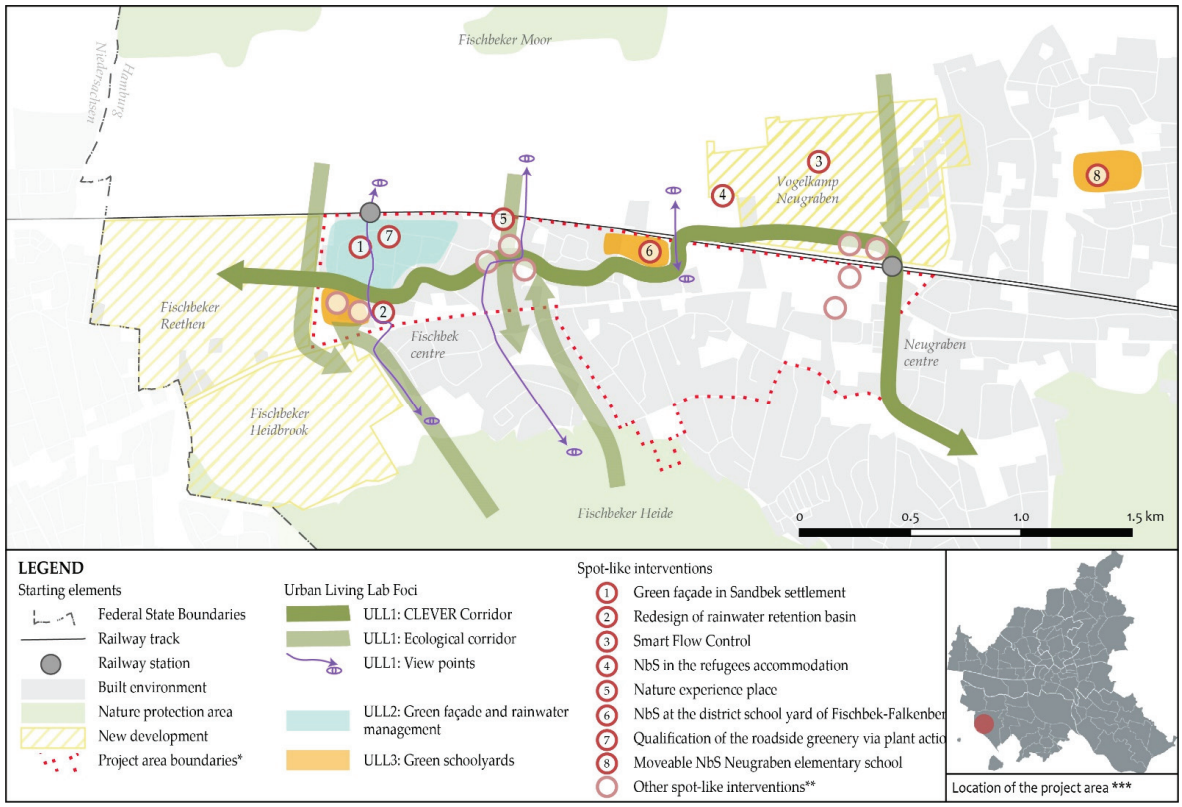


Figure 1. The CLEVER Cities project area in Hamburg. * Project area boundaries as defined in the CLEVER Cities Grant Agreement. ** Other spot-like interventions that are part of the CLEVER Cities Hamburg strategy but are not mentioned in this paper. *** Location of the project area [27]. (Own elaboration).

The project area is connected to the city center and the federal transport infrastructure through two local and federal train stations. Social housing developments are mainly located in the western part of the project area. At the time of the CLEVER activities (November 2020), three new large construction developments were under construction at the existing built area's fringe. Due to these new developments, the population is expected to increase in the district by about 40% [28]. According to the Social Monitoring Plan of 2019 [29], NF is considered to have a low or very low value in terms of social conditions and is therefore eligible for receiving special Hamburg funding for its requalification and further development (Integrated City Development Programme—RISE). Concerning the social structure, it is essential to mention that the refugees' accommodation facility, located in the neighborhood of Vogelkamp–Neugraben, has been included in the CLEVER Cities project activities (point 4 in Figure 1).

Notably, NF presents a distinct social and economic situation by hosting a varied social and spatial mix. In this context, CLEVER Cities decided to implement a range of NbS initiatives as an experimental pilot to explore the social co-benefits and environmental and economic improvements generated by the implementation of NbS. The simultaneous and reciprocal strengthening of the local community and natural resources constitutes an opportunity to address four urban regeneration challenges: human health and well-being, sustainable economic prosperity, social cohesion and environmental justice, and citizen security.

As Hamburg is a city-state, it is crucial to define the three governance levels involved in the process that will appear in the text. The term "federal level" refers to Hamburg as a federal city-state; with the term "district level," the Harburg district is meant; lastly, the term "local level" implies the urban district of NF.

3. Results

According to the framework illustrated in Section 2, the project team was set up in Hamburg before starting the co-creation process. The project team includes the District

Office of Hamburg-Harburg (DHH), three governmental institutions of the state Hamburg (Senate Chancellery; the Ministry of Environment, Energy, Climate, and Agriculture—BUKEA; and the State Agency for Geoinformation and Surveying—LGV), the urban development agency (steg), and three scientific partners (HafenCity University—HCU; Hamburg University of Technology—TUHH; and Hamburg Institute of International Economics—HWWI). An overview is provided in Table 1.

Table 1. Project team members' categorization (Own elaboration).

Institution Name	Level	Type	Resources [1]
DHH	District	Public	Political, economic, legal
Senate Chancellery	Federal	Public	Political, legal
BUKEA	Federal	Public	Political, legal, cognitive
LGV	Federal	Public	Cognitive
steg	local	Private	Political, cognitive, relational
HCU	Federal	University	Cognitive, relational
TUHH	Federal	University	Cognitive, relational
HWWI	Federal	Research	Cognitive

[1] Type of resources according to Dente [22].

The District Office of Hamburg-Harburg (DHH) is the institution responsible for coordinating all project partners and processes and implementing the local interventions. The tasks of the DHH include coordination of the Hamburg interventions and evaluation and further concretization of the project ideas together with partners and UIPs. Moreover, DHH is responsible for planning processes, contracting third parties to commission project implementation, and keeping a constant dialogue between the parties involved to ensure innovation and co-creation in the design process. The DHH acts as an intermediary for Hamburg interventions both within the district office's administrative departments and for the project's local, district, federal, and international partners. Most importantly, the DHH is the primary contact concerning issues around the CLEVER Cities project in Hamburg. Presenting and raising awareness on the project at different scales (within the administration and civil society) is one of the DHH work's cornerstones.

The other three governmental institutions represent the federal level of the city-state of Hamburg. Senate Chancellery is the leading international contact point and the coordinator for the entire CLEVER Cities project and is in charge of communicating at the state level. BUKEA is the ministry at Hamburg-level in charge of policies regarding the environment, energy, and climate. Within the CLEVER Cities project, BUKEA is engaged in developing and upscale the environmental strategy learnt from the CLEVER Cities experience at the federal level. LGV holds the georeferenced database and the cadastre land register for the Federal State of Hamburg and provides technical measurements. In the CLEVER Cities project, LGV has the task of developing, implementing, and integrating the urban data platform with new information gathered during the project's lifetime. Though not physically involved with the interventions at the local level, they contribute substantially with their specific expertise on particular aspects of the NbS interventions, and they represent the direct link to the federal level.

The local development agency, steg, runs an on-site district office in the project area to improve visibility through various activities promoted at the local level in recent years. The local presence of steg is of significant importance, especially regarding co-creation processes and citizen participation for the various project activities.

Lastly, the three research institutions involved support the local activities with their scientific competencies in urban planning, policies, and landscape architecture (HCU), environmental technology, energy, and water management (TUHH), and socio-economic studies (HWWI).

3.1. Initiating the Co-Creation Process

In 2018, to inaugurate the CLEVER Cities project's activities and ensure visibility among local stakeholders, a large-scale kick-off event was organized by DHH, BUKEA, and

steg. The event's main intention was to raise awareness about the project's objectives and provide a factual basis for further co-creation steps. The event brought together around 130 people, including citizens and representatives from private and public sectors. An innovative tool for digital participation (DIPAS) has facilitated the process of gathering valuable insights and ideas from the participants, which laid the groundwork for specifying particular interventions within three main Urban Living Labs (ULL) (Figure 2a). The content of each ULL will be briefly presented in Section 3.2.

Figure 2. (**a**) Digital participation system (DIPAS) used in the kick-off meeting (DHH, 2018); (**b**) carpet with the orthophoto of Neugraben–Fischbek (NF) in the kick-off meeting (DHH, 2018); (**c**) graphic recording during the kick-off meeting (DHH, 2018); (**d**) model of the garden in the school Fischbek–Falkenberg built with pupils and teachers (steg, 2019); (**e**) high bed realized by refugees (steg, 2019); (**f**) planting action in the Sandbek settlement (steg, 2019).

The DIPAS tool has been used not only during the event day: it was also available online a few weeks after, allowing for further contributions from the local population to the co-creative process. Additionally, a huge carpet representing the Neugraben-Fischbek urban district's orthophoto was used as a basis for further discussion and commenting during the inaugural event (Figure 2b) and other events (district festival Neugraben). Another addition to the event was the graphic recording of the event and its results (Figure 2c).

After the kick-off event, the work in each ULL started with defining the local UIPs. The definition of the local UIP is denoted as phase 1 (i) in the Co-Creation Pathway of

Morello et al. [30]. Depending on the intervention types, the UIPs were organized into various formats, such as jours fixes, workshops, and multilateral or bilateral strategic planning meetings. UIP meetings have been carried out in face-to-face format, and online meetings due to Covid-19 restrictions and dynamically adapted depending on the specific steps and goals of each ULL. Generally, the DHH initiates the UIP formation process and accompanies it throughout its development, supported by the other project team members.

During the initiation phase of the local UIPs, the project team applied the Theory of Change (ToC) method. The ToC meeting brought together the main interested local stakeholders in defining visions and incremental outcomes needed to achieve the visions set for each ULL under the moderation of the project team.

In September 2019, the project team organized its first annual UIP event, which registered around 140 participants. The meeting took place simultaneously at three different locations throughout the project area, strategically selected to implement NbS using a hands-on approach. As an example of the activities conducted, pupils were involved in building a physical model of their ideal school garden (see Figure 2d); in another location, young and old representatives were brought together for a planting action project (Figure 2f).

Additionally, the co-creation process within CLEVER Cities was not limited to the activities conducted in the three ULL. The project team brought the CLEVER Cities project's experience to other external activities and events, aiming at broader participation. Of particular importance, during the urban district festival "Neugraben Erleben," the "Sensafety-App" was presented by LGV [31]. It is a mobile application that allows users to evaluate specific locations in the project area based on their subjective impressions and perceptions of safety. The citizens' participation via the "Sensafety-App" defines one of the integral elements in the co-monitoring phase (iv).

3.2. Co-Creation Processes in Hamburg

The following paragraphs describe the implemented projects in Hamburg for each of the three ULL, with a particular focus on the co-creation process, which included the previously mentioned co-creation phases "UIP establishment*"' (i) and "co-design"(ii) with their respective stakeholders, procedures, and tools. Three different focus topics have been defined for the project area: (1) a green corridor (ULL 1), (2) green roofs and façade, and rainwater management (ULL 2), and (3) green schoolyards (ULL 3).

Funding opportunities from the Horizon 2020 Program are covering interventions and activities within the project timeframe, demanding for taking decisions towards enabling mechanisms of ownership building for future maintenance for both technical solutions, such as aquaponics (Section 3.2.2) and social solutions, such as the high beds constructed together with refugees (Section 3.2.1). Notably, because of the COVID-19 situation, alternative participation tools had to be considered to continue the co-creation processes.

3.2.1. Focus—"CLEVER Corridor" (ULL 1)

The "CLEVER Corridor" aims to establish a connection among several NbS interventions spatially spread across the CLEVER Cities project area (Figure 1). The interventions have a broad objective of connecting the two surrounding nature conservation areas with a potential bridging function. The connection effort was translated into a set of small interventions developed organically under the corridor's frame. A guiding system that will be co-created with diverse stakeholders and inclusive formats, such as workshops, will function as a recognizable sign for the corridor. Private and public entities and individual citizens were strongly involved. The CLEVER Corridor will reciprocally link all these diverse spot-like interventions and will emphasize and highlight the existing path connections between the two nature conservation areas. This ULL consists of two levels: the individual spot-like interventions and the guiding system that creates the umbrella for all projects. Therefore, co-creation in this ULL is organized in multiple UIPs established in phase 1 (i) of the co-creation process. The UIPs within the focus topic "CLEVER Corridor" are practicing and representing diverse forms of collaboration between local

stakeholders, private entities, the public administration, and universities and signal the active participation of different social and age groups in many actions along the corridor. Another intervention within the corridor's scope is the "nature experience place" project coordinated by the public management office department of DHH and facilitated by a landscaping architecture company. In this case, face-to-face participation during the co-design phase (ii) was complemented by online participation due to COVID-19 prevention regulations. For this purpose, the project team used the DIPAS tool supported by LGV and local NGOs, where citizens for three weeks had the opportunity to directly participate in the planning by choosing their favorite options of natural elements.

In the context of the "CLEVER Corridor" ULL, it is worth mentioning that the project also realized a collaboration with the refugee accommodation facility close to the new development area Vogelkamp–Neugraben (Figure 1). With the facilitation of steg and the help of translators, in the co-design phase (ii), ideas for designing mobile elements for the common exterior area of the accommodation were collected from the refugees via workshops. Successively, under the guidance of steg and the facilitation of the manager of the refugees' accommodation, refugees were involved in the co-designing (ii) of multi-purpose islands with seats and planting areas constructed out of timber and destined as places for gathering and entertainment. Additionally, this participatory process involved refugees in the third phase of co-implementation (iii) (construction and planting) of the high beds to transform the area into a place that "invites them to stay" (Figure 2e). A local NGO and a carpenter were supporting the construction works. Figure 3 shows the stakeholders' constellation in ULL 1.

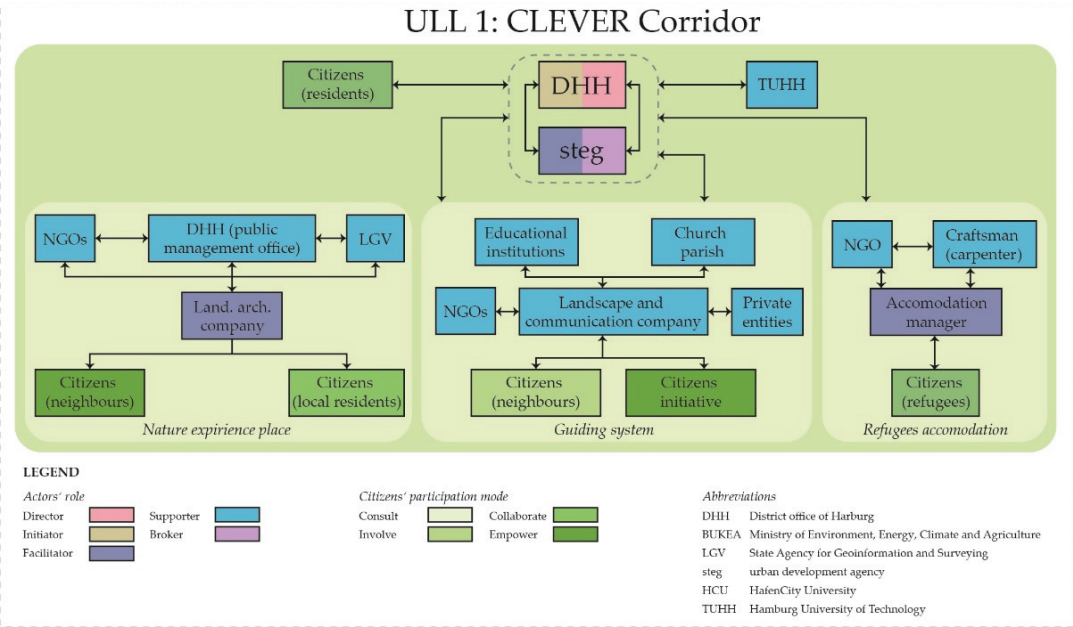


Figure 3. Representation of the stakeholders' constellation for Urban Living Lab (ULL) 1. Roles were adapted from Dente [22] (see Supplementary Material A for definitions). Roles of citizens refer to the degrees of participation according to Morello and Mahmoud [32] based on Arnstein [33]. This graph has to be understood as a simplified representation of a more comprehensive and complex stakeholder constellation. The stakeholders represented here are the project team members and the main stakeholders involved in the local urban innovation partnerships (UIPs). The constellation represented here is the one that can activate and bring on board other stakeholders for achieving the vision defined in the Theory of Change (ToC) process.

3.2.2. Focus—"Green Roof and Façade, and Rainwater Management" (ULL 2)

The focus of ULL 2 consists of two main pillars: (a) implementation of green roofs and façades, and (b) rainwater management. Interventions include the greening of a noise barrier at the train station Neugraben and installing a green façade in the Sandbek residential area. The co-creation process covers various activities, such as the ToC workshop

with the federal housing company's participation and continuous monthly meetings with project partners and Integrated City Development Programme (RISE) representatives. Throughout the period marked by strict COVID-19 prevention regulations, informational letters were sent to the residents via mail. However, on-site events (e.g., the planting action of the façade) needed to be postponed to the future.

Furthermore, awareness-raising measures regarding green roofs and façades funding possibilities have been carried out. During the annual UIP event, information about funding opportunities has been disseminated thanks to the direct involvement of BUKEA. Furthermore, press releases were issued, and additional informational material was disseminated during the urban district festival (see Section 3.1).

Building greenery is also closely related to the second pillar within ULL 2—an analysis of the Neugraben–Fischbek area's vulnerability against heavy rainfall events. The concept that will be developed based on this analysis is innovative per se, as it will be applied at the entire urban district Neugraben–Fischbek, a new scale for conducting such analysis in Hamburg. The co-creation framework has brought together many stakeholders, from the public sector to academic representatives. The local UIP members are meeting regularly through online sessions wherein the progress and next steps are discussed.

Concerning the rainwater management topic, two more projects need to be mentioned. The collaboration with the Hamburg Water management company (Hamburg Wasser) has succeeded in a pilot project using innovative Smart Flow Control (SFC) technology [34]. The public-private collaboration project is planned to be tested on a ca. 10 sq.m green roof to further optimize the retention capacity and application-controlled release and discharge water into the sewer system. Another part of the ULL 2 envisions redesigning a rainwater retention basin by building a retention soil filter. The co-creative process will see the involvement of Hamburg Wasser and landscape architecture studios under the guidance of steg and HCU. Figure 4 shows the stakeholders' constellation in ULL 2.

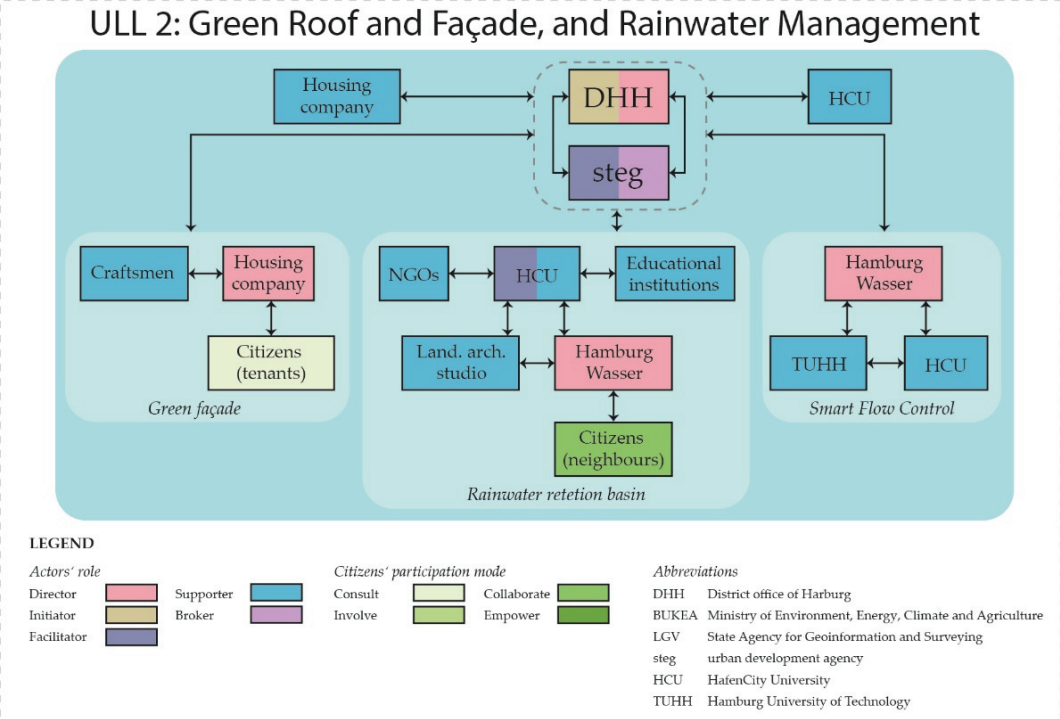


Figure 4. Representation of the stakeholders' constellation for the ULL 2. Roles were adapted from Dente [22] (see Supplementary Material A for definitions). Roles of citizens refer to the degrees of participation according to Morello and Mahmoud [32] based on Arnstein [33]. The stakeholders represented here are the project team members and the main stakeholders involved in the local UIPs. The constellation represented here is the one that can activate and bring on board other stakeholders for achieving the vision defined in the ToC process.

3.2.3. Focus—"Green Schoolyards" (ULL 3)

The third ULL is fostering the redesign of schoolyards located in the project area. At the beginning of the co-creation process, a workshop was held in the district school of Fischbek–Falkenberg to gather innovative ideas from pupils, parents, and teachers. The school staff is taking the lead in the process, which is planned to be further replicated by at least one other school in the project area. Planned interventions include the so-called researchers' garden that combines the curriculum with gardening and outdoor activities and the realization of aquaponics.

One of the participating schools (Neugrabe elementary school—point 8 in Figure 1) introduced a specific challenge for NbS implementation into the project because the school and its yard will be completely renovated in the coming years. New elements included in the schoolyard will be therefore positioned only temporarily. Hence, participants of the co-creative process were engaged to think about mobile and temporary NbS. The local UIP is composed mainly of the schools' administrations, the school building company, a teacher, pupils, CLEVER project partners (steg, DHH, and HCU), and students of the architectural faculty HCU. The solutions developed in the actual school shall be an excellent example for other schools in the urban district to undertake NbS projects with a dedicated focus on sustainability. Plans developed during the co-design process will be realized together with teachers, pupils, and parents, and with the help of steg in 2021. The ULL 3 activities are supported by an increase in teaching hours linked to environmental aspects, including sustainability topics in the school curriculum. Figure 5 shows the stakeholders' constellation in ULL 3.

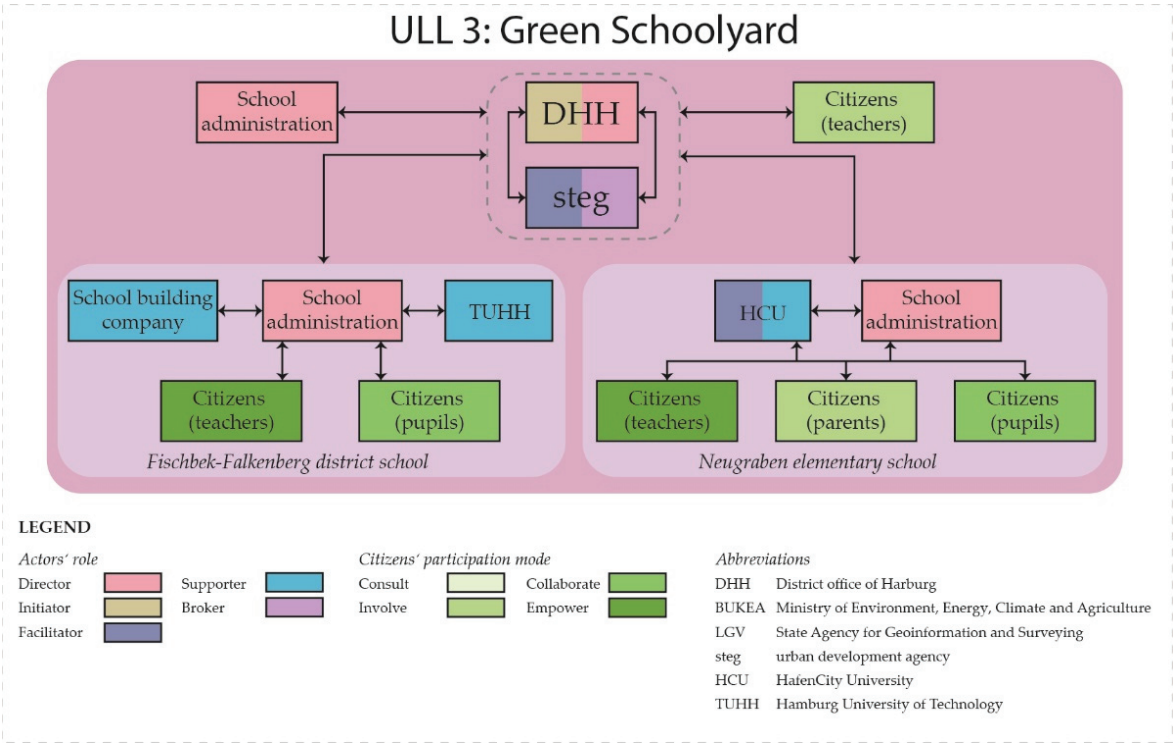


Figure 5. Representation of the stakeholders' constellation for the ULL 3. Roles were adapted from Dente [22] (see Supplementary Material A for definitions). Roles of citizens refer to the degrees of participation according to Morello and Mahmoud [32] based on Arnstein [33]. The stakeholders represented here are the project team members and the main stakeholders involved in the local UIPs. The constellation represented here is the one that can activate and bring on board other stakeholders for achieving the vision defined in the ToC process.

4. Discussion

This section identifies and discusses the main results of the co-creation experience in the Hamburg case study and their challenges regarding stakeholders' participation.

As explained in Section 3.2, various procedures and methods have been used to manage the different phases of the co-creation process. Since only the first two steps (i) and (ii) of the Co-Creation Pathway have been discussed, procedures, methods, tools, and stakeholder experiences deployed during these phases are analyzed. The first part of the discussion will concentrate on procedural and methodological issues in the first two co-creation phases, and the second part will analyze the stakeholder constellation and its implications during these phases. Lastly, recommendations are considered. Figures 3–5 represent the stakeholders and their constellation within the three ULL synthetically.

It is essential to mention that the commitment towards the EU commission and the strict allocation of funds as an incentive to apply the process is not to underestimate and brought the adoption of individual specifications and principles, such as the use of the NbS concept as a strict requirement. However, the network built during the process is expected to continue for the project's duration and even beyond. This is also obtained by establishing new and strengthening existing stakeholders' networks and applying formal and informal instruments.

4.1. Procedural and Methodological Aspects of NbS Co-Creation in the Hamburg Case-Study

Regarding the co-creation process of NbS, the systematic application of the Theory of Change (ToC) [17] guaranteed a particular path dependency of the co-creation process, which translated in a rigid but structured logic. As mentioned in Section 3, the application of ToC guided the project team and the stakeholders involved from a common understanding of the problems towards a shared definition of the objectives. Especially the inherent common sense of the ToC approach helped to structure the process. Additionally, it favored an easy understanding of the process itself also from the participants' perspective. In fact, the passage between steps is based on understanding how and why certain activities produce effects on the local context [35] and drives towards the resolutions of eventual challenges encountered. In Hamburg, the ToC process resulted in the visions and outcomes that currently guide local stakeholders in their activities on site. Further, the ToC workshop results have been fed into the co-monitoring phase (iv) of the NbS implemented in the project area.

For the co-creation process, the local UIPs played a core role as experimental interventions. They have been established for different interventions, and each case was composed of a varying set of stakeholders. Additionally, the focus area of the corridor of ULL 1 requires many different stakeholders and combinations from ULL 2 and ULL 3. Mostly classical formats like workshops and meetings to bring together the stakeholders were chosen and adapted to co-creation principles. With this, it is essential to mention that Hamburg's stakeholders had already experienced co-creation approaches through the RISE program. Hence, previous experiences have facilitated the implementation of the project framework.

Concerning the co-creation formats, the participation formats deployed in the schools (ULL 3) were suitable for catching pupils' attention for the project activities and objectives to raise their awareness for NbS specifically and sustainability issues in a broader sense. Hence, hands-on workshops to grasp people's attention and integrate them into the development processes revealed their potentials in Hamburg's case.

Nevertheless, the concept of NbS is mostly founded on capacity building and bottom-up participation (e.g., [7] p. 14) in the conviction that only participation-based processes can raise awareness on complex topics such as sustainable development (see [36]). Accordingly, a shared definition of common objectives plays a relevant role in the next steps of the NbS development process. Lastly, the ULL approach was addressed as a challenge in terms of time and resource deployed: especially, bringing together local, district, and federal stakeholders required specific facilitation and coordination competencies. Nonetheless, the

organizational process has resulted in more vital and more solid networking among the key stakeholders.

The integration of the Living Lab approach with a large event format, on the one hand, provided updates cyclically on the project and allowed citizens to get informed on the current initiatives and to contribute with different ideas and suggestions (as in the kick-off event). On the other hand, organizing and steering such a process required a considerable investment of time and human resources: activities must flow across scales in a continuous effort of communication and decisional steps, investigating and deepening each element and their interconnection [35]. Nevertheless, the two big events organized in Hamburg were useful for two reasons: increasing the project's visibility to the broader public (130 and 140 participants respectively) and synthesizing the work done so far.

The several moderation tools and methods deployed along the co-creation process were advantageous, particularly the online-tool DIPAS, the orthophoto-carpet, and the graphic recording. Additionally, the Hamburg CLEVER Team has deployed a combination of traditional and innovative tools to facilitate knowledge transfer and support the discussion along the process. The DIPAS tool, with its participatory data-table, was used in the kick-off event to collect stakeholders' opinions and visualizing issues within the project area. The advantage of using such digital participation tools is that all identified issues are immediately linked to geo-data coordinates. After the event, the conversion of stakeholder comments into a digital format was more straightforward and less time-consuming. Therefore, this tool's use led to reduced operational costs and time within the stakeholder participation processes. DIPAS was further used on a second occasion to support citizen participation in the nature experience park along the corridor in ULL 1.

As a further tool, the carpet realized with the orthophoto of Neugraben–Fischbeck was applied successfully during the kick-off event in autumn 2018 and at the district festival "Neugraben Erleben" in 2019. It attracted people to express their interests and issues in the project area: in fact, a carpet of such size catches people's eye and animates them to participate. Therefore, it was regarded as a useful tool for stakeholder activation during phase (i) of the co-creation process.

Lastly, the graphic recording of the discussion was useful to depict the outputs of the meeting visually and, at the same time, create a recognizable design for the participants.

4.2. Stakeholder-Related Aspects of NbS Co-Creation in the Hamburg Case Study

Co-creation requires managing the challenge of engaging local stakeholders to listen to all opinions and empower them to participate in policy-making actively [37]. Concerning policy-making, individual stakeholders' role is discussed in the next subsection concerning their constellations and experiences within the project activities.

Firstly, in a co-creation process, the local stakeholders' network has to be created and, secondly, to be maintained. This includes the management of the various activities conducted. While many scholars claim that local public authorities do not have power or interest in this sense (see [21]), the situation for Hamburg was somewhat different due to the central role of co-creation for the CLEVER Cities project around which the project team organized all other activities in the first two analyzed phases (i) and (ii).

Additionally, the kick-off event format with the large-scale participation created a favorable environment for the citizens to play a central role in defining the topics to debate upon [8]. Concerning the refugee accommodation facilities, the activities developed together with the residents resulted already in physical interventions (see Section 3.2.1). As a result, engagement is one of the critical elements of the NbS design process, as previously discussed.

The district public administration thus functions as initiator and coordinator of the entire process, and it was one of the main stakeholders having interests in the success of the initiatives put in place by the CLEVER Cities project (Figures 3–5). It has the authority to initiate and foster co-creation activities within its project partner capacities and by subcontracting third parties or directly commissioning works entailing the planning, realization,

and implementation of different project co-creation activities. With various stakeholders' involvement, the coordination, supervision, and approval of the commissioned work rested with the district public administration, which remained *de facto* always indirectly involved. In this way, the respect of the co-creation principles can be guaranteed if the administration is backing them. Meetings within the project team were held regularly to update on the status of the various interventions.

Additionally, the district public administration participated in several political committee meetings at the district and city level, where the CLEVER Cities project and its activities were documented. However, multiple spot-like interventions, tailored co-creation approaches for these interventions, diverse stakeholders with different institutional settings and experiences, and multilateral agreement rounds for fine-tuning the processes in some cases lead to lengthy procedures and a high workload [38]. Furthermore, since the budgetary authority rested with the district public administration, together with the coordination role and the communication activities with the Hamburg partners as well as internationally in the overall project consortium (cf. [39] p. 14), its decisional power resulted in being very relevant, compared to the other partners. However, the political constellation's multi-level character in Hamburg puts the district public administration in a constant dialogue with the Hamburg ministries level.

The BUKEA contributed with scientific expertise on the natural environment and provided support from and within institutional levels. The Ministry shares a political interest at a city-wide level, being in charge of green roofs strategy while being engaged through CLEVER Cities at the local level (see ULL 2). One of the benefits of having the different city authority levels on board is the potential for upscaling the districts' results to the city-level (vertical integration) and, similarly, its transfer to other districts (horizontal integration).

Having an urban development agency being physically present in the area allowed the project activities to be adequately spread among the residents. Organizing events and attracting people to participate were not the only advantages; also, the profound knowledge of the local (social) situation and their agency's daily contact with citizens were crucial elements for the success of the initiatives (see the role of "Broker" in Busetti and Vecchi [40]). Indeed, the presence of an intermediary organization active in citizen involvement at the local level and knowing some of the most important local stakeholders in person has proved to be fundamental in establishing a stakeholder network in the urban district. This helped the project team in several situations to get into contact with key players and to solve conflicts. Nevertheless, the local development agency's inner knowledge and moderation skills were considered substantially useful for raising awareness on NbS among local stakeholders and citizens and contributing to capacity-building processes.

Furthermore, the co-creation process was largely supported by scientific partners' involvement, both federal and international. While the structure of the framework was provided by the international project partners (UIP, ToC, Co-Creation Pathway), the federal research institutions were in charge of adapting it to the local context and translating the general framework instructions to the specific implementation level. Steering activities, data collection, and analysis of the ToC workshops' results were carried out with the help of the federal scientific partners. The practicality degree was also challenging throughout the project while providing sparks for reflections based on real case implementation. Nevertheless, the involvement of scientific partners facilitated the further elaboration of the main results to be coupled with a broader context and to be able to respond with novel and sound scientific background to the local challenges encountered.

4.3. Recommendations

Based on the aspects discussed in the previous subsections, some critical issues for NbS co-creation organization can be derived, comprising the horizontal and vertical dialogue, the essential characteristics of the stakeholder constellation, and the presence of an overarching guiding framework.

According to the contract signed with the European Commission, the project team initiated the complex participation and implementation process. The public administration played a steering role, among others, because it holds an intermediate position, guiding and supporting the initiatives on the ground and participating at the strategic level. The guiding role often signifies that the public administration plays a central role in the co-creation process. On the local side, the local development agency has been working in many directions, e.g., as a coordinator of the local activities in the urban district, as a mediator between local stakeholders and the district public administration, and as a facilitator for enhancing social inclusion. Since the administration was involved in all processes, it was perceived as close to the citizens' challenges and wishes. The district public administration's leading role in the initiation and coordination of co-creative processes has proven to be beneficial. However, it was only through close cooperation with the urban development agency that residents could be reached and co-creative processes carried out. Therefore, it is highly recommended to combine one planning (public administration) and one implementing body (local development agency) to implement co-creative processes.

The establishment of such cooperation opened up new involvement opportunities and enriched the process with additional ideas. In this sense, communication was particularly relevant in Hamburg, with the scope of informing and involving the broader public and requiring a continuous adaptation to search for a common and understandable language. Additionally, to achieve the desired outcomes defined through the co-creative process, it was necessary to establish dialogues and cooperation not only across administrative levels [41] (p. 26) but also within the institutions themselves [42]. This cross-sectoral dynamic is revealed to be of enormous importance to reaching the project's objectives concerning the inherent characteristics of NbS, which requires a certain degree of interdisciplinary, cross-sectoral cooperation and a broader view of the local challenges. Barriers could be overcome by establishing contacts, building relationships, subscribing to formal and informal cooperation formats. To some extent, changes to correct the process trajectory were envisioned and enabled by facilitation tools.

Concerning the role of civil society and academia, the entire process should be conceived to let citizens and, most importantly, disadvantaged social groups play a direct role in the implementation. This direct involvement that will be translated into co-implementation activities in the next phases of the project fosters the sense of ownership of the various co-implemented interventions and further maintains their interest to continue to take care of these interventions after their realization. Direct involvement also contributes to a certain degree of empowerment. The process's learning effects are fundamental to continuity in applying co-creation activities at the local level. Thus, thanks to the first-hand experience in dealing with NbS through hands-on workshops, it can help enhance the understanding of such complex topics to the general public. In this sense, the workshops serve as a knowledge transfer tool.

Generally, combining the several local aggregation and meeting formats (local UIPs) with the more comprehensive and outreaching annual UIP events can be considered a reasonable practice. This integration was useful for connecting the various local interventions under a broader and shared vision and informing and mobilizing a broader and more diverse group of people, thus enhancing the potential for creativity in the intervention design. Furthermore, it helps gather and synthesize the work conducted locally in a presentable way for dissemination and visibility purposes.

Working with citizens usually entails a more significant effort to prepare the various steps within the co-creation process. The timing and content of communication with stakeholders affect their willingness to participate. Keeping their interest high and showing the results coming from the discussions regularly increases motivation. Further, laypersons' involvement requires finding suitable communication formats, instruments, and wording where all can meet and agree upon, which should avoid reaching only certain groups and excluding others. The risk of excluding specific participant sets is amplified when working with vulnerable social groups, such as in ULL 1. Starting the dialogue with the

refugees requires more extended and more careful preparation. Besides the necessity of hiring translators for various languages, the main challenge is to awaken their interest in a place where they presumably intend to live only temporarily (e.g., opened in 2016, the refugee camp in Vogelkamp– Neugraben is planned to be closed by 2026).

In the current scientific discourse, co-creation processes are discussed as a potent tool to sustain the development of NbS through the involvement of all social groups [7,42] when addressing sustainability and resiliency in cities. The Co-Creation Pathway provides a guide for consistent implementation of this process yet allowing for adjustments when applied at the local level as presented in [14,30]. In Hamburg, the adaptation of the Co-Creation Pathway to the local context was facilitated by the scientific institutions by a broader involvement of civil society and other social groups in addition to the usual suspects [21]. As previously mentioned, communication and conflicts were fundamental for achieving the project's objectives because they helped reach new levels of knowledge and understanding of sustainable urban development and the role of NbS. The continuous integration of local knowledge, the support from academia, and the business sector's involvement create a potent base for developing further the initial ideas of a project. Improved organization and participation strategies include providing a foundation for a discourse, collecting examples to implement possible ideas, and proposing alternative and ad hoc approaches [4,37]. This is achieved due to a mutual and constant dialogue with the local partners and agreement on project continuation.

5. Conclusions

This paper provided insight into the current situation (November 2020) of the advancement of the NbS interventions achieved in the CLEVER Cities project in Hamburg and the interplay of the several stakeholders that contributed to the process. Hence, the analyses conducted to draft this paper refer to the interim project results. Nevertheless, some relevant outcomes can be derived to continue the work within the CLEVER Cities project timeframe and for the scientific discussion on stakeholder involvement in planning and designing NbS and some thoughts for their implementation.

Given the intrinsic multi-dimensionality of NbS, they can be identified to address complex issues characterized by uncertainty and interdependence. NbS are claimed to answer several current societal challenges [43], and foster local economies and allow inclusion simultaneously [7]. According to a co-creative model, the CLEVER Cities project's answer to this complexity is to bring various views, knowledge, and areas of expertise under the same roof.

As discussed, the project team gathered representatives from a wide range of backgrounds (Section 3.1), complemented by the sectorial expertise of the different stakeholders involved that suited the best specific interventions. It is possible to notice that the project team is frequently present as a core stakeholder within the ULL (Figures 3–5). These are the district public administration and the local development agency: for legal, political, and economic resources, the former; for proximity with the local population and experience with co-creation processes, the latter. These two stakeholders had to overview all activities being conducted and punctually activate the necessary stakeholders to address specific challenges of the selected areas of intervention.

The co-creation processes [18] (p. 273) might be a difficult and tortuous path, implying a considerable amount of time and resources to dedicate to its sustainment. Instruments and cooperation modes are critical and should not be underestimated. Concerning the Hamburg experience, it can be stated that the co-creation process benefited from the support of an overarching strategy. As an additional benefit, co-creating the NbS contributed to generating a learning effect among the participants. From the point of view of the co-creation approach's resilience in the case-site, it became apparent that formal and informal cooperation mechanisms have to be considered early in the process and should outlast the research project's duration reach a self-sustaining state.

The case study experiences showed that the experimental approach of research-based interventions could lead to new insights that will transform the existing governance settings. Hence, the co-creation principles that sustain the NbS development effort are demanding a restructuring of the decision-making processes by learning from the approaches mentioned above and becoming common practice (see [44,45]). The enlargement of participatory design solutions includes foreseeing a certain degree of flexibility, which allows reacting to problems, offering alternative solutions, and deploying different mechanisms to connect, commit, and share decision-making power with ad hoc governance models.

The described co-creation activities, the chosen pathway, and the involved stakeholders can be taken as examples of how NbS co-creation can be steered, supported, and facilitated. It was recognized that the NbS topic is of great interest among the different social groups and contributes to uniting people while achieving beneficial results for their neighborhoods and cities [8]. Additionally, district public administrations fostering the NbS idea can profit from enhanced visibility in the district and resulting benefits from new networks within and beyond the authorities' boundaries.

All this said, by addressing governance and decision-making structures, bringing together different expertise in the joint effort to address significant societal challenges, NbS are claimed to unlock potential for building resilient cities and fostering more shared sustainable development.

Supplementary Materials: The following are available online at https://www.mdpi.com/2071-1050/13/5/2572/s1.

Author Contributions: Conceptualization, A.A., A.R., S.K.-C., and J.K.; methodology, A.A. and A.R.; writing—original draft preparation, A.A., A.R., and S.K.-C.; writing—review and editing, A.R., S.K.-C., and J.K.; funding acquisition, J.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Union's Horizon 2020 innovation action program under grant agreement number 776604.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. Data are taken from Konjaria-Christian et al. [24]. The data are not publicly available due to the internal character of the deliverable.

Acknowledgments: This work has been presented at the Greening Cities Shaping Cities Symposium in October 2020 (https://www.greeningcities-shapingcities.polimi.it/ accessed on 18 November 2020). The work was prepared in the framework of the European Horizon 2020 project Clever Cities. Herewith, the authors would like to thank Jan Pastoors (DHH) and steg Hamburg mbH for their comments and suggestions for the draft and the provision of information related to local stakeholders and activities; and Fabrizio M. Amoruso from the Sustainable Architecture Integrated Design Lab of SKKU (Republic of Korea) for his general feedback on the text. Lastly, the authors would like to thank Israa Mahmoud and Eugenio Morello (Politecnico di Milano) as editors of this Special Issue.

Conflicts of Interest: The authors declare no conflict of interest.

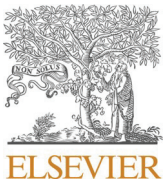
References

1. Maes, J.; Jacobs, S. Nature-Based Solutions for Europe's Sustainable Development. *Conserv. Lett.* **2017**, *10*, 121–124. [CrossRef]
2. Biermann, F. The future of 'environmental' policy in the Anthropocene: Time for a paradigm shift. *Environ. Politics* **2020**, *21*, 1–20. [CrossRef]
3. Mahmoud, I.; Morello, E. Co-Creation Pathways as a catalyst for implementing Nature-based Solution in Urban Regeneration Strategies: Learning from CLEVER Cities framework and Milano as test-bed. *Urban Inf.* **2018**, *278*, 204–210.
4. Frantzeskaki, N.; McPhearson, T.; Collier, M.J.; Kendal, D.; Bulkeley, H.; Dumitru, A.; Walsh, C.; Noble, K.; van Wyk, E.; Ordóñez, C.; et al. Nature-Based Solutions for Urban Climate Change Adaptation: Linking Science, Policy, and Practice Communities for Evidence-Based Decision-Making. *BioScience* **2019**, *69*, 455–466. [CrossRef]

5. European Commission (EC). Nature-Based Solutions: Nature-Based Solutions and How the Commission Defines Them, Funding, Collaboration and Jobs, Projects, Results and Publications. Available online: https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en (accessed on 15 February 2021).
6. European Commission (EC). Nature-Based Solutions Research Policy: EU Research Policy, What Nature-Based Solutions Are, Background, News and Documents. Available online: https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions/research-policy_en (accessed on 15 February 2015).
7. IUCN. Global Standard for Nature-based Solutions. In *A User-Friendly Framework for the Verification, Design and Scaling up of NbS*, 1st ed.; IUCN: Gland, Switzerland, 2020; ISBN 978-2-8317-2058-6.
8. Ferreira, V.; Barreira, A.; Loures, L.; Antunes, D.; Panagopoulos, T. Stakeholders' Engagement on Nature-Based Solutions: A Systematic Literature Review. *Sustainability* **2020**, *12*, 640. [CrossRef]
9. Frantzeskaki, N.; Kabisch, N. Designing a knowledge co-production operating space for urban environmental governance—Lessons from Rotterdam, Netherlands and Berlin, Germany. *Environ. Sci. Policy* **2016**, *62*, 90–98. [CrossRef]
10. Kemp, R.; Loorbach, D. Governance for Sustainability through Transition Management. In Proceedings of the Open Meeting of Human Dimensions of Global Environmental Change Research Community, Montreal, QC, Canada, 16 October 2003; (accessed on 26 February 2021).
11. Frantzeskaki, N.; Loorbach, D.; Meadowcroft, J. Governing societal transitions to sustainability. *Int. J. Sustain. Dev.* **2012**, *15*, 19–36. [CrossRef]
12. CLEVER Cities. About the Project. Available online: https://clevercities.eu/the-project/ (accessed on 13 September 2020).
13. Bulkeley, H.; Coenen, L.; Frantzeskaki, N.; Hartmann, C.; Kronsell, A.; Mai, L.; Marvin, S.; McCormick, K.; van Steenbergen, F.; Voytenko Palgan, Y. Urban living labs: Governing urban sustainability transitions. *Curr. Opin. Environ. Sust.* **2017**, *22*, 13–17. [CrossRef]
14. Morello, E.; Mahmoud, I.; Gulyurtlu, S. CLEVER Cities Guidance on Co-Creating Nature-Based Solutions: PART II-Running CLEVER Action Labs in 16 Steps. 2018. Available online: https://clevercities.eu/resources/deliverables/ (accessed on 3 September 2020).
15. Carayannis, E.G.; Campbell, D.F. Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other?: A Proposed Framework for a Trans-disciplinary analysis of Sustainable development and Social Ecology. *Int. J. Soc. Ecol. Sustain. Dev.* **2010**, *1*, 41–69. [CrossRef]
16. Weiss, C.H. Nothing as practical as a good theory: Exploring theory-based evaluation for comprehensive community initiatives for children and families. In *New Approaches to Evaluating Community Initiatives: Concepts, Methods and Contexts*; Connell, J., Kubisch, A.C., Schorr, L.B., Weiss, C.H., Eds.; The Aspen Institute for Humanistic Studies: New York, NY, USA, 1995; ISBN 0-89843-167-0.
17. Perez, I.G.; Cantergiani, C.; Boelman, V.; Davies, H.; Murphy-Evans, N. CLEVER Monitoring and Evaluation Framework. Available online: https://clevercities.eu/resources/deliverables/ (accessed on 14 January 2021).
18. Mahmoud, I.; Morello, E. Co-creation Pathway for Urban Nature-Based Solutions: Testing a Shared-Governance Approach in Three Cities and Nine Action Labs. In *Smart and Sustainable Planning for Cities and Regions: Results of SSPCR 2019—Open Access Contributions*; Bisello, A., Vettorato, D., Ludlow, D., Baranzelli, C., Eds.; Springer International Publishing: Cham, Switzerland, 2021; pp. 259–276. ISBN 978-3-03-057764-3.
19. Hooghe, L.; Marks, G. Types of Multi-Level Governance. *J. Eur. Integr.* **2002**, *5*. [CrossRef]
20. Betsill, M.M.; Bulkeley, H. Cities and the Multi-level Governance of Global Climate Change. *Glob. Gov.* **2006**, *12*, 141–159. [CrossRef]
21. Frantzeskaki, N.; Rok, A. Co-producing urban sustainability transitions knowledge with community, policy and science. *Environ. Innov. Soc. Transit.* **2018**, *29*, 47–51. [CrossRef]
22. Dente, B. *Understanding Policy Decisions*; Springer: Cham, Switzerland, 2014; ISBN 978-3-319-02520-9.
23. Bryson, J.M. What to do when stakeholders matter: Stakeholder identification and analysis techniques. *Public Manag. Rev.* **2014**, *6*, 21–53. [CrossRef]
24. Konjaria-Christian, S.; Pastoors, J.; Arlati, A.; Rödl, A.; Berghausen, M.; Quanz, J.; Robert, J.; Carlini, G. CAL Specific co-Implementation Plan. 2020. Available online: https://clevercities.eu/resources/deliverables/ (accessed on 3 September 2020).
25. Statistisches Amt für Hamburg und Schleswig-Holstein. Bevölkerung in Hamburg am 31.12.2019: Auszählung aus dem Melderegister. Available online: https://www.statistik-nord.de/fileadmin/Dokumente/Statistische_Berichte/bevoelkerung/A_I_S_1_j_H/A_I_S1_j19.pdf (accessed on 15 October 2020).
26. Statistisches Amt für Hamburg und Schleswig-Holstein. Hamburger Stadtteil-Profile Berichtsjahr 2018. Available online: https://www.statistik-nord.de/fileadmin/Dokumente/NORD.regional/NR21_Statistik-Profile_HH-2018.pdf (accessed on 15 October 2020).
27. Hamburg-stadtteile.de. Hamburg Stadtteile. Available online: http://www.hamburgs-stadtteile.de/hamburg/allnsbin/ (accessed on 4 January 2021).
28. Bezirk Harburg. *Neugraben-Fischbek: Aktives Fördergebiet*; Bezirk Harburg: Hamburg, Germany, 2017. Available online: https://www.hamburg.de/harburg/rise-neugraben-fischbek/ (accessed on 3 September 2020).
29. Frei und Hansestadt Hamburg (FHH). Sozialmonitoring Integrierte Stadtteilentwicklung: Ergebnisbericht 2019. Available online: https://www.hamburg.de/contentblob/13278936/8e978b2127057b0e459f30d81ef9f00c/data/d-sozialmonitoring-bericht-2019.pdf (accessed on 3 September 2020).

30. Morello, E.; Mahmoud, I.; Gulyurtlu, S.; Boelman, V.; Davis, H. CLEVER Cities Guidance on Co-Creating Nature-Based Solutions: PART I-Defining the Co-Creation Framework and Stakeholder Engagement. 2018. Available online: https://clevercities.eu/resources/deliverables/ (accessed on 3 September 2020).
31. Bezirk Harburg. *Das Projekt CLEVER Cities Nahm am Stadtteilfest 'Neugraben Erleben' 2019 Teil*; Bezirk Harburg: Hamburg, Germany, 2019. Available online: https://www.hamburg.de/harburg/horizon-2020-clever-cities/13703868/clever-cities-bei-neugraben-erleben/ (accessed on 3 September 2020).
32. Morello, E.; Mahmoud, I. CLEVER Cities-Co-Design Planning: Steps 07/08-Co-Creation Pathway. Available online: https://clevercitiesguidance.files.wordpress.com/2019/10/steps-7-and-8-instructions.pdf (accessed on 18 February 2021).
33. Arnstein, S.R. A Ladder Of Citizen Participation. *J. Am. Inst. Plan.* **1969**, *35*, 216–224. [CrossRef]
34. Optigrün Dachbegrünung. Smart Flow Control SFC. Available online: https://www.optigruen.de/produkte/ablaufdrosseln/smart-flow-control-sfc/ (accessed on 30 September 2020).
35. Connell, J.; Kubisch, A.C. Applying a Theory of Change Approach to the Evaluation of Comprehensive Community Initiatives: Progress, Prospects, and Problems. Available online: http://dmeforpeace.org/sites/default/files/080713%20Applying+Theory+of+Change+Approach.pdf (accessed on 30 September 2020).
36. Mauser, W.; Klepper, G.; Rice, M.; Schmalzbauer, B.S.; Hackmann, H.; Leemans, R.; Moore, H. Transdisciplinary global change research: The co-creation of knowledge for sustainability. *Curr. Opin. Environ. Sustain.* **2013**, *5*, 420–431. [CrossRef]
37. Vignola, R.; Locatelli, B.; Martinez, C.; Imbach, P. Ecosystem-based adaptation to climate change: What role for policy-makers, society and scientists? *Mitig. Adapt. Strateg. Glob. Chang.* **2009**, *14*, 691–696. [CrossRef]
38. Frantzeskaki, N.; Borgström, S.; Gorissen, L.; Egermann, M.; Ehnert, F. Nature-Based Solutions Accelerating Urban Sustainability Transitions in Cities: Lessons from Dresden, Genk and Stockholm Cities. In *Nature-based Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice*; Kabisch, N., Korn, H., Stadler, J., Bonn, A., Eds.; Springer Imprint: Cham, Switzerland, 2017; pp. 65–88. ISBN 978-3-319-53750-4.
39. Dushkova, D.; Haase, D. Not Simply Green: Nature-Based Solutions as a Concept and Practical Approach for Sustainability Studies and Planning Agendas in Cities. *Land* **2020**, *9*, 19. [CrossRef]
40. Busetti, S.; Vecchi, G. Process tracing change management: The reform of the Italian judiciary. *Int. J. Public Sect. Manag.* **2018**, *31*, 566–582. [CrossRef]
41. Cantergiani, C.; Perez, I.G.; Menny, M.; Murphy-Evans, N.; Casagrande, S. UIP Launch: Urban Innovation Partnership (UIP) Launching. Available online: https://clevercities.eu/resources/deliverables/ (accessed on 11 January 2021).
42. Mahmoud, I.; Morello, E. Are Nature-based solutions the answer to urban sustainability dilemma? The case of CLEVER Cities CALs within the Milanese urban context. In *Proceedings of the Atti della XXII Conferenza Nazionale SIU., L'Urbanistica italiana di fronte all'Agenda 2030. L'Urbanistica italiana di fronte all'Agenda 2030. Portare territori e comunità sulla strada della sostenibilità e della resilienza, Matera-Bari, 5–7 June*; Planum Publisher: Roma Milano, Italy, 2019; ISBN 9788899237219.
43. IUCN. *Nature-Based Solutions to Address Global Societal Challenges*; Cohen-Shacham, E., Walters, G., Janzen, C., Maginnis, S., Eds.; IUCN: Gland, Switzerland, 2016; ISBN 978-2-8317-1812-5.
44. Bulkeley, H.; Kern, K. Local Government and the Governing of Climate Change in Germany and the UK. *Urban Stud.* **2006**, *43*, 2237–2259. [CrossRef]
45. Kemp, R.; Loorbach, D.; Rotmans, J. Transition management as a model for managing processes of co-evolution towards sustainable development. *Int. J. Sustain. Dev. World Ecol.* **2009**, *14*, 78–91. [CrossRef]

Futures 161 (2024) 103403



Contents lists available at ScienceDirect

Futures

journal homepage: www.elsevier.com/locate/futures

Navigating urban futures: Exploring NbS upscaling discourses, practices, and relations in reimagining human-nature relationships

Alessandro Arlati [1]

HafenCity University Hamburg RTG 2725 "Urban future-making: professional agency across time and scale", Henning-Voscherau-Platz 1, 20457 Hamburg

ARTICLE INFO

Keywords:
Future imaginary
Upscaling
Nature-based solutions
Transition research
Governance perspective

ABSTRACT

Recent discussions within urban planning support nature as a potent ally to facing climate change in cities. Among all, nature-based solutions (NbS) and their upscaling have been proposed to address climate change challenges in the urban environment. Different visions on how NbS uscapling is advanced in the urban context, by whom, and for what purpose have generated conflicting imaginaries by which the city of the future could look like. Yet, this plurality has generated confusion and controversies on the 'right way' to perform NbS upscaling. Stemming from urban sustainability transition and governance research, the paper proposes a working definition of upscaling NbS based on three analytical dimensions: discourses, practices, and relations. The combination of the three dimensions suggests a new understanding of the complex phenomenon of NbS upscaling that implies the effort of different actors to frame a winning picture of NbS to be normalised as an implementable solution in the pursuit of a selected nature-based future imaginary. The paper argues for an alternative perspective on human–nature relationship that puts at the centre nature and considers tradition and locality for NbS upscaling for a greener and more just future in cities.

1. Introduction

Climate change increasingly confronts humanity with new and always more complex challenges (see IPCC, 2023). Recognising the profound and intricate interplay of natural and human systems, researchers and international organisation representatives stress the transformative role of nature in addressing climate change (Díaz et al., 2019; UNEP, 2022a). This transformative change would require a paradigm shift to achieve a desirable future that puts nature at the centre of urban environmental policies (McPhearson et al., 2021).

Recently, the concept of nature-based solutions (NbS) has gained significant traction in the global discourse as a cost-effective innovation to address social, economic, and environmental threats, harnessing the power of nature (see Cohen-Shacham et al., 2016; Seddon, 2022). Further, international organisations demand nations worldwide to prompt upscaling NbS to achieve broader systemic change (Science for Environment Policy, 2021; UNEP, 2022b). This view is shared by scholars who support the great potential of NbS as an urban planning practice to cope with climate change and start addressing the question of upscaling such solutions (Mahmoud et al., 2022; Xie et al., 2022).

E-mail address: alessandro.arlati@hcu-hamburg.de.
[1] ORCID: 0000–0003-3335–6612

https://doi.org/10.1016/j.futures.2024.103403
Received 28 April 2023; Received in revised form 1 April 2024; Accepted 22 May 2024
Available online 1 June 2024

While the necessity to upscale NbS is recognised by many, it is still under debate in the political arena and the process to achieve this goal remains unclear. This lack of clarity has both conceptual and practical origins. On one side, upscaling and NbS are ambiguous and profoundly debated concepts (e.g. Augenstein et al., 2020; Sowińska-Świerkosz & García, 2022) for which the plethora of equivocal definitions creates additional contestation. On the other, this contestation translates into conflicting ideas of urban futures proposed by urban actors, leaving each claiming sovereignty over the 'right' reasons and ways to enact NbS upscaling (Adams et al., 2023). This paper enters the debate on NbS upscaling by asking: *What are the implications for cities in selecting NbS upscaling for pursuing desirable socio-natural futures based on human–nature relationships?*

Under the premise that NbS upscaling is a promising path for achieving specific desirable futures based on innovative human–nature relationships, the paper argues that the enormous pressure from governments and international organisations to concentrate on NbS upscaling risks creating another path dependency. Drawing on future studies, the contribution of this paper is twofold: to conceptually define and fine-tune the concepts of NbS upscaling as an act of 'futuring' and to propose an analytical framework to holistically investigate this phenomenon as a process of interlinkages between discourses, practices, and relations. The paper is organised into three parts. Sections two and three address the concepts of upscaling and NbS in transition literature and touch on the creation of urgency for NbS upscaling. Based on the concept of the sociotechnical imaginary by Jasanoff (2015), section four discusses key analytical dimensions for studying NbS upscaling through a governance perspective to describe a coherent analytical framework and set the basis for further research in this field.

2. Upscaling in transition research

The research on NbS and its upscaling is strictly linked to urban experimentation. The transition literature offers a vibrant field in trying to explain transformative forces, such as those deployed in experiments. In this paragraph, a literature review of transition research offers an overview of six transition frameworks that attempt to explain upscaling processes.

Transition research has traditionally studied transformative pathways that explain the evolution of (technological) innovations towards being accepted by the wider society (Rip & Kemp, 1998). This evolution can be related to as upscaling, whereby materials, actors, and rules join together to make explicit the linkages between science, technology, and contextual (political and social) factors (Hughes, 1986, p. 282). By using projections as an anticipatory exercise to explore possible pathways and enact desirable futures, transition research has become influential in studying transformative change as an act of 'futuring' (Brand, 2016). Through (NbS) upscaling, it is possible to trigger such change, and therefore, it became a core research interest of transition studies (Bögel et al., 2022). Although many other terms exist (see Lam et al., 2020), 'upscaling' is the most commonly used and has entered the everyday language beyond academia (see the IPCC, 2023, pp. 27–29). Because upscaling has metaphorical, symbolic, and cultural meanings in addition to an actual physical increase in the scale of things (Merriam-Webster.com, 2023), its openness has generated a plethora of ontologies and epistemologies to study this phenomenon from a transition perspective. It can express the desired outcome of transition (Durrant et al., 2018; Gorissen et al., 2018; Karic & Losacker, 2023), a measurement of the potential of transformative change (scalability in Castán Broto & Bulkeley, 2018, p. 71); or a process in which new 'ways of doing, thinking, and organising' introduced by an innovation grow in scale and become the new normal (Augenstein et al., 2020, p. 143). Within transition research, six frameworks can be identified, each with its conceptualisation of upscaling.

In studying the causal connections between technological change and economic growth, the technological innovation systems framework (TIS) detects upscaling when "the impact of the new technology on the economic system" becomes relevant enough for various economic agents (Carlsson & Stankiewicz, 1991, pp. 98–99).[2] Herein, government support plays a significant role in removing barriers through policies addressing relationships between actors, cultural values, and norms (Carlsson & Stankiewicz; Jacobsson & Bergek, 2006). Hekkert et al. (2007) explain this support through three "motors of change" (p. 426). First, 'guidance of the search' describes the process of identifying problems and defining goals, which lead to new resources and knowledge development for new technological options. The second consists of the action of 'counteracting resistance' and unlocking more resources for R&D. The last sees the government lobbying for new 'market formation'.

Strategic niche management (SNM) articulates a strategic act of the government to shift socio-technological systems[3] by stimulating new (niche) technologies (Schot et al., 1994). Accordingly, SNM describes upscaling as the act of "creation, development and controlled phase-out of protected spaces for the development and use of promising technologies through experimentation", aiming at generating new learnings and widening the application of the new technology (Kemp et al., 1998, p. 186). Rip & Kemp (1998) define three 'levels' within which the 'phase-out' occurs: an overarching socio-technical landscape made of materials, rules, and culture; a technological regime, the environment of "stabilized interdependencies [between rules and cultural patterns] that shape further action" (pp. 337–338); and niches, where novelties can develop in a "protected space, in which the product can survive more easily" (p. 355). Upscaling[4] is understood as the active and strategic role of the government to gradually minimise barriers at the regime levels, allowing niche technologies to enter the market. This happens in a nondisruptive fashion, i.e. without causing social problems during the process (Kemp et al., 2001, p. 278).

According to the multi-level perspective (MLP), upscaling involves the "breaking out of radical innovations from niche- to regime-level" (Geels, 2002, p. 1262), stimulating the shift from one socio-technical system (ST-system) to another (Geels, 2004). An ST-system

[2] Carlsson and Stankiewicz talk about diffusion.
[3] Schot et al. talk exclusively about technical systems.
[4] Kemp, Rip, and Schot refer to uptake, diffusion, or adoption.

is characterised by linkages between different social (actors) and technical (materials) elements organised in ST-regimes, each based on coherent stories and symbols. Geels defines these linkages as meta-coordination between different ST-regimes, making up for clearly recognisable routines, organisations, and rules. Meta-coordination allows constant adaptation through learning, delineating dynamic stability that allows ST-regimes for incremental innovations (Geels, 2002). This dynamic stability also generates tensions and mismatches among social and material elements: these tensions create a window of opportunity that can be used for innovation to 'breakthrough' in the market (Geels, 2004, p. 914). Thus, MLP suggests an active role of ST-regimes and niches in selecting new technologies, focusing on supporting or hindering dynamics between these two levels (Geels, 2014). This dynamism introduces a temporal understanding of upscaling (Geels, 2006) and links actors, institutions, and technologies in a multi-level system (Geels, 2011).

Transition management (TM) conceptualises upscaling as different possible development pathways that lead from a dynamic equilibrium to a new one (Rotmans et al., 2001). Based on a temporal understanding of transition, TM identifies different phases: innovations are predeveloped in niches (phase 1) until they get stable enough to take off (phase 2) and breakthrough in the system acquiring momentum (phase 3); as a consequence, the system starts to change until it stabilises in a new equilibrium (phase 4). In particular, the breakthrough phase is associated with the wording acceleration, describing the "accumulation of socio-cultural, economic, ecological and institutional changes that react to each other" through learning, diffusion, and embedding (Rotmans et al., p. 17). The idea of acceleration suggests that transitions can occur at different speeds (see Geels & Schot, 2007). TM envisions a relevant role of the government that varies in all phases, both content-wise (agenda setting) and process-wise (as controller, facilitator, leader, etc.). Loorbach (2010) successfully applies a governance approach to TM and identifies four governance activities: strategic, tactical, operational, and reflexive. In this perspective, innovations alone are not considered responsible for broader system transformation. Rather, transition is the result of bringing a successful innovation (operational) from the niche to the regime level through upscaling (Loorbach, p. 176). Success means that the innovation has met the evaluation and learning expectations (reflexive) based on the commonly defined vision (strategic) and that it was able to overcome all identified barriers (tactical).

These frameworks make technology their core study object. Conversely, socio-ecological systems (SES) and socio-ecological-technological systems (SETS) focus on the dynamics between the ecosystem and society. The SES framework understands transition as a "collective management of natural resources […] within a territory" (Triboulet et al., 2019, p. 129). Mathias et al. (2020), highlighting the non-linearity of human–nature relations, base their interpretation of the SES framework on uncertainty. Accordingly, even the slightest change applied to a complex system such as the environment opens up highly diverse but equally possible transition pathways. In this conceptualisation, upscaling describes reaching specific tipping points, moments in which cumulative small changes can trigger a non-linear shift in the system (Mathias et al., p. 1). The SES framework is based on perceptions, i.e. subjective opinions of the actors when assessing a specific socio-ecological situation that drives various possibilities of change in the system. The consideration of different actors' perceptions involves social, economic, and political settings in the governance of a territory (Ostrom, 2009). With its focus on the linkages between nature and society, SES highlights the complexity of managing expectations between long-term and short-term benefits when dealing with the natural environment (Mathias et al., p. 8).

Similarly, the SETS framework considers the world as a complex, rapidly changing system of pluralism and diversity where all events are uncertain (Chester et al., 2023, p. 2). Specific to the urban context, the SETS framework urges a "paradigm shift from human-centeredness, isolation of domains, and control" and concentrates on the interdependencies of humans, nature, and technology (Chester et al., p. 3). Thus, SETS refers to a profound transformation at the institutional level to cope with uncertainty, pushing 'city managers and stakeholders' to challenge existing conceptualisations, reimagine institutional goal, promote experimentation, and foster institutions restructuring. Institutions can deploy four different strategies: 'sustained adaptation' is the ability to adapt to future surprises; 'anticipatory futures' reflect the ability to identify key signals for future trajectories, allowing for dynamic long-term time horizons understanding of problems and solutions; 'loose-fit design' represents the ability to provide more freedom in designing responsive solutions adapting to complex systems; 'co-governance' is the ability to understand knowledge as an entanglement of shared values, views, politics, and identities besides scientific data and information, favouring reflexivity.

These six frameworks have some elements in common when referring to upscaling. First, highly diverse elements, such as actors, artefacts, culture, and language, are involved in the upscaling. These elements are entangled and form complex structures and more or less stable sets of practices. Second, different levels are identified to synthesize the complexity of reality, namely niche, regime, and landscape. Upscaling seems to occur mainly between niche and regime levels, while the landscape is a stabilised set of guiding pathways (Geels, 2002). Third, upscaling is an essential and contested moment of the evolution process of innovation where different actors, beliefs, politics, markets, and culture interact and conflict (Geels, 2011). Fourth, as part of a process, upscaling can be identified as one phase among many in a more or less defined 'upscaling phase'. This phase is also called acceleration, when "new practices accumulate momentum" (Durrant et al., 2018, p. 1540), highlighting the temporal character of transition. Lastly, researchers confer a privileged role on public institutions when it comes to governing upscaling processes.

3. Constructing the future through NbS upscaling

This section discusses the concept of nature-based solutions (NbS) as a practice of 'futuring' to enhance human–nature relationship in cities. NbS are currently defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits" (UNEP, 2022c, p. 2). After briefly introducing how the NbS concept entered the current political debate, this section presents a literature review to identify key elements for understanding how socio-natural futures are imagined through NbS upscaling.

3.1. NbS concept

NbS was first mentioned in the title of a report by the World Bank promoting biodiversity conservation in combating climate change (World Bank, 2008). Afterwards, other international organisations, especially the International Union for Conservation of Nature (IUCN), started to use the wording NbS to refer to actions for combating climate change, fostering human health, and bringing economic benefits through the preservation of nature.

IUCN proposed the first known worldwide accepted definition of NbS for the IUCN World Conservation Congress in 2016: "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN, 2016). In the same year, the European Union (EU) adopted this definition with some modifications: "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions" (R&I, 2016). While IUCN focuses on the relationship between nature and society, the EU definition reveals efficiency and economic growth as central foci. The concept of NbS was successfully placed near other more well-known concepts, such as ecosystem-based adaptation (EbA) and green infrastructure (GI). The juxtaposition with other concepts and its broadened use raised essential questions concerning the policy, practice, and science of NbS (Cohen-Shacham et al., 2016) and specifically their monitoring and evaluation (Raymond, Berry et al., 2017; Raymond, Frantzeskaki et al., 2017). In response to some of these questions, the IUCN (2020) published the first standards for NbS, followed by the Handbook on NbS evaluation in the EU context (Dumitru & Wendling, 2021).

Successively, NbS started to be associated with a more active role of nature towards fostering biodiversity rather than limiting its conservation. In the EU context, the EU Biodiversity Strategy 2030 drafted in 2020 explicitly mentioned NbS to reverse the trends of green space loss in urban areas. Aspiring to reach the objective of restoring, making resilient, and protecting the world's ecosystems by 2050, the strategy aims at creating incentives and eliminating barriers to the uptake of NbS in urban areas that will require the investment of "a significant proportion of the 25 % of the EU budget dedicated to climate action" (EC, 2020a, p. 17). Underlying this statement is the general understanding that NbS must be systematically upscaled in cities to reach desired results, which otherwise would remain fragmented attempts (Cohen-Shacham et al., 2019). The EC has underlined the importance of fostering the uptake of NbS in cities multiple times in several official documents (EC, 2023; R&I, 2016, 2023). Such efforts have materialised in the Horizon 2020 research and innovation funding programme (EC, 2020b; Wild et al., 2020). Specifically, the EC allocated €282 m subdivided among 33 projects, starting from 2016–2020 (EC, 2020b, p. 7), for studying and implementing NbS, and confirmed the urgency of NbS upscaling in the new strain of investment for R&I (EC, 2022). Additionally, projects like NetworkNature (NN), platforms such as OPPLA, and working groups such as the Task Forces work to streamline interproject learning and strengthen knowledge generation on NbS. In particular, the importance of speaking different languages has been taken up by the NN project (and continued by NertworkNature+), whereby also art can play a role in proposing alternative ways of telling about nature in cities, such as the NbS comics (NetworkNature, 2022).

The increased emphasis at the political level on NbS treats the concept as a panacea for addressing sustainability in cities through the re-introduction or strengthening of nature in the urban context, and NbS eventually became an umbrella concept including all other similar approaches (Cohen-Shacham et al.; Nesshöver et al., 2017; O'Sullivan et al., 2020). The resonance was such that NbS was officially included as one of the priorities at COP26 (IUCN, 2021) and COP27 (Natue Based Solutions Initiative, 2022). Nevertheless, the utilitarian tendency of the definition and the term solution in the name make NbS a concept that primarily pursues benefits for humans and not nature itself (Welden et al., 2021). Conserving nature has also become attractive to private actors and corporations, which have entered the market of nature protection investment under the concept of natural capital (Monbiot, 2014). Big oil corporations, such as Shell Global, TotalEnergies, and ENI, developed their business strategies for a greener future by promising to implement NbS (e.g. Shell Global, 2021). However, the conduct of such actors has been flagged by activists as greenwashing or offsetting under the slogan #OurNatureIsNotYourSolution (GFC, 2020). This may create the risk of deviating from actual decarbonisation and instead supporting greenwashing and land-grabbing practices (WRM, 2021; FOEI, 2021; GYBN, Y4N, & YOUNGO, 2021; GYBN, YOUNGO, & Y4N, 2021; Melanidis & Hagerman, 2022). This has raised concerns about the definition and its possible misuse expressed by activists (CLARA, 2020) and within the scientific community (Hanson et al., 2020; Nesshöver et al., 2017; O'Sullivan et al., 2020). These critiques have shown the discursive power of NbS and the risk of treating nature apolitically (Kotsila et al., 2021; Seddon et al., 2020; Seddon et al., 2021). Also, it has been demonstrated that specific ways of framing nature enable some actors and constrain others (Woroniecki et al., 2020). In particular, Melanidis & Hagerman (2022) warn of using NbS either as a way to 'leverage the power of nature' or as a 'dangerous distraction'.

The call to clarify the NbS concept led to a new definition, developed during the United Nations Environmental Assembly in 2022, that shifts the conceptualisation of NbS from a techno-economic perspective to an ecological one (UNEP, 2022c). Following this understanding, Europe's role has been central in bringing forward the NbS concept by passing the new EU Nature Restoration Law, considered the first law worldwide on biodiversity and ecosystem protection (European Parliament, & European Council, 2022). There are still, however, concerns around justice (Y4N et al., 2022) and inequalities perpetrated through a narrative that depicts nature as a positive alien force; instead, nature is not passive nor external to human society (Woroniecki et al., 2020). While many governments, private actors, and NGOs are embracing NbS, grassroots movements and other local communities are more sceptical and cautious, rejecting NbS due to uncertainties about the term and its possible misuse, revealing a relevant gap between needs and implementation (Seddon, 2022).

3.2. Upscaling of NbS: a literature review

To answer the matter of the meaning and implications of NbS upscaling, a literature review was conducted in Scopus on the 20th of September 2023 using the following search string: "*scal* " AND "transition" AND "urban experiment" AND "nature-based solutions" OR "NbS" OR "biodiversity" OR "nature" OR "green" AND "2000 to 2023" AND "Europe (in the title, abstract, and keywords)". The reason for the last criterion reflects the attempt of the EU to position itself as the world leader in NbS research (Davies et al., 2021) and implementation (El Harrak & Lemaitre, 2023). A total of 23 articles were found. An additional 18 papers were identified through the snowball method, for a total of 41 papers reviewed. These additional papers were mainly based on the references within the 23 papers identified previously but were excluded by the Scopus research because they do not refer explicitly to upscaling. As the analysis in this paper should not be limited to terminology, these additional papers were considered relevant for the discussion, although they did not fulfil all criteria. More than half of the papers (26 out of 41) refer to urban sustainability transition, embracing a governance perspective. The review focuses on three aspects: the concept of NbS upscaling, related problems, and relevant actors involved in this process.

NbS upscaling can refer to "extending, linking or merging successful" realised NbS (Fastenrath et al., 2020, p. 63). Success implies fulfilling specific expected values (Jørgensen et al., 2022), which are translated into increased benefits for all (Kiss et al., 2022). Following a governance perspective, scholars refer to NbS as an experiment (Cortinovis et al., 2022) characterized by ad hoc governance configurations (Egusquiza et al., 2019). Such experiments are considered as showcasing (Albert et al., 2021), and if successful, they can be transformed into business cases (Frantzeskaki et al., 2020). A broader understanding of upscaling refers to the integration of NbS practices in the current policy mix (Bayulken et al., 2021; Bona et al., 2023; pp, 1301, 0168; Tozer, Bulkeley, & Xie, 2022) in combination with formal and informal instruments or approaches, such as co-creation (Mahmoud & Morello, 2021; Mitić-Radulović & Lalović, 2021). Co-creation refers to the participation of citizens, which is supposed to facilitate the integration of NbS in policies (Brokking et al., 2021; Kauark-Fontes et al., 2023). Thus, integration is another word used for upscaling: it suggests a slow process of stepping stone alignment of NbS with strategic priorities (Xie et al., 2022), thereby changing the status quo through bundling of solutions, normalisation, and mainstreaming (Tozer, Bulkeley, van der Jagt et al., 2022). Also, some authors refer to mainstreaming as alternative wording describing "the process of uptake [NbS practices] and 'becoming the new norm' in policy and planning" (Adams et al., 2023, p. 2; Hölscher et al., 2023; Kabisch et al., 2022; Tozer, Bulkeley, & Xie). Mainstreaming occurs with the support of new narratives and spaces for actors to bridge across different levels (Hölscher et al.). Each governance level has different hierarchical power relations. This reflects the "mix of agendas [of different actors] and involves interpreting, translating, or realising top-down agendas, policies, and/or strategies" (Adams et al., p. 5). Hence, upscaling can be understood as a combination of actions among local actors, such as horizontal expansion of the experiments and vertical coordination actions among actors of different levels (Petrovics et al., 2022). The concept of NbS itself implies the recognition of the more-than-human as central in NbS experiments (Pineda-Pinto et al., 2023). This change of perspective is regarded as a disruptive structural change that involves emotions, touching upon cultural and personal values (Raymond et al., 2023).

Many authors report the difficulty of NbS upscaling in cities due to the specificities of the urban context (Cortinovis et al., 2022; Dignum et al., 2020; Shahani et al., 2022) and the regime structure, which is considered stable and dominated by rational thinking (Hansen et al., 2022; Kabisch et al., 2022). Resistance from the regime to the integration of NbS in policy can refer to the existence of current technologies and infrastructure; existing actors' networks and organisations; dominant cultural values, policies, regulations, economic mechanisms, and funding structures; and inadequate knowledge and user behaviour (Dorst et al., 2021; van der Jagt et al., 2023). In addition, the upscaling of NbS in one region can lead to problems in other regions (Anderegg et al., 2020), demanding efforts in cross-boundaries collaboration. While some authors criticise the incrementalism of change as non-disruptive enough (Hansen et al., 2022), others point out that some NbS never actually leave the experimental state (Rizzo et al., 2021), underlining a gap between the experiment and its adoption into practice (Barbanente & Grassini, 2022). The effective upscaling of NbS practices is also hindered by the different understanding of the concept of upscaling itself (Adams et al., 2023; Dorst et al.; Fastenrath et al., 2020; Schmid & Taylor Aiken, 2023). An excessive instrumentalisation of upscaling would tend to privilege novelties over already existing (and functioning) solutions and contribute to creating a politics of urgency through the narrative of "impact-effecting change-the-world perspective" (Schmid & Taylor Aiken, p. 5). Additionally, NbS upscaling is obstructed by competing visions of nature (Kabisch et al.; Tozer, Bulkeley, & Xie, 2022), whereby only the most powerful actors' idea of nature wins (Kiss et al., 2022). Also, NbS can be seen as reframing older concepts that risk being oversold as a panacea based on an idealised nature (O'Sullivan et al., 2020). This reframing raises the matter of justice both for society as a whole and for nature itself (Pineda-Pinto et al., 2022).

Given these caveats, researchers agree that NbS upscaling requires inter- and transdisciplinary expertise (Adams et al., 2023; Fastenrath et al., 2020; Kabisch et al., 2022; Kiss et al., 2022). Scholars call for actions that lead to capacity building, favouring the link between science and political commitment (Frantzeskaki et al., 2020) with the support of data monitoring and evaluation models (Xie et al., 2022). Thus, connecting different levels, visions, and actors appears essential for the proper governance of NbS upscaling. Co-creation, co-governance, or similar all-including approaches contribute to rising expectations on the success of these processes, most of the time clashing with the complexity of reality (Mahmoud et al., 2023; Mahmoud et al., 2021). In this direction, Bradley et al. (2022) suggest that these promises cannot be maintained throughout the process. In contrast, an ideal governance setting would instead require actors to collaborate in a hybrid setting in between a complete horizontal and bottom-up model and a command-and-control approach. Hence, a relevant role is attributed to the figure of the connector or intermediary in linking adequately different governance levels (Petrovics et al., 2022), primarily through mediation in communications (Adams et al.; Fastenrath et al., 2020; Xie et al.). Communication between levels and actors can influence how systemic changes occur (Frantzeskaki et al., 2022). Through communication, new significance can be attributed to NbS through novel storytelling, which could lead to

building other actors' networks (Hölscher et al., 2023). By describing a tactical scaling for NbS, Schmid and Taylor Aiken suggest considering diverse factors of NbS upscaling, namely: which is the type of NbS to upscale, why, for whom, and by whom; which power unbalances are present and are generated through the upscaling; and which temporal orientation to consider, mediating between the urgency of upscaling and the 'patience' needed to account for the slow growth of nature (Alberti et al., 2020).

4. Enacting socio-natural imaginaries through NbS upscaling

Because there is no consensus on how cities will look, N. Brown et al. (2000) emphasise the co-existence of parallel and contrasting visions of the future, each supported by specific groups of actors sharing defined interests and beliefs. Once a specific idea of the future is commonly shared, it can be called an imaginary, i.e. "collectively held and performed visions of desirable futures" that are temporally situated and culturally particular (Jasanoff, 2015, p. 19). Having implications on both the material (e.g. nature, people, buildings) and the non-material (e.g. values, culture), NbS upscaling represents a complex pathway to enact specific imaginaries of a particular urban future. Baker & Ruming (2015) analyse the effects of urban future imaginaries on spatiality. While each urban imaginary is probable per se, groups of actors can deploy "strategic and political tools […] to achieve political objectives" (Baker and Ruming, p. 66). These groups work constantly to create "powerful political narratives [which] capture future promises" in creating a specific urban imaginary of the future (N. Brown et al., p. 9). Creating specific urban future imaginaries produces pre-determined pathways that can directly influence the direction of innovation development (Geels & Smit, 2000). In turn, selecting a particular innovation and its practices and materiality can obstruct other futures and create path dependency (N. Brown & Kraft, 2006). The understanding that humans can influence the future implies that such futures can be, to a certain extent, governed, thus creating the new expert category of the future maker (Adam & Groves, 2007, p. 80). Sections 2 and 3 of this paper have shown that the upscaling of NbS in the urban context can be fundamentally treated as a political subject whereby the construction of futures is determined by the framing of a problem and its solutions by groups of future makers through a narrative of urgency that creates path-dependent actions.

Thus, this paper argues that *NbS upscaling in cities is a process of 'futuring' by which urban actors deploy NbS as newly routinized practices to enact a specific urban future imaginary*. This includes an emotional re-definition of human–nature relationships, the just

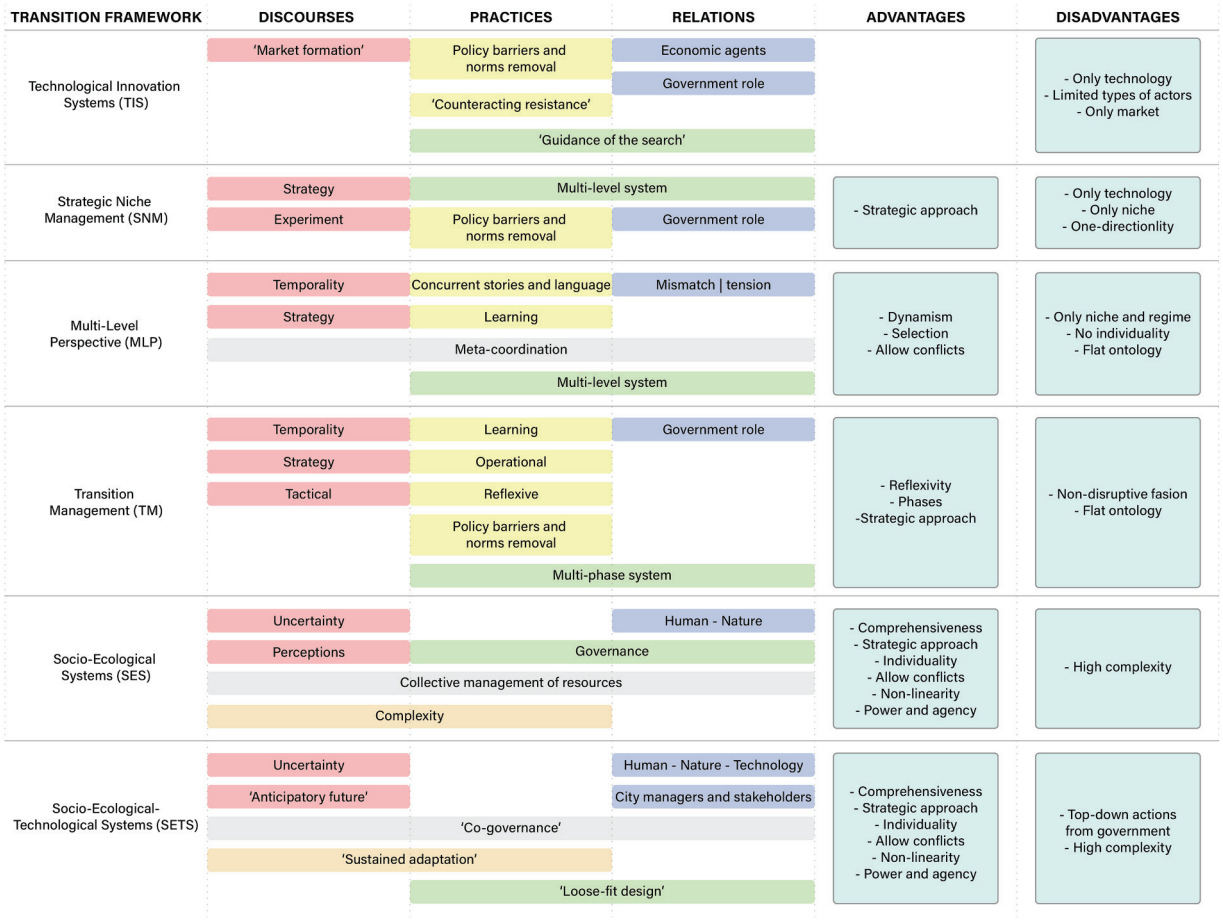


Fig. 1. Key elements of the six transition frameworks organized in discourses, practices, and relations. The advantages and disadvantages of each framework in studying NbS upscaling as a practice of 'futuring' are reported in the last two columns (Author 2024).

inclusion of nature in everyday practices, and the capacity to work inter- and transdisciplinarily between different actors. Hence, upscaling NbS designates a complex process of entangled material and non-material elements whereby it is relevant: what future is to be achieved, how that future is communicated, how existing practices are malleable for accommodating that communicated future, and which actors deploy what resources to support the achievement of that future. Based on this definition, the article identifies three analytical dimensions to study NbS upscaling as a performative process of imagining futures: discourses, practices, and relations. Fig. 1 presents key elements of each transition framework organized within the three proposed analytical dimensions. The three dimensions and their interdependencies are discussed in the following pages.

4.1. Discourses: rightly communicating the 'right' imaginary

A performative understanding of urban future imaginaries highlights how discourses function as methods to secure a specific future (N. Brown et al., 2000). In the discourse literature, discourses are defined as an "ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices" (Hajer & Versteeg, 2005, p. 175). Discourses follow some rules that are organized in frames. Framing means "making a piece of information more noticeable, meaningful, or memorable to audiences" (Entman, 1993, p. 53). Policy actors use different frames to make their discourses more plausible and to gain supporters (Dodge & Lee, 2017). This understanding shows that futures are objectified and can be disembodied and decontextualized by actors to be at will filled with beliefs, values, ideas, etc. (Adam & Groves, 2007).

Thus, the frames conveyed by discourses can guide specific sustainability transition pathways (Wittmayer & Loorbach, 2016, p. 20), exercising the social action of 'visioning' and 'futuring' (Brand, 2016). In response to the urgency to act in the face of the current climate change challenges, NbS upscaling can be seen as the selected pathway towards a specific urban future imaginary, whereby the 'need to upscale' acquires a political connotation (Castán Broto & Bulkeley, 2018). By becoming fashionable, NbS upscaling has created political tensions between international and local policy-making levels that have translated into organisations at the international level, such as the EU, devolving responsibility to local governments to conduct the upscaling of innovations a priori (Pfotenhauer et al., 2022). As a result, cities are pulled "into a hyper-competitive game whereby they must produce a narrative of innovation to get money" (Hodson et al., 2018, p. 1495). This understanding of upscaling requires governments to demonstrate "fast and visible returns on investment and impact at scale", often resulting in over-promising and quick but short-lived wins (Schut et al., 2020, pp. 1–2). Similarly, expectations of specific urban future imaginaries can steer or hinder a transition pathway, especially when these futures are uncertain and complex (Tutton, 2017). In fact, discourses can support dominant existing structures rather than promoting transformative change by "providing agency and legitimacy to a larger group of actors who then support the existing system" (Leipold et al., 2019, p. 455).

From a discourse perspective, networks are understood as groups of actors sharing the same set of beliefs and responding to a selected urban future imaginary. The advocacy coalition framework describes a recognisable network of actors following a single storyline and pursuing a stable equilibrium where different advocacy coalitions try to impose their frames over others' frames to reach stability, which can last more than a decade (Zafonte & Sabatier, 2004). The discourse coalition concept offers a more dynamic understanding of networks. Maarten Hajer defines 'discourse coalitions' as groups of actors sharing a common interpretation of the world, which structures their individual and collective actions (Hajer, 1993). A discourse coalition is described as dominant if all actors accept the new discourse structure, and this leads to its institutionalization (Hajer, 1993). Herein, the path dependency created by the specific urban future imaginary creates a network of actors that is based on commonly communicated expectations (N. Brown et al., 2000).

Within SNM, strategies of upscaling are elaborated and communicated by urban actors based on expectations. Drawing on institutional theory and the sociology of expectation, Konrad et al. (2012) consider discourses as actors' "public communication activities about the novel technology" (p. 1087) through which alternative trajectories are put to the fore. As environmental problems are socially constructed and subjectively experienced, no consensus around 'right' or 'wrong' can easily be reached. Thus, transitions count on languages, values, and symbols to enact certain pathways or justify specific choices (Brugger & Henry, 2021). The TM cycle offers a strategic approach to guide urban actors along this complex process and allows for reflection on past choices. MLP considers the simultaneous existence of conflicting ideas specifically arguing for tensions and mismatches; whereas TM and SNM advocate for a more linear process. Conversely, SES and SETS explicitly embrace uncertainty and highlight the need to understand upscaling as a non-linear process including mechanisms of reproduction and routinization of innovation to control the complexity of current environmental problems (Shove & Walker, 2010, p. 475). Thus, the attempt to upscale NbS can be understood as the "endeavour of normalising an idea from one policy domain into the decision-making and routine activities of other policy domains" to deliver effectiveness over the long term and try to persuade other actors to follow that idea (Scott et al., 2022, p. 201).

In this context, NbS upscaling can be understood as the attribution of new meanings of nature developing from actors' discourses at different governance levels to enact a specific urban future imaginary. Thus, relations affect discourses by defining the rules within which discourses take place and how, and discourses affect relations by setting the agenda and defining acceptable relations.

4.2. Practices: upscaling as routinization of innovations

Jasanoff (2015) claims that understanding urban future imaginaries necessitates investigating action and performance beyond language. As the future can be considered a realm that can be governed, its performativity also affects everyday practices that must deal with uncertainties regarding future scenarios (N. Brown et al., 2000). Adam and Groves (2007, p. 6) refer to knowledge practices

as actors' attempt to provide structural security for society. For sustainability transition research, upscaling symbolizes a destabilisation of this security. SNM, MLP, TM, and SES describe a process when "new practices accumulate momentum" (Durrant et al., 2018, p. 1540) and, thus, the acquisition of a new set of routinized actions through structural change. Yet, TIS refers only to economic agents and, therefore, does not include the broader set of urban practices. SNM remains linked to a linear and one-directional action between niche and regime. MLP, TM, SES and SETS address practices more comprehensively. Yet, transition research rarely considers the everyday activities of the users it aims to study (Hargreaves et al., 2013; Shove & Walker, 2007). Additionally, MLP tends to conceptualize regimes as compact blocks, leading to difficulties distinguishing individualities (Schot & Kanger, 2018), and its notion of upscaling mostly follows linear and hierarchical ontologies (Bouzarovski & Haarstad, 2019). While TM refers rather to a non-disruptive change, MLP and SES accept more courageous actions towards the destabilization of existing regimes. SES and SETS refer to a broader and collective attempt to manage resources and drive transformation. Considering regimes and practices "as overlapping and closely interlinked entities that hold one another in place and mutually coevolve" (Hargreaves et al., 2013, p. 416), the combination of practice theory, the governance perspective, and transition research looks at upscaling as processes of collective appropriation of new practices in everyday life (Shove & Walker, 2010; Welch & Yates, 2018).

Coming from organisational studies, Nicolini uses the concept of 'site' to describe the geography of practices (and of experiments) by which one activity becomes the resource and antecedent for others, forming "complex nets with dense patterns and mutual references" (2011, p. 603). The site suggests a specific location of the practice and in a specific place in time. Practices are, therefore, not isolated events; rather, "practices […] constitute enduring regimes of activity" (Nicolini, 2009, p. 1405). The interface between practices and their context suggests a continuous adjustment of internal rules through the carrying out of the practice. The tensions between practices and context create preferable courses of action while refusing others: power thus plays a role in defining the 'right' practice to promote (Nicolini & Monteiro, 2016). In turn, the chosen practice pre-determines and limits others' actions, which are not part of the selected urban future imaginary. The stabilisation of any connection is based on the ability to "reinterpret, represent, or appropriate" others' interests through a negotiation process where power is exercised (Nicolini, p. 605). Reckwitz (2002) defines discursive practice as a type of practice through which the world is meaningfully constructed through language (p. 254). This conceptualization of practices as discourses is not explained simply in linguistic terms, but rather on how the truth is being told (Bacchi & Bonham, 2014). Similarly, the creation or elimination of specific urban future imaginaries and their adoption at a broader level is the result of an act of power by individuals or a small group of individuals (Jasanoff, 2015) in the understanding that the humans can transform the future by controlling and imposing "one's will on the world" (Adam & Groves, 2007, p. 98).

In a later work, Hajer (2006) defines a discourse coalition as a "group of actors that, in the context of an identifiable set of practices, shares the usage of a particular set of storylines over a particular period of time" (p. 70). Practices are defined here as embedded routines and mutually understood rules and norms that provide coherence to social life. Accordingly, linguistic utterances cannot be usefully understood outside the practice in which they are uttered. Actors in a discourse coalition use storylines to produce, reproduce, and transform particular discourses and the practices linked to them. Similarly, Nicolini explains that a practice "constitutes the figure of discourse" (2011, p. 602). Through discourses, actors enable the formation of new practices or the modification of existing ones by setting the agenda and framing acceptability for practices. Additionally, Nicolini and Monteiro argue that to examine practices, they must be turned into discursive objects. In their view, practices are defined as "orderly sets of materially mediated doings and sayings", where mediation occurs through an act of translation, a negotiation between the different interests of the carriers of specific practices (Nicolini & Monteiro, 2016, p. 110).

While Reckwitz states that "practice theory does not place the social in discourse, nor interactions" (2002, p. 249), Davide Nicolini (2011) instead argues that practices must be studied according to a relational ontology, suggesting that actions, reactions, and interactions make sense of the practices in a spatially and temporally determined context. His concept of 'site' contributes to explaining reality as being formed by a nexus of interconnected practices. This interconnectedness is facilitated by an act of 'translation' as in the actor-network tradition. Through this translation, connections between entities are established among actors carrying out different practices (Nicolini, 2011, p. 605). As a particular type of communication, translation involves an act of appropriation of the practice to be translated, whereby a selection of the features an urban future imaginary should have occurs. Power and agency are, therefore, fundamental to successfully arguing for following trajectories that will enact specific futures (N. Brown et al., 2000). Altogether, the inherent relationality described by Nicolini and Monteiro makes practices as "meaning-making, order-producing, and reality-shaping activities" (2016, p. 114). Rules, habits, and culture contribute to these activities of practice and provide a 'safe' structure to refer to (Adam & Groves, 2007).

As power and interests define which connection is maintained and which is discarded, discourses provide the structure in which the selection of practices takes place. Hence, the upscaling of NbS can be seen as enhancing and justifying new practices by the selected urban future imaginary through discourses.

4.3. Relations: networks for supporting future imaginaries

As action is not possible in isolation, the enaction of urban future imaginaries creates a divide between actors that support a specific urban future imaginary and actors that endure it, or, using the words of Adam and Groves (2007), between future makers and future takers. Accordingly, future makers actively create some futures while eliminating others by spoiling or filling them with new meanings. Aiming to enact the urban future imaginaries they prefer, actors intentionally engage in the political debate around upscaling and form networks (Smith & Raven, 2012). Sustainability transition research focuses on social actors' contributions to achieve a broader change (Wittmayer et al., 2017), whereby (NbS) upscaling can be read as meanings and learnings actively transferred from a single individual to the level of society (Bögel et al., 2022, p. 180). MLP uses the concept of meta-coordination to depict this transfer; whereas TM

envisions strategic actions based on learning and interpretation. Specifically, intermediaries are actors situated at the interface between niche and regime and can hold more or less power according to the dimension and number of 'entities' (individuals and networks) they can connect (Kanda et al., 2020). Sovacool et al. (2020) address the matter of power by describing hindering (gatekeeper) or supporting (guide) roles. SNM, TIS, SETS, and TM focus on the role of governments in removing or reducing barriers to the transfer of innovations and learning. However, TIS and SNM contemplate mainly two types of actors: the government and economic agents, whereas MLP and TM mainly consider all actors involved in the process of upscaling being represented by a single voice and pursuing the same objectives (Augenstein et al., 2020; Hermans et al., 2016) thus failing to account for contrasting, conflictual, and incumbent orientations (e.g. R. R. Brown et al., 2013; Durrant et al., 2018; Grin, 2010a; Pesch, 2015; Westley et al., 2013).

In social network theories, actors situated between networks have been invested with a fundamental role in bringing about innovations (and upscaling them). These actors have the power to create new relations and bring novelty benefiting both connected networks (Burt, 2003; Vedres & Stark, 2010). David Obstfeld (2017) proposes three orientations that can be assumed to guide the upscaling of innovation towards specific urban future imaginaries: actors can exploit their influence and power by manipulating the network to shut other actors out (*tertius gaudens*); incentivise strategic connections or ease coordination (*tertius iungens*); or pass information neutrally without any attempt of altering existing relationships (conduit).

Further, transition research considers power mainly with a negative connotation, as being a feature of existing structures used to foster stagnation rather than change (Giddens 2002, in Avelino, 2021). Avelino, working on the nexus between power and politics, argues that power is possessed by actors and can either be used or not used in a given situation. Accordingly, upscaling processes can be understood as disruptive events producing new power relations or as reproducing existing relations (Avelino, p. 442). MLP, by accepting co-existing and conflicting ideas, offers the possibility to account for power and agency; but its flat and linear ontology limits the understanding of more complex systems proper of the natural environment. SES and SETS talk generally about city manager and stakeholders but suggest a more profound interrelation between human, nature, and technology and accept conflictual actions on the base of different perceptions and expectations.

From the network literature, the relational sociology of Harrison White and colleagues considers communication as foundational for understanding social phenomena. They see communication as a motor through which social structures are reproduced and stabilized. Ann Mische (2003) argues that social networks evolve as a result of a series of communicative events. In this view, relations acquire importance based on their ability to govern the communication process. As relations are based on communication and generate meaning, it is possible to study relations not only between groups or individuals but also between practices and events (Mische). Jan Fuhse takes this conceptualization further and argues that the reality of networks is characterised both by the ability of identities and relations to form a 'meaning structure' (Fuhse, 2009) and by 'regularities of communicative events', suggesting that relations are the results of the continuous process of meaning formation resulting from the series of communicative events. Therefore, actors give importance to the continuity of communication and the relations built through the series of events rather than on the single events per se (Fuhse, 2015).

By linking discourses and relations ontologically, it is possible to understand network structures and the meaning behind these structures (Fuhse & Mützel, 2011) to explain the influence of specific urban future imaginaries on the urban context. Additionally, recent work on social innovations links discourses and actors on different levels of governance. Communications among actors occur differently according to the specific technical and institutional features of each governance level (Pel et al., 2020), creating distinct meaning structures that can become incompatible. Similarly, Hajer's concept of discourse coalition can be used to understand how discourse affects the positions (or relations) of actors created out of the discourse (Lynggaard, 2019). According to the morphological characteristic of the network, relations can be altered more or less easily through the advent of a new practice and the work of actors holding in-between positions. In this sense, it is possible to connect the concept of translation with the one of the tertius. The orientation of the tertius in its three described variants can be deployed to explain the dynamics that can bring either the modification of existing practices or the introduction of new ones, depending on the particular context.

Thus, the upscaling of NbS can be interpreted as the adoption of specific practices facilitated by actors' relations to pursue a selected urban future imaginary. In contrast, the selection of practices defines, in turn, which relations are allowed.

4.4. A governance perspective: socio-natural imaginaries

Stemming from transition governance, urban sustainability transition claims that through the upscaling of innovations, it is possible to steer urban development towards a more desirable future by triggering political and institutional transformations of current 'unsustainable' pathways (Loorbach & Shiroyama, 2016). As such, it considers holistically the interdependencies between institutions, actors, culture, and practices concerning solving specific and commonly defined governance problems (Dorst et al., 2021). Thus, upscaling is not limited to a phase-out of innovation – as in TIS and SNM – but involves a restructuring of political and institutional systems in a broader sense through the interactions of politics, society, and markets (Grin, 2010b). The management approach in TM, MLP, SES, and SETS towards transition refers to a broader and more comprehensive understanding of environmental issues, which are diverse, specific, and complex (Meadowcroft, 2002, p. 176). As sparks of novelty that challenge the status quo, urban experiments are instruments to control and facilitate the governance of new and complex changes (Durrant et al., 2018; Ehnert et al., 2018; Schut et al., 2020). Urban experiments can create interlinkages between people and place (and nature), challenge current systems structures, actors' relations, and policies, and promote systemic approaches to social-ecological-technological systems (Frantzeskaki et al., 2021). Reflecting on the experience within the experiment allows a better governmental response to environmental challenges and facilitates the upscaling of innovation (Rotmans et al., 2001). Experimentation also allows for reflection and learning. Pahl-Wostl suggests a form of adaptive management based on social learning. Through learning, it is possible to provoke changes in existing structures, which in

turn influence the learning process as well (Pahl-Wostl et al., 2010). In this sense, social learning is the base for breaking through innovation and shifting from one governance regime to another. Urban sustainability transition authors have used the multi-level governance (MLG) model to describe the relations between planning and policies in the upscaling of new practices, stressing the involvement of societal actors in decision-making positioned at various levels of governance (Frantzeskaki & Tilie, 2014; Gorissen et al., 2018). In between these levels, the role of mediators, translators, networkers, and intermediaries are considered vital for the upscaling process (Ehnert et al., 2018; Naber et al., 2017; Sengers et al., 2021). Thus, the governance perspective describes upscaling as a sum of fundamental changes in 1) practices, referring to behaviour, beliefs, and routinised actions; 2) culture, related to values, norms, and ethics; and 3) structures, namely institutions, rules, and laws (Ehnert et al., 2018; Frantzeskaki & Haan, 2009; Gorissen et al., 2018; van den Bosch & Rotmans, 2008).

However, while upscaling is considered by transition research a specific and limited phase of innovation development, its effects perpetrate temporally and spatially far beyond that phase as "long-term change [is] messier and more conflicted than transition management intimates" (Meadowcroft, 2009, p. 335). The process of upscaling seems to be a natural evolution for the innovation, as the wording 'mechanism' used in the transition literature suggests (Adams et al., 2023; Durrant et al.; Fastenrath et al., 2020; Karic & Losacker, 2023; Lam et al., 2020). Instead, upscaling would consider a much deeper process of production and reproduction of practices and knowledge linked to the upscaled innovation. In fact, MLP stops its interpretation of upscaling with the newly established system and does not inquire about successive dynamics. Similarly, experiments in their protected space tend to be treated as isolated from other urban processes. This implicitly creates discrepancies on temporal and spatial scales with the existing political system that is supposed to govern the desired shift through upscaling (Tozer, Bulkeley, van der Jagt et al., 2022). Additionally, the reflexivity exercise celebrated by TM has paradoxically produced an increase in uncertainty about the future, whereby any action to counteract climate change requires caution, even if causal connections are clear (N. Brown et al., 2000). In fact, examples of unsuccessful upscaling have been documented, revealing a grounded mismatch between theory and practice (Augenstein et al., 2020; Bossink et al., 2023). In their seminal book, Adam and Groves (2007) attribute to this mismatch a profound dis-embedding of the technology from its social context. They describe a politics of broken promises whereby administrators and regulators tend to represent material objects abstracted from the society, and always more specialised and discontinuous knowledge risks losing the bigger picture (p. 87). Hence, dealing with nature recalls a more profound link with the context, in the understanding that nothing works in isolation. In this sense, the TIS framework is not appealing to discuss NbS upscaling as it refers exclusively to technology; while SNM considers actions only between niches and regimes, excluding the context. Although MLP and TM link upscaling with broadening, widening, and including more elements in the attempt to make sense of the complexity of reality, the simple addition of measures, actors, and meanings leads to increased intricacy and variety of possible answers (Meadowcroft, 2002). SES and SETS try to deal with such complexity by embracing uncertainty in constructing pathways for governing the future of human-natural systems. However, complexity, as celebrated today, can lead to a moral nihilism whereby agency, causes, and responsibilities are too distributed and promiscuous (Jasanoff, 2015, p. 16). To conclude, introducing a political dimension in urban sustainability transition seems imperative to understand how societal interests are considered, how institutions can shape or hinder specific future trajectories, and how ideas of the future shape the definition of the problems and the acceptance of solutions (Meadowcroft, 2011).

The complexity of the NbS upscaling process, which involves the three dimensions discussed, originates in the increased uncertainty of dealing with futures dominated by discursive practices faced with the increased uncertainty of dealing with futures dominated by the spectre of climate change and its material manifestations (Tutton, 2017, p. 480). The six transition frameworks attempt to navigate this complexity by comprehensively including all measures, actors, and meanings. However, the governance perspective on transition, attempting to create a consistent structure, neglects how forms of power and agency impact processes in highly political ways (Meadowcroft, 2009), thereby often creating additional problems rather than solutions. Also, upscaling is not only a phase of transition; rather it is a more comprehensive process to embrace NbS as part of the culture through constant production and reproduction on the ground of social and planning practices (Geels & Smit, 2000). Thus, it is not sufficient to upscale an innovation only in terms of quantity; rather, it must undergo a process of appropriation and internalization by the wider public discourses, in lived daily and planning practices, and within relational structures and framings. This understanding needs a more fundamental conceptualization that involves shifts in cultural beliefs, new routinized practices, and formation and stabilization of networks.

5. Conclusions

This paper aims to provide an analytical tool to understand NbS upscaling processes as experimental innovations to bring nature back into cities as an action of 'futuring'. It does that by reviewing the concepts of upscaling and of NbS within transition and governance literature. The analysis shows that the term 'upscaling' is only one of many equivalent concepts which are used interchangeably in transition literature to describe the migration of innovation from the niche level to the regime. This conceptualization is made more complex through the inclusion of nature: in fact, upscaling NbS involves a combination of social, ecological, technological, and economic factors that are brought to the fore when making an urban environmental policy that considers cultural aspects, actions of framing, and different understandings of nature, routines, values, and behaviours.

However, NbS as a concept has proved to be controversial. While on one hand it is celebrated as a new panacea, on the other, caution is suggested in the use of this type of solution. First, the very definition of NbS represents an issue. Due to its indefiniteness, the concept aims to achieve 'everything', creating challenges in defining precisely what, in practice, an NbS is and what it is not. The huge popularity of NbS upscaling, demonstrated through a plethora of reports and documents from various organisations, has contributed to promoting NbS upscaling as 'the way' to cope with contemporary societal challenges through nature. This has placed pressure on the limited capacities of urban administrations that are committed to dealing with NbS and its upscaling (e.g. Seddon et al., 2020). Second,

the word 'solution' in NbS suggests an outcome-oriented approach focused on effectiveness, linked to business thinking in terms of economic growth and job creation (Welden et al., 2021). This conceptualization risks leaving out less quantifiable aspects of the NbS upscaling process such as culture, values, behaviours, and nature itself. Also, the here-and-now narrative contrasts with the slow and long-term horizon in which nature grows and develops (Alberti et al., 2020). Third, as a new concept, NbS is relatively appealing to those actors who are interested in selling new solutions as part of their political strategy. This may allow certain actors, such as oil corporations, to profit from this momentum to preserve the status quo instead of pursuing carbon neutrality (FOEI, 2021). Fourth, the debate about upscaling NbS is relatively new and very dynamic making its analysis arduous (Melanidis & Hagerman, 2022). The literature review shows that, within only a few years, the different disciplines and actors engaged in understanding the NbS upscaling have generated a plethora of concepts and definitions for referring to the same process. Fifth, matters of power and knowledge imbalances, if not properly considered, can turn the upscaling of NbS into an engine for sustaining injustice and inequality by reproducing existing dominant structures. The specificity and complexity of local realities make a generalisation of an approach to upscaling difficult and risk ignoring fundamental aspects when trying to upscale NbS in cities.

As advocated by many scholars, advancements in transition research will require look at other disciplines to account for the complexity of reality and the process of upscaling innovations based on nature, such as NbS. Consequently, transition researchers have started to unpack the upscaling concept describing a series of mechanisms of acceleration and integration. Transition research has developed six transition frameworks to make sense of NbS upscaling where discourses, practices, and relations have been identified as relevant analytical dimensions. The interlinkages among these dimensions have been analysed within the six transition frameworks, each presenting advantages and disadvantages in analysing (NbS) upscaling accordingly. Drawing on future studies, the concept of urban future imaginaries expands the interpretation of upscaling within the six frameworks, which regards NbS upscaling as a chosen pathway that locks in actions towards reaching specific socio-natural urban futures. This has created performatively path-dependent discourses, practices, and relations to achieve a particular urban future imaginary with, at its core, a new understanding of human–nature relationships. The combination of the three dimensions suggests a new understanding of the complex phenomenon of NbS upscaling, whereby language, culture, and symbols are used by different actors to frame a winning picture of NbS to be normalised as an implementable solution in the pursuit of what can be called a socio-natural imaginary. Following the governance approach, upscaling has acquired a more profound conceptualization that goes beyond the mere quantitative increase of the innovation towards the inclusion of ways of doing, thinking, and organising while linking different levels of governance and the actors located in these levels. From this premise, the paper proposes that *NbS upscaling in cities is a process of 'futuring' by which urban actors deploy NbS as newly routinized practices to enact a specific urban future imaginary*.

To conclude, adopting the lenses of future studies allows to ontologically perceive NbS upscaling as an urban future imaginary dominated by the human–nature relationship with new eyes, whereby humans are seen as part of and dependent on nature rather than existing in a separate realm. Epistemologically, 'with new eyes' does not automatically mean innovation, as NbS upscaling implies less the invention of new technology and more the rediscovery of traditional solutions that may have been abandoned, as well as reconnection with the past and opening up to a set of possible future pathways. Socio-natural urban futures are not a distant technological-driven utopian vision of the urban, rather it is a commonly built space bringing together society and the nature realm in shaping new forms. The NbS concept, with its proven ability to affect discourses, practices, and relations, are playing a relevant role in constructing such futures. Particularly, attention should be devoted in understanding urban actors' agencies, considering whose actions, which conditions, and what effects lead to a determined urban future imaginary, which is told through discourses, enacted through practices, and supported by relations. This openness should reflect the uncertainty of future challenges concerning climate change. Empirically, researchers should look for methodologies able to consider discourses, practices, and relations simultaneously. Methodologies from other disciplines could be explored to analyse such linkages and spotlight both successes and failures for a more just upscaling of NbS in cities.

Formatting and funding sources

This work was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - GRK 2725 - Projektnummer 445103843.

CRediT authorship contribution statement

Alessandro Arlati: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

none.

Data availability

No data was used for the research described in the article.

Acknowledgements

I would like to thank Prof. Gernot Grabher and Dr Joachim Thiel for their consistent help in defining the structure of the paper and in the provision of theoretical and methodological support. A big thank goes to the reviewers and editors, who, with their precise and constructive comments, encouraged me to work further on the paper. Also, I would like to show my gratitude to Prof. Harriet Bulkeley for her support and insights on NbS governance research and methods. Additionally, I would like to thank Erin Troseth and Kimberley Tatum for their language support. Last but not least, I would like to express my gratitude to my colleagues of the RTG 2725, particularly, Dr Louis Volont, with whom I exchanged thoughts, problems, and solutions.

References

Adams, C., Frantzeskaki, N., & Moglia, M. (2023). Mainstreaming nature-based solutions in cities: A systematic literature review and a proposal for facilitating urban transitions. *Land Use Policy, 130*, Article 106661. https://doi.org/10.1016/j.landusepol.2023.106661

Albert, C., Brillinger, M., Guerrero, P., Gottwald, S., Henze, J., Schmidt, S., Ott, E., & Schröter, B. (2021). Planning nature-based solutions: Principles, steps, and insights. *Ambio, 50*(8), 1446–1461. https://doi.org/10.1007/s13280-020-01365-1

Alberti, M., Palkovacs, E. P., Roches, S. D., Meester, L. D., Brans, K. I., Govaert, L., Grimm, N. B., Harris, N. C., Hendry, A. P., Schell, C. J., Szulkin, M., Munshi-South, J., Urban, M. C., & Verrelli, B. C. (2020). The complexity of urban eco-evolutionary dynamics. *BioScience, 70*(9), 772–793. https://doi.org/10.1093/biosci/biaa079

Anderegg, W. R. L., Trugman, A. T., Badgley, G., Anderson, C. M., Bartuska, A., Ciais, P., Cullenward, D., Field, C. B., Freeman, J., Goetz, S. J., Hicke, J. A., Huntzinger, D., Jackson, R. B., Nickerson, J., Pacala, S., & Randerson, J. T. (2020). Climate-driven risks to the climate mitigation potential of forests. *Science (New York, N York), 368*(6497). https://doi.org/10.1126/science.aaz7005

Augenstein, K., Bachmann, B., Egermann, M., Hermelingmeier, V., Hilger, A., Jaeger-Erben, M., Kessler, A., Lam, D. P., Palzkill, A., Suski, P., & Wirth, T. von (2020). From niche to mainstream: the dilemmas of scaling up sustainable alternatives. *GAIA - Ecological Perspectives for Science and Society, 29*(3), 143–147. https://doi.org/10.14512/gaia.29.3.3

Avelino, F. (2021). Theories of power and social change. Power contestations and their implications for research on social change and innovation. *Journal of Political Power, 14*(3), 425–448. https://doi.org/10.1080/2158379X.2021.1875307

Bacchi, C., & Bonham, J. (2014). Reclaiming discursive practices as an analytic focus: Political implications. *Foucault Studies*, 179–192. https://doi.org/10.22439/fs.v0i17.4298

Baker, T., & Ruming, K. (2015). Making 'Global Sydney': Spatial imaginaries, worlding and strategic plans. *International Journal of Urban and Regional Research, 39*(1), 62–78. https://doi.org/10.1111/1468-2427.12183

Barbanente, A., & Grassini, L. (2022). Integrating Nature-Based Solutions into Urban Planning and Policies: Learning from the Apulia Case Study. In D. La Rosa, & R. Privitera (Eds.), *Innovation in Urban and Regional Planning* (Vol. 242, pp. 12–21). Springer International Publishing. https://doi.org/10.1007/978-3-030-96985-1.

Bayulken, B., Huisingh, D., & Fisher, P. M. (2021). How are nature based solutions helping in the greening of cities in the context of crises such as climate change and pandemics? A comprehensive review. *Journal of Cleaner Production, 288*, Article 125569. https://doi.org/10.1016/j.jclepro.2020.125569

Bögel, P. M., Augenstein, K., Levin-Keitel, M., & Upham, P. (2022). An interdisciplinary perspective on scaling in transitions: Connecting actors and space. *Environmental Innovation and Societal Transitions, 42*, 170–183. https://doi.org/10.1016/j.eist.2021.12.009

Bona, S., Silva-Afonso, A., Gomes, R., Matos, R., & Rodrigues, F. (2023). Nature-based solutions in urban areas: A European analysis. *Applied Sciences, 13*(1), 168. https://doi.org/10.3390/a

Bossink, B., Blankesteijn, M. L., & Hasanefendic, S. (2023). Upscaling sustainable energy technology: From demonstration to transformation. *Energy Research & Social Science, 103*, Article 103208. https://doi.org/10.1016/j.erss.2023.103208

Bouzarovski, S., & Haarstad, H. (2019). Rescaling low-carbon transformations: Towards a relational ontology. *Transactions (Institute of British Geographers: 1965), 44*(2), 256–269. https://doi.org/10.1111/tran.12275

Bradley, S., Mahmoud, I. H. [Israa Hanafi], & Arlati, A. (2022). Integrated collaborative governance approaches towards urban transformation: Experiences from the CLEVER cities project. *Sustainability, 14*(23), 15566. https://doi.org/10.3390/su142315566

Brand, U. (2016). How to get out of the multiple crisis? Contours of a critical theory of social-ecological transformation. *Environmental Values, 25*(5), 503–525. https://doi.org/10.3197/096327116×14703858759017

Brokking, P., Mörtberg, U., & Balfors, B. (2021). Municipal practices for integrated planning of nature-based solutions in urban development in the stockholm region. *Sustainability, 13*(18), 10389. https://doi.org/10.3390/su131810389

Brown, N., & Kraft, A. (2006). Blood Ties: Banking the Stem Cell Promise. *Technology Analysis & Strategic Management, 18*(3-4), 313–327. https://doi.org/10.1080/09537320600777044

Brown, N., Rappert, B., & Webster, A. (2000). *Contested futures: A sociology of prospective techno-science.* Ashgate.

Brown, R. R., Farrelly, M. A., & Loorbach, D. A. (2013). Actors working the institutions in sustainability transitions: The case of Melbourne's stormwater management. *Global Environmental Change, 23*(4), 701–718. https://doi.org/10.1016/j.gloenvcha.2013.02.013

Brugger, H., & Henry, A. D. (2021). Influence of policy discourse networks on local energy transitions. *Environmental Innovation and Societal Transitions, 39*, 141–154. https://doi.org/10.1016/j.eist.2021.03.006

Burt, R. S. (2003). The Social Structure of Competition. In R. S. Burt (Ed.), *Networks in the Knowledge Economy*. Oxford University Press. https://doi.org/10.1093/oso/9780195159509.003.0006.

Carlsson, B., & Stankiewicz, R. (1991). On the nature, function and composition of technological systems. *Journal of Evolutionary Economics, 1*(2), 93–118. https://doi.org/10.1007/BF01224915

Castán Broto, V., & Bulkeley, H. (2018). Realigning Circulations. In B. Turnheim, P. Kivimaa, & F. Berkhout (Eds.), *Innovating Climate Governance* (pp. 69–84). Cambridge University Press. https://doi.org/10.1017/9781108277679.006.

Chester, M. V., Miller, T. R., Muñoz-Erickson, T. A., Helmrich, A. M., Iwaniec, D. M., McPhearson, T., Cook, E. M., Grimm, N. B., & Markolf, S. A. (2023). Sensemaking for entangled urban social, ecological, and technological systems in the Anthropocene. *Npj Urban Sustainability, 3*(1). https://doi.org/10.1038/s42949-023-00120-1

CLARA. (2020, July 28). *CLARA Submission to Standing Committee on Finance: Nature Based Solutions Forum.* Climate, Land Ambition and Rights Alliance (CLARA).

Cohen-Shacham, E., Andrade, A., Dalton, J., Dudley, N., Jones, M., Kumar, C., Maginnis, S., [Stewart], Maynard, S., Nelson, C. R., Renaud, F. G., Welling, R., & Walters, G. [Gretchen] (2019). Core principles for successfully implementing and upscaling Nature-based Solutions. *Environmental Science & Policy, 98*, 20–29. https://doi.org/10.1016/j.envsci.2019.04.014

Cohen-Shacham, E., Walters, G. [G.], Janzen, C., & Maginnis, S. [S.] (2016). *Nature-based solutions to address global societal challenges.* IUCN International Union for Conservation of Nature. https://doi.org/10.2305/IUCN.CH.2016.13.en

Cortinovis, C., Olsson, P. [Peter], Boke-Olén, N., & Hedlund, K. (2022). Scaling up nature-based solutions for climate-change adaptation: Potential and benefits in three European cities. *Urban Forestry & Urban Greening, 67*, Article 127450. https://doi.org/10.1016/j.ufug.2021.127450

WRM. (2021, May 18). *Conservation NGOs Gift Polluters a Massive Land Grab called Nature Based Solutions: World Rainforest Movement (WRM) Bulletin 255* [Press release]. ⟨https://www.wrm.org.uy/bulletin-articles/conservation-ngos-gift-polluters-a-massive-land-grab-called-nature-based-solutions⟩.

Davies, C., Chen, W. Y., Sanesi, G., & Lafortezza, R. (2021). The European Union roadmap for implementing nature-based solutions: A review. *Environmental Science & Policy, 121*, 49–67. https://doi.org/10.1016/j.envsci.2021.03.018

Díaz, S., Settele, J., Brondízio, E. S., Ngo, H. T., Agard, J., Arneth, A., Balvanera, P., Brauman, K. A., Butchart, S. H. M., Chan, K. M. A., Garibaldi, L. A., Ichii, K., Liu, J., Subramanian, S. M., Midgley, G. F., Miloslavich, P., Molnár, Z., Obura, D., Pfaff, A., & Zayas, C. N. (2019). Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science (New York, N York), 366*(6471). https://doi.org/10.1126/science.aax3100

Dignum, M., Dorst, H., van Schie, M., Dassen, T., & Raven, R. (2020). Nurturing nature: Exploring socio-spatial conditions for urban experimentation. *Environmental Innovation and Societal Transitions, 34*, 7–25. https://doi.org/10.1016/j.eist.2019.11.010

Dodge, J., & Lee, J. (2017). Framing dynamics and political gridlock: The curious case of hydraulic fracturing in New York. *Journal of Environmental Policy & Planning, 19*(1), 14–34. https://doi.org/10.1080/1523908X.2015.1116378

Dorst, H., van der Jagt, A., Runhaar, H., & Raven, R. (2021). Structural conditions for the wider uptake of urban nature-based solutions – A conceptual framework. *Cities, 116*, Article 103283. https://doi.org/10.1016/j.cities.2021.103283

Dumitru, A., & Wendling, L. (Eds.). (2021). *Evaluating the impact of nature-based solutions: A handbook for practitioners (First edition)*. Publications Office of the European Union.

Durrant, R., Barnes, J. [Jacob], Kern, F., & Mackerron, G. (2018). The acceleration of transitions to urban sustainability: A case study of Brighton and Hove. *European Planning Studies, 26*(8), 1537–1558. https://doi.org/10.1080/09654313.2018.1489783

EC. (2020a). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: EU Biodiversity Strategy for 2030* [Bringing nature back into our lives]. European Commission (EC).

EC. (2020b). *Nature-based Solutions: State of the Art in EU-funded Projects*. Independent Expert Report. European Commission (EC). https://doi.org/10.2777/236007.

EC. (2022). *Horizon Europe. Work Programme 2021–2022: 9. Food, Bioeconomy, Natural Resources, Agriculture and Environment* [(European Commission Decision C (2022)2975 of 10 May 2022)]. European Commission (EC). ⟨https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021–2027/horizon/wp-call/2021–2022/wp-9-food-bioeconomy-natural-resources-agriculture-and-environment_horizon-2021–2022_en.pdf⟩.

EC. (2023, February 2). *A European Green Deal*. European Commission (EC). ⟨https://commission.europa.eu/strategy-and-policy/priorities-2019–2024/european-green-deal_en⟩.

Egusquiza, A., Cortese, M., & Perfido, D. (2019). Mapping of innovative governance models to overcome barriers for nature based urban regeneration. *IOP Conference Series: Earth and Environmental Science, 323*(1), 12081. https://doi.org/10.1088/1755-1315/323/1/012081

Ehnert, F., Frantzeskaki, N., Barnes, J. [Jake], Borgström, S., Gorissen, L., Kern, F., Strenchock, L., & Egermann, M. (2018). The Acceleration of Urban Sustainability Transitions: A Comparison of Brighton, Budapest, Dresden, Genk, and Stockholm. *Sustainability, 10*(3), 612. https://doi.org/10.3390/su10030612

El Harrak, M., & Lemaitre, F. (2023, June 8). *European Roadmap to 2030 for research and innovation on nature-based solutions*. Network Nature (NN). ⟨https://networknature.eu/sites/default/files/uploads/networknatureeuropean-ri-roadmap-nbs.pdf⟩.

Entman, R. M. (1993). Framing: Toward Clarification of a Fractured Paradigm. *Journal of Communication, 43*(4), 51–58. https://doi.org/10.1111/j.1460-2466.1993.tb01304.x

European Parliament, & European Council. (2022, June 22). Com(2022) *304 final: Proposal for a regulation of the European Parliament and of the Council on nature restoration* . European Union (EU).

Fastenrath, S., Bush, J., & Coenen, L. (2020). Scaling-up nature-based solutions. Lessons from the Living Melbourne strategy. *Geoforum, 116*, 63–72. https://doi.org/10.1016/j.geoforum.2020.07.011

FOEI. (February 2021). *Chasing Carbon Unicorns: The deception of carbon markets and "net zero"*. Friends of the Earth International (FOEI). ⟨https://www.foei.org/publication/chasing-unicorns-carbon-markets-net-zero/⟩.

Frantzeskaki, N., & Haan, H. de (2009). Transitions: Two steps from theory to policy. *Futures, 41*(9), 593–606. https://doi.org/10.1016/j.futures.2009.04.009

Frantzeskaki, N., Mahmoud, I. H. [Israa H.], & Morello, E. (2022). Nature-Based Solutions for Resilient and Thriving Cities: Opportunities and Challenges for Planning Future Cities. In I. H. Mahmoud, E. Morello, F. Lemes de Oliveira, & D. Geneletti (Eds.), *Nature-based Solutions for Sustainable Urban Planning* (pp. 3–17). Springer International Publishing. https://doi.org/10.1007/978-3-030-89525-9.

Frantzeskaki, N., McPhearson, T., & Kabisch, N. (2021). Urban sustainability science: Prospects for innovations through a system's perspective, relational and transformations' approaches: This article belongs to. *Ambio's 50th Anniversary Collection Theme: Urbanization Ambio, 50*(9), 1650–1658. https://doi.org/10.1007/s13280-021-01521-1

Frantzeskaki, N., & Tilie, N. (2014). The dynamics of urban ecosystem governance in Rotterdam, the Netherlands. *Ambio, 43*(4), 542–555. https://doi.org/10.1007/s13280-014-0512-0

Frantzeskaki, N., Vandergert, P., Connop, S., Schipper, K., Zwierzchowska, I., Collier, M., & Lodder, M. (2020). Examining the policy needs for implementing nature-based solutions in cities: Findings from city-wide transdisciplinary experiences in Glasgow (UK), Genk (Belgium) and Poznań (Poland). *Land Use Policy, 96*, Article 104688. https://doi.org/10.1016/j.landusepol.2020.104688

Fuhse, J. A. (2009). The meaning structure of social networks. *Sociological Theory, 27*(1), 51–73.

Fuhse, J. A. (2015). Networks from communication. *European Journal of Social Theory, 18*(1), 39–59. https://doi.org/10.1177/1368431014549683

Fuhse, J. A., & Mützel, S. (2011). Tackling connections, structure, and meaning in networks: Quantitative and qualitative methods in sociological network research. *Quality & Quantity, 45*(5), 1067–1089. https://doi.org/10.1007/s11135-011-9492-3

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy, 31*(8-9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8

Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems. *Research Policy, 33*(6-7), 897–920. https://doi.org/10.1016/j.respol.2004.01.015

Geels, F. W. (2006). Multi-Level Perspective on System Innovation: Relevance for Industrial Transformation. In X. Olsthoorn, & A. J. Wieczorek (Eds.), *Environment & Policy. Understanding Industrial Transformation* (Vol. 44, pp. 163–186). Kluwer Academic Publishers. https://doi.org/10.1007/1-4020-4418-6_9.

Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions, 1*(1), 24–40. https://doi.org/10.1016/j.eist.2011.02.002

Geels, F. W. (2014). Regime resistance against low-carbon transitions: Introducing politics and power into the multi-level perspective. *Theory, Culture & Society, 31*(5), 21–40. https://doi.org/10.1177/0263276414531627

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy, 36*(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Geels, F. W., & Smit, W. A. (2000). Failed technology futures: Pitfalls and lessons from a historical survey. *Futures, 32*(9-10), 867–885. https://doi.org/10.1016/S0016-3287(00)00036-7

GFC (2020, May 16). Action alert: join us to oppose nature-based solutions greenwash on International Day for Biological Diversity. Global Forest Coalition (GFC). ⟨https://globalforestcoalition.org/our-nature-is-not-your-solution/⟩.

Gorissen, L., Spira, F., Meynaerts, E., Valkering, P., & Frantzeskaki, N. (2018). Moving towards systemic change? Investigating acceleration dynamics of urban sustainability transitions in the Belgian City of Genk. *Journal of Cleaner Production, 173*, 171–185. https://doi.org/10.1016/j.jclepro.2016.12.052

Grin, J. (2010a). The Governance of Transitions: An Agency Perspective. In J. Grin, J. Rotmans, & J. Schot (Eds.), *Transitions to Sustainable Development* (pp. 265–284). Routledge.

Grin, J. (2010b). Understanding Transitions from a Governance Perspective: Introduction. In J. Grin, J. Rotmans, & J. W. Schot (Eds.), *Routledge studies in sustainability transitions. Transitions to sustainable development: New directions in the study of long term transformative change* (pp. 223–235). Routledge.

GYBN, Y4N, & YOUNGO. (April 2021). *What are nature-based solutions? Risks, concerns, and opportunities*. Global Youth Biodiversity Network (GYBN); Youth 4 Nature (Y4N); Official youth consituency of the UNFCCC (YOUNGO). ⟨https://www.nbsyouthposition.org/brief⟩.

GYBN, YOUNGO, & Y4N. (November 2021). *Global youth position statement on nature-based solutions*. ⟨https://www.nbsyouthposition.org/brief⟩.

Hajer, M. A. (1993). Discourse Coalitions and the Institutionalization of Practice. In F. Fischer, & J. Forester (Eds.), *The Argumentative Turn in Policy Analysis and Planning* (pp. 43–76). Duke University Press. https://doi.org/10.1215/9780822381815-003.

Hajer, M. A. (2006). Doing discourse analysis: Coalitions, practices, meaning. In M. den van Brink (Ed.), *Netherlands geographical studies: Vol. 344. Words matter in policy and planning: Discourse theory and method in the social sciences* (pp. 65–74). Koninklijk Nederlands Aardrijkskundig Genootschap.

Hajer, M. A., & Versteeg, W. (2005). A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. *Journal of Environmental Policy & Planning, 7*(3), 175–184. https://doi.org/10.1080/15239080500339646

Hansen, R., Buizer, M., Buijs, A., Pauleit, S., Mattijssen, T., Fors, H., van der Jagt, A., Kabisch, N., Cook, M., Delshammar, T., Randrup, T. B., Erlwein, S., Vierikko, K., Nieminen, H., Langemeyer, J., Soson Texereau, C., Luz, A. C., Nastran, M., Olafsson, A. S., & Konijnendijk, C. (2022). Transformative or piecemeal? Changes in green space planning and governance in eleven European cities. *European Planning Studies*, 1–24. https://doi.org/10.1080/09654313.2022.2139594

Hanson, H. I., Wickenberg, B., & Alkan Olsson, J. (2020). Working on the boundaries—How do science use and interpret the nature-based solution concept? *Land Use Policy, 90*, Article 104302. https://doi.org/10.1016/j.landusepol.2019.104302

Hargreaves, T., Longhurst, N., & Seyfang, G. (2013). Up, down, round and round: Connecting regimes and practices in innovation for sustainability. *Environment and Planning a: Economy and Space, 45*(2), 402–420. https://doi.org/10.1068/a45124

Hekkert, M. P., Suurs, R., Negro, S. O., Kuhlmann, S., & Smits, R. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological Forecasting and Social Change, 74*(4), 413–432. https://doi.org/10.1016/j.techfore.2006.03.002

Hermans, F., Roep, D., & Klerkx, L. (2016). Scale dynamics of grassroots innovations through parallel pathways of transformative change. *Ecological Economics, 130*, 285–295. https://doi.org/10.1016/j.ecolecon.2016.07.011

Hodson, M., Evans, J., & Schliwa, G. (2018). Conditioning experimentation: The struggle for place-based discretion in shaping urban infrastructures. *Environment and Planning C: Politics and Space, 36*(8), 1480–1498. https://doi.org/10.1177/2399654418765480

Hölscher, K., Frantzeskaki, N., Collier, M., Connop, S., Kooijman, E., Lodder, M., McQuaid, S., Vandergert, P., Xidous, D., Bešlagić, L., Dick, G., Dumitru, A., Dziubała, A., Fletcher, I., Adank, C.G.-E., Vázquez, M.G., Madajczyk, N., Malekkidou, E., Mavroudi, M., … Vos, P. (2023). Strategies for mainstreaming nature-based solutions in urban planning in ten European cities. Advance online publication. https://doi.org/10.21203/rs.3.rs-2876567/v1.

Hughes, T. P. (1986). The seamless web: Technology, science, etcetera, etcetera. *Social Studies of Science, 16*(2), 281–292. https://doi.org/10.1177/030631278601600 2004

IPCC. (2023). Summary for PolicymakersHoesung Lee, & José Romer (Eds.). *Climate Change 2023: Synthesis Report Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 1–34. https://doi.org/10.59327/IPCC/AR6-9789291691647.001

IUCN. (2016). Defining Nature-based Solutions (NbS): IUCN Definitional Framework. *World Conservation Congress (WCC). International Union for Conservation of Nature.* IUCN,.

IUCN. (2020). Global Standard for Nature-based Solutions: A user-friendly framework for the verification, design and scaling up of NbS: first edition. *IUCN, International Union for Conservation of Nature.* https://doi.org/10.2305/IUCN.CH.2020.08.en

International Union for Conservation of Nature. (2021, November 12). *IUCN welcomes recognition of nature's role at COP26 and calls for more ambition* [Press release]. ⟨https://www.iucn.org/news/secretariat/202111/iucn-welcomes-recognition-natures-role-cop26-and-calls-more-ambition⟩.

Jacobsson, S., & Bergek, A. (2006). A Framework for Guiding Policy-makers Intervening in Emerging Innovation Systems in 'Catching-Up' Countries. *The European Journal of Development Research, 18*(4), 687–707. https://doi.org/10.1080/09578810601094902

Jasanoff, S. (2015). Future imperfect: science, technology, and the imaginations of modernity. In S. Jasanoff, & S.-H. Kim (Eds.), *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power* (pp. 1–33). The University of Chicago Press.

Jørgensen, G., Fryd, O., Lund, A. A., Andersen, P. S., & Herslund, L. (2022). Nature-based climate adaptation projects, their governance and transitional potential-cases from Copenhagen (Article) *Frontiers in Sustainable Cities, 4*, Article 906960. https://doi.org/10.3389/frsc.2022.906960.

Kabisch, N., Frantzeskaki, N., & Hansen, R. (2022). Principles for urban nature-based solutions. *Ambio, 51*(6), 1388–1401. https://doi.org/10.1007/s13280-021-01685-w

Kanda, W., Kuisma, M., Kivimaa, P., & Hjelm, O. (2020). Conceptualising the systemic activities of intermediaries in sustainability transitions. *Environmental Innovation and Societal Transitions, 36*, 449–465. https://doi.org/10.1016/j.eist.2020.01.002

Karic, S., & Losacker, S. (2023). How can green events accelerate urban sustainability transitions? Insights from eight German regional garden shows. *Urban Research & Practice, 16*(2), 189–221. https://doi.org/10.1080/17535069.2021.1991998

Kauark-Fontes, B., Marchetti, L., & Salbitano, F. (2023). Integration of nature-based solutions (NBS) in local policy and planning toward transformative change. Evidence from Barcelona, Lisbon, and Turin. *Ecology and Society, 28*(2). https://doi.org/10.5751/ES-14182-280225

Kemp, R., Rip, A., & Schot, J. (2001). Constructing transition paths through the management of niches. In R. Garud, & P. Karnøe (Eds.), *LEA's organization and management series. Path dependence and creation (Online-Ausg.* Psychology Press.

Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic Management, 10*(2), 175–198. https://doi.org/10.1080/09537329808524310

Kiss, B., Sekulova, F., Hörschelmann, K., Salk, C. F., Takahashi, W., & Wamsler, C. (2022). Citizen participation in the governance of nature-based solutions. *Environmental Policy and Governance, 32*(3), 247–272. https://doi.org/10.1002/eet.1987

Konrad, K., Markard, J., Ruef, A., & Truffer, B. (2012). Strategic responses to fuel cell hype and disappointment. *Technological Forecasting and Social Change, 79*(6), 1084–1098. https://doi.org/10.1016/j.techfore.2011.09.008

Kotsila, P., Anguelovski, I., Baró, F., Langemeyer, J., Sekulova, F., & JT Connolly, J. (2021). Nature-based solutions as discursive tools and contested practices in urban nature's neoliberalisation processes. *Environment and Planning E: Nature and Space, 4*(2), 252–274. https://doi.org/10.1177/2514848620901437

Lam, D. P. M., Martín-López, B., Wiek, A., Bennett, E. M., Frantzeskaki, N., Horcea-Milcu, A. I., & Lang, D. J. (2020). Scaling the impact of sustainability initiatives: A typology of amplification processes. *Urban Transformations, 2*(1). https://doi.org/10.1186/s42854-020-00007-9

Leipold, S., Feindt, P. H., Winkel, G., & Keller, R. (2019). Discourse analysis of environmental policy revisited: Traditions, trends, perspectives. *Journal of Environmental Policy & Planning, 21*(5), 445–463. https://doi.org/10.1080/1523908X.2019.1660462

Loorbach, D. (2010). Transition management for sustainable development: A prescriptive, complexity-based governance framework. *Governance, 23*(1), 161–183. https://doi.org/10.1111/j.1468-0491.2009.01471.x

Loorbach, D., & Shiroyama, H. (2016). The Challenge of Sustainable Urban Development and Transforming Cities. In D. Loorbach, J. M. Wittmayer, H. Shiroyama, J. Fujino, & S. Mizuguchi (Eds.), *Theory and Practice of Urban Sustainability Transitions. Governance of Urban Sustainability Transitions* (pp. 3–12). Springer Japan.

Lynggaard, K. (2019). Discourse Analysis and European Union Politics (1st ed. 2019). *Springer eBooks Political Science and International Studies.* Palgrave Macmillan. https://doi.org/10.1057/978-1-137-39326-5

Mahmoud, I. H., Ferreira, I., Arlati, A., Bradley, S., Lupp, G., Nunes, N, & Garcia-Mateo, M. C. (2023). Towards a Co-Governance Approach For Nature-based Solutions. In I. Ferreira, G. Lupp, & I. H. [Israa Hanafi] Mahmoud (Eds.), *Guidelines for Co-creation and Co-governance of Nature-Based Solutions: Insights from EU-funded projects* (pp. 44–54). Publications Office of the European Union. https://data.europa.eu/doi/10.2777/157060.

Mahmoud, I. H. [Israa Hanafi], & Morello, E. (2021). Co-creation Pathway for Urban Nature-Based Solutions: Testing a Shared-Governance Approach in Three Cities and Nine Action Labs. In A. Bisello, D. Vettorato, D. Ludlow, & C. Baranzelli (Eds.), *Green Energy and Technology. Smart and Sustainable Planning for Cities and Regions* (pp. 259–276). Springer International Publishing. https://doi.org/10.1007/978-3-030-57764-3_17.

Mahmoud, I. H. [Israa Hanafi], Morello, E., Lemes de Oliveira, F., & Geneletti, D. (Eds.). (2022). *Nature-based Solutions for Sustainable Urban Planning.* Springer International Publishing. https://doi.org/10.1007/978-3-030-89525-9.

Mahmoud, I. H. [Israa Hanafi], Morello, E., Ludlow, D., & Salvia, G. (2021). Co-creation pathways to inform shared governance of urban living labs in practice: Lessons from three European Projects (Article) *Frontiers in Sustainable Cities, 3*, Article 690458. https://doi.org/10.3389/frsc.2021.690458.

Mathias, J.-D., Anderies, J. M., Baggio, J., Hodbod, J., Huet, S., Janssen, M. A., Milkoreit, M., & Schoon, M. (2020). Exploring non-linear transition pathways in social-ecological systems. *Scientific Reports, 10*(1), 4136. https://doi.org/10.1038/s41598-020-59713-w

McPhearson, T., M. Raymond, C., Gulsrud, N., Albert, C., Coles, N., Fagerholm, N., Nagatsu, M., Olafsson, A. S., Soininen, N., & Vierikko, K. (2021). Radical changes are needed for transformations to a good Anthropocene. *Npj Urban Sustainability, 1*(1). https://doi.org/10.1038/s42949-021-00017-x

Meadowcroft, J. (2002). Politics and scale: some implications for environmental governance. *Landscape and Urban Planning, 61*(2-4), 169–179. https://doi.org/10.1016/S0169-2046(02)00111-1
Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sciences, 42*(4), 323–340. https://doi.org/10.1007/s11077-009-9097-z
Meadowcroft, J. (2011). Engaging with the politics of sustainability transitions. *Environmental Innovation and Societal Transitions, 1*(1), 70–75. https://doi.org/10.1016/j.eist.2011.02.003
Melanidis, M. S. [Marina Stavroula], & Hagerman, S. (2022). Competing narratives of nature-based solutions: Leveraging the power of nature or dangerous distraction? *Environmental Science & Policy, 132*, 273–281. https://doi.org/10.1016/j.envsci.2022.02.028
Merriam-Webster.com. (2023, August 28). *Definition of UPSCALE*. ⟨https://www.merriam-webster.com/dictionary/upscale⟩.
Mische, A. (2003). Cross-talk in Movements: Reconceiving the Culture-Network Link. In M. Diani, & D. McAdam (Eds.), *Comparative politics. Social movements and networks: Relational approaches to collective action* (pp. 258–280). Oxford University Press. https://doi.org/10.1093/0199251789.003.0011.
Mitić-Radulović, A., & Lalović, K. (2021). Multi-level perspective on sustainability transition towards nature-based solutions and co-creation in urban planning of Belgrade, Serbia. *Sustainability, 13*(14), 7576. https://doi.org/10.3390/su13147576
Monbiot, G. (2014, July 24). Put a price on nature? We must stop this neoliberal road to ruin. *The Guardian.* ⟨https://www.theguardian.com/environment/georgemonbiot/2014/jul/24/price-nature-neoliberal-capital-road-ruin⟩.
Naber, R., Raven, R., Kouw, M., & Dassen, T. (2017). Scaling up sustainable energy innovations. *Energy Policy, 110*, 342–354. https://doi.org/10.1016/j.enpol.2017.07.056
Nature Based Solutions Initiative. (2022, November 22). *Nature-based Solutions included in COP27 Cover Decision text* [Press release]. ⟨https://www.naturebasedsolutionsinitiative.org/news/nature-based-solutions-included-cop27-cover-decision-text⟩.
Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., Waylen, K. A., Delbaere, B., Haase, D., Jones-Walters, L., Keune, H., Kovacs, E., Krauze, K., Külvik, M., Rey, F., van Dijk, J., Vistad, O. I., Wilkinson, M. E., & Wittmer, H. (2017). The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *The Science of the Total Environment, 579*, 1215–1227. https://doi.org/10.1016/j.scitotenv.2016.11.106
Nicolini, D. (2009). Zooming in and out: Studying practices by switching theoretical lenses and trailing connections. *Organization Studies, 30*(12), 1391–1418. https://doi.org/10.1177/0170840609349875
Nicolini, D. (2011). Practice as the site of knowing: Insights from the field of telemedicine. *Organization Science, 22*(3), 602–620. https://doi.org/10.1287/orsc.1100.0556
Nicolini, D., & Monteiro, P. (2016). The Practice Approach: For a Praxeology of Organisational and Management Studies. In A. Langley, & H. Tsoukas (Eds.), *The SAGE Handbook of Process Organization Studies* (pp. 110–126). SAGE Publications Ltd. https://doi.org/10.2307/j.ctt46nrzt.12.
NetworkNature. (2022, November 9). *Annual Event Report: Upscaling nature-based solutions in policy and practice.* International Union for Conservation of Nature (IUCN). ⟨https://networknature.eu/nbs-resources?mefibs-form-keywords-field_product_type_value%5B%5D=16&mefibs-form-keywords-combine=&mefibs-form-keywords-mefibs_block_id=keywords⟩.
O'Sullivan, F., Mell, I., & Clement, S. (2020). Novel solutions or rebranded approaches: Evaluating the use of nature-based solutions (NBS) in Europe (Article) *Frontiers in Sustainable Cities, 2*, Article 572527. https://doi.org/10.3389/frsc.2020.572527.
Obstfeld, D. (2017). *Getting new things done: Networks, brokerage, and the assembly of innovative action*. Stanford Business Books an imprint of Stanford University Press.
Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science (New York, N York), 325*(5939), 419–422. https://doi.org/10.1126/science.1172133
Pahl-Wostl, C., Holtz, G., Kastens, B., & Knieper, C. (2010). Analyzing complex water governance regimes: The Management and Transition Framework. *Environmental Science & Policy, 13*(7), 571–581. https://doi.org/10.1016/j.envsci.2010.08.006
Pel, B., Wittmayer, J., Dorland, J., & Søgaard Jørgensen, M. (2020). Unpacking the social innovation ecosystem: An empirically grounded typology of empowering network constellations. *Innovation: The European Journal of Social Science Research, 33*(3), 311–336. https://doi.org/10.1080/13511610.2019.1705147
Pesch, U. (2015). Tracing discursive space: Agency and change in sustainability transitions. *Technological Forecasting and Social Change, 90*, 379–388. https://doi.org/10.1016/j.techfore.2014.05.009
Petrovics, D., Giezen, M., & Huitema, D. (2022). Towards a deeper understanding of up-scaling in socio-technical transitions: The case of energy communities. *Energy Research & Social Science, 94*, Article 102860. https://doi.org/10.1016/j.erss.2022.102860
Pfotenhauer, S., Laurent, B., Papageorgiou, K., & Stilgoe, A. J. (2022). The politics of scaling. *Social Studies of Science, 52*(1), 3–34. https://doi.org/10.1177/03063127211048945
Pineda-Pinto, M., Frantzeskaki, N., & Nygaard, C. A. (2022). The potential of nature-based solutions to deliver ecologically just cities: Lessons for research and urban planning from a systematic literature review. *Ambio, 51*(1), 167–182. https://doi.org/10.1007/s13280-021-01553-7
Pineda-Pinto, M., Frantzeskaki, N., & Raymond, C. M. (2023). Senses of injustices-in-place: nature's voice through Melbourne's environmental stewards. *Sustainability Science*. Advance online publication. https://doi.org/10.1007/s11625-023-01355-8
R&I. (2016). *Nature-based solutions.* European Commission (EC). ⟨https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en⟩.
R&I. (2023, February 2). *Research policy: Research and Innovation.* European Commission (EC). ⟨https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions/research-policy_en⟩.
Raymond, C. M., Berry, P., Breil, M., Nita, M. R. [Mihai R.], Kabisch, N., de Bel, M., Enzi, V., Frantzeskaki, N., Geneletti, D., Cardinaletti, M., Lovinger, L., Basnou, C., Monteiro, A., Robrecht, H., Sgrigna, G., Munari, L., & Calfapietra, C. (2017). *An Impact evaluation Framework to Support Planning and evaluation of Nature-Based solutions projects*. https://doi.org/10.13140/RG.2.2.18682.08643
Raymond, C. M., Frantzeskaki, N., Kabisch, N., Berry, P., Breil, M., Nita, M. R. [Mihai Razvan], Geneletti, D., & Calfapietra, C. (2017). A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environmental Science & Policy, 77*, 15–24. https://doi.org/10.1016/j.envsci.2017.07.008
Raymond, C. M., Stedman, R., & Frantzeskaki, N. (2023). The role of nature-based solutions and senses of place in enabling just city transitions. *Environmental Science & Policy, 144*, 10–19. https://doi.org/10.1016/j.envsci.2023.02.021
Reckwitz, A. (2002). Toward a theory of social practices. *European Journal of Social Theory, 5*(2), 243–263. https://doi.org/10.1177/13684310222225432
Rip, A., & Kemp, R. (1998). Technological change. In S. Rayner (Ed.), *Human choice and climate change* (pp. 327–399). Battelle Press.
Rizzo, A., Habibipour, A., & Ståhlbröst, A. (2021). Transformative thinking and urban living labs in planning practice: A critical review and ongoing case studies in Europe. *European Planning Studies, 29*(10), 1739–1757. https://doi.org/10.1080/09654313.2021.1911955
Rotmans, J., Kemp, R., & van Asselt, M. (2001). More evolution than revolution: Transition management in public policy. *Foresight, 3*(1), 15–31. https://doi.org/10.1108/14636680110803003
Schmid, B., & Taylor Aiken, G. (2023). A critical view on the role of scale and instrumental imaginaries within community sustainability transitions research. *Area*, Article area.12884. Advance online publication. https://doi.org/10.1111/area.12884.
Schot, J., Hoogma, R., & Elzen, B. (1994). Strategies for shifting technological systems. *Futures, 26*(10), 1060–1076. https://doi.org/10.1016/0016-3287(94)90073-6
Schot, J., & Kanger, L. (2018). Deep transitions: Emergence, acceleration, stabilization and directionality. *Research Policy, 47*(6), 1045–1059. https://doi.org/10.1016/j.respol.2018.03.009
Schut, M., Leeuwis, C., & Thiele, G. (2020). Science of Scaling: Understanding and guiding the scaling of innovation for societal outcomes. *Agricultural Systems, 184*, Article 102908. https://doi.org/10.1016/j.agsy.2020.102908
Science for Environment Policy. (February 2021). The solution is in nature: Future Brief 24. Brief produced for the European Commission DG Environment (Environment Issue 24). European Commission (EC). ⟨https://knowledge4policy.ec.europa.eu/publication/future-brief-solution-nature_en⟩.
Scott, A., Holtby, R., East, H., & Lannin, A. (2022). Mainstreaming the environment: Exploring pathways and narratives to improve policy and decision-making. *People and Nature, 4*(1), 201–217. https://doi.org/10.1002/pan3.10276

Seddon, N. (2022). Harnessing the potential of nature-based solutions for mitigating and adapting to climate change. *Science (New York, N York), 376*(6600), 1410–1416. https://doi.org/10.1126/science.abn9668

Seddon, N., Chausson, A., Berry, P., Girardin, C. A. J., Smith, A. [Alison], & Turner, B. (2020). Understanding the value and limits of nature-based solutions to climate change and other global challenges. *Philosophical Transactions of the Royal Society of London Series B, Biological Sciences, 375*(1794), 20190120. https://doi.org/10.1098/rstb.2019.0120

Seddon, N., Smith, A. [Alison], Smith, P., Key, I., Chausson, A., Girardin, C., House, J., Srivastava, S., & Turner, B. (2021). Getting the message right on nature-based solutions to climate change. *Global Change Biology, 27*(8), 1518–1546. https://doi.org/10.1111/gcb.15513

Sengers, F., Turnheim, B., & Berkhout, F. (2021). Beyond experiments: Embedding outcomes in climate governance. *Environment and Planning C: Politics and Space, 39*(6), 1148–1171. https://doi.org/10.1177/2399654420953861

Shahani, F., Pineda-Pinto, M., & Frantzeskaki, N. (2022). Transformative low-carbon urban innovations: Operationalizing transformative capacity for urban planning. *Ambio, 51*(5), 1179–1198. https://doi.org/10.1007/s13280-021-01653-4

Shell Global. (2021). *Ensuring high quality nature-based carbon credits.* ⟨https://www.shell.com/energy-and-innovation/new-energies/nature-based-solutions.html⟩.

Shove, E., & Walker, G. (2007). Caution! transitions ahead: Politics, practice, and sustainable transition management. *Environment and Planning a: Economy and Space, 39*(4), 763–770. https://doi.org/10.1068/a39310

Shove, E., & Walker, G. (2010). Governing transitions in the sustainability of everyday life. *Research Policy, 39*(4), 471–476. https://doi.org/10.1016/j.respol.2010.01.019

Smith, A. [Adrian], & Raven, R. (2012). What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy, 41*(6), 1025–1036. https://doi.org/10.1016/j.respol.2011.12.012

Sovacool, B. K., Turnheim, B., Martiskainen, M., Brown, D., & Kivimaa, P. (2020). Guides or gatekeepers? Incumbent-oriented transition intermediaries in a low-carbon era. *Energy Research & Social Science, 66*, Article 101490. https://doi.org/10.1016/j.erss.2020.101490

Sowińska-Świerkosz, B., & García, J. (2022). What are Nature-based solutions (NBS)? Setting core ideas for concept clarification. *Nature-Based Solutions, 2*, Article 100009. https://doi.org/10.1016/j.nbsj.2022.100009

Tozer, L., Bulkeley, H., van der Jagt, A., Toxopeus, H., Xie, L., & Runhaar, H. (2022). Catalyzing sustainability pathways: Navigating urban nature based solutions in Europe. *Global Environmental Change, 74*, Article 102521. https://doi.org/10.1016/j.gloenvcha.2022.102521

Tozer, L., Bulkeley, H., & Xie, L. (2022). Transnational governance and the urban politics of nature-based solutions for climate change. *Global Environmental Politics, 22*(3), 81–103. https://doi.org/10.1162/glep_a_00658

Triboulet, P., Del Corso, J.-P., Duru, M., Galliano, D., Gonçalves, A., Milou, C., & Plumecocq, G. (2019). Towards an Integrated Framework for the Governance of a Territorialised Agroecological Transition. In J.-E. Bergez, E. Audouin, & O. Therond (Eds.), *Agroecological Transitions: From Theory to Practice in Local Participatory Design* (pp. 121–147). Springer International Publishing. https://doi.org/10.1007/978-3-030-01953-2_7.

Tutton, R. (2017). Wicked futures: Meaning, matter and the sociology of the future. *The Sociological Review, 65*(3), 478–492. https://doi.org/10.1111/1467-954X.12443

UNEP. (2022a, November 15). *Why nature holds the key to meeting climate goals.* United Nations Environment Programme (UNEP). ⟨https://www.unep.org/news-and-stories/story/why-nature-holds-key-meeting-climate-goals⟩.

UNEP. (2022b, October 12). *Nature-based Solutions: Opportunities and Challenges for Scaling Up.* United Nations Environment Programme (UNEP). ⟨https://www.unep.org/resources/report/nature-based-solutions-opportunities-and-challenges-scaling⟩.

UNEP. (2022c, March 2). Resolution adopted by the United Nations Environment Assembly on 2 March 2022: 5/5. Nature-based solutions for supporting sustainable development [Press release].

van den Bosch, S., & Rotmans, J. (2008). Deepening, Broadening and Scaling up: A Framework for Steering Transition Experiments. Knowledge Centre for Sustainable System Innovations and Transitions (KCT).

van der Jagt, A., Tozer, L., Toxopeus, H., & Runhaar, H. (2023). Policy mixes for mainstreaming urban nature-based solutions: An analysis of six European countries and the European Union. *Environmental Science & Policy, 139*, 51–61. https://doi.org/10.1016/j.envsci.2022.10.011

Vedres, B., & Stark, D. (2010). Structural folds: Generative disruption in overlapping groups. *American Journal of Sociology, 115*(4), 1150–1190. https://doi.org/10.1086/649497

Welch, D., & Yates, L. (2018). The practices of collective action: Practice theory, sustainability transitions and social change. *Journal for the Theory of Social Behaviour, 48*(3), 288–305. https://doi.org/10.1111/jtsb.12168

Welden, E. A., Chausson, A., & Melanidis, M. S. [Marina S.] (2021). Leveraging nature-based solutions for transformation: Reconnecting people and nature. *People and Nature, 3*(5), 966–977. https://doi.org/10.1002/pan3.10212

Westley, F. R., Tjornbo, O., Schultz, L., Olsson, P. [Per], Folke, C., Crona, B., & Bodin, Ö. (2013). A theory of transformative agency in linked social-ecological systems. *Ecology and Society, 18*(3). https://doi.org/10.5751/ES-05072-180327

Wild, T., Bulkeley, H., Naumann, S., Vojinovic, Z., Calfapietra, C., & Whiteoak, K. (2020). European Commission (EC). Independent Expert Report. *Nature-Based solutions: State of the Artelor in EU-Funded projects*.

Wittmayer, J. M., Avelino, F., van Steenbergen, F., & Loorbach, D. (2017). Actor roles in transition: Insights from sociological perspectives. *Environmental Innovation and Societal Transitions, 24*, 45–56. https://doi.org/10.1016/j.eist.2016.10.003

Wittmayer, J. M., & Loorbach, D. (2016). Governing Transitions in Cities: Fostering Alternative Ideas, Practices, and Social Relations Through Transition Management. In D. Loorbach, J. M. Wittmayer, H. Shiroyama, J. Fujino, & S. Mizuguchi (Eds.), *Theory and Practice of Urban Sustainability Transitions. Governance of Urban Sustainability Transitions* (pp. 13–32). Springer Japan. https://doi.org/10.1007/978-4-431-55426-4_2.

World Bank. (September 2008). *Biodiversity, Climate Change, and Adaptation: Nature-Based Solutions from the World Bank Portfolio.* The International Bank for Reconstruction and Development / THE WORLD BANK. ⟨https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/149141468320661795/biodiversity-climate-change-and-adaptation-nature-based-solutions-from-the-world-bank-portfolio⟩.

Woroniecki, S., Wendo, H., Brink, E., Islar, M., Krause, T., Vargas, A.-M., & Mahmoud, Y. (2020). Nature unsettled: How knowledge and power shape 'nature-based' approaches to societal challenges. *Global Environmental Change, 65*, 1–12. https://doi.org/10.1016/j.gloenvcha.2020.102132

Xie, L., Bulkeley, H., & Tozer, L. (2022). Mainstreaming sustainable innovation: Unlocking the potential of nature-based solutions for climate change and biodiversity. *Environmental Science & Policy, 132*, 119–130. https://doi.org/10.1016/j.envsci.2022.02.017

Y4N, YOUNGO, & GYBN (2022, December 2). Nature-based Solutions ahead of COP15: where are we now? *Youth4Nature.* ⟨https://www.youth4nature.org/blog/nbs-ahead-of-cop15⟩.

Zafonte, M., & Sabatier, P. (2004). Short-term versus long-term coalitions in the policy process: Automotive pollution control, 1963-1989. *Policy Studies Journal, 32*(1), 75–107. https://doi.org/10.1111/j.0190-292X.2004.00054.x

Monika Grubbauer, Alessandra Manganelli, Louis Volont (eds.)

Conflicts in Urban Future-Making

Governance, Institutions, and Transformative Change

[transcript]

Funded by the Deutsche Forschungsgemeinschaft (German Research Foundation, DFG) – Projektnummer 445103843 – GRK 2725.

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at https://dnb.dnb.de/

First published in 2024 by transcript Verlag, Bielefeld

Cover layout: Maria Arndt, Bielefeld
Logo: OPS Vision(Beta), Our Polite Society
Copy editing: Erin Troseth
Proofreading: Erin Troseth
Printed by: Majuskel Medienproduktion GmbH, Wetzlar
https://doi.org/10.14361/9783839474679
Print-ISBN: 978-3-8376-7467-5
PDF-ISBN: 978-3-8394-7467-9
ISSN of series: 2944-0106
eISSN of series: 2944-0114

Printed on permanent acid-free text paper.

Contents

5. Mapping conflicts of prioritization

National parliamentary discourses on urban greening and biodiversity implementation in Germany and Italy

Alessandro Arlati

Introduction

Climate change and its effects on people's lives are among the biggest challenges of the present times. A recent report jointly authored by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Intergovernmental Panel on Climate Change (IPCC) highlights the connection between climate change and biodiversity loss (Pörtner et al., 2021). While urban development has been identified as one of the leading causes of biodiversity loss (McDonald et al., 2018), cities themselves offer opportunities for developing solutions to address urban greening and biodiversity through ad hoc policies that recognize the prominent role of nature in combating climate change (Grimm et al., 2008). However, addressing climate change implies that diverse issues should be considered simultaneously, that uncertainties drive actions undertaken, and that conflicting interests are involved when changes are envisioned (Meadowcroft, 2011: 72). These challenges are exacerbated as the notion of nature 'is culturally invented and reinvented', thus contested and open to interpretation (Hajer and Versteeg, 2005: 178). Hence, the debate on urban greening and biodiversity, as they are related to climate change, is highly controversial, as political actors have different opinions on the problems, solutions, and actions to take.

In this chapter, I propose analysing political debates to explain climate governance policy-making processes within the context of global targets, national commitments, and local actions. Specifically, I investigate the conditions and reasons for conflict concerning urban greening and biodiversity policies in the German and Italian national parliaments as the appointed

authorities that translate supralocal recommendations into national decisions (Scharpf, 2009). I ask: What are the conditions of and reasons for contestation in the debate on urban greening and biodiversity at the national level? I deploy a discourse network analysis (DNA) to delineate the evolution of actors' discourses on the implementation of urban greening and biodiversity policies (Leifeld and Haunss, 2012). Stemming from discourse analysis and network analysis, DNA makes it possible to build networks of actors, called discourse coalitions, which are based on their agreement and disagreement patterns on a particular issue. The greater the polarization between these coalitions, the more detectable the conflicts become. After reflecting on the importance of discourses in environmental politics, I elaborate on the opportunities to study political debates in national parliaments in the European Union (EU). I also briefly present recent insights on EU urban greening and biodiversity policies. The third section of this chapter depicts the cases of Germany and Italy as two paradigmatic examples in the EU. The results reveal a general agreement among political actors on the relevance of implementing urban greening and biodiversity policies. However, conflicts become evident when other issues are deemed more urgent than urban greening and biodiversity interventions. In the fourth section, inspired by work on discourses of climate delay, which comprise various strategies that actors deploy to 'justify inaction or inadequate support' (Lamb et al., 2020: 1), I illustrate five 'latent conflicts' behind an apparently unanimously agreed upon policy solution. These conflicts result from a prioritization activity involving the deployment of climate delay discourses.

Localizing discourses in environmental politics

If, in Western countries, climate change is somewhat accepted by political parties of both the right and left (Ghinoi and Steiner, 2020: 216), disagreements on the most appropriate ways and tools to cope with climate change remain observable (Hulme, 2009). On one side, national governments are urgently asked to act (see Haarstad et al., 2023); on the other, dealing with climate change obligates national governments to weigh different priorities, debating on 'what action should be taken, how fast, who bears responsibility and where costs and benefits should be allocated' (Lamb et al., 2020: 1). Analysing the political debates on climate change can help to interpret policy-makers' choices of prioritization and their communication strategies (Schmidt and Radaelli, 2004).

Maarten Hajer has amply discussed the importance of discourses in environmental politics. Introducing the argumentative turn in discourse analysis, he sees actors producing and reproducing storylines based on shared ideas and beliefs through discourses (Hajer, 1995). Storylines serve to orientate actors' arguments in favour of or against a specific issue, forming discourse coalitions (Hajer, 1993). The more an issue is invested with ideologies and beliefs, as in the case of nature (Hajer and Versteeg, 2005), the stronger the relationships among the actors in the coalition who will attempt to impose their storylines over those of other coalitions. Hajer's argumentative discourse analysis shows that discourses do not occur in a void but are dependent on their context in a continuous dynamism whereby different coalitions engage permanently in discourse activities. The advocacy coalition framework (ACF), theorized by Paul Sabatier, describes an advocacy coalition as a network of actors that agree on a set of core policy beliefs. According to ACF, the dynamics between different coalitions tend towards the establishment of one definite storyline in the pursuit of a stable equilibrium (Zafonte and Sabatier, 2004). In doing so, different coalitions try to dominate the storylines of others, giving rise to conflictual situations. However, ACF is often criticized because it offers a relatively static picture of coalition dynamics, failing to explain the reasons for policy change (Schmid et al., 2020: 1114–15).

Conversely, the discourse network analysis (DNA) methodology provides a dynamic and longitudinal study of political discourses together with qualitative and quantitative social network analysis (Leifeld and Haunss, 2012). The unit of analysis of this method is the statement expressed by an actor concerning an issue. DNA can be used to find correlations between statements and the actors that utter them to provide a picture of the evolution of discourses on a specific issue based on agreement and disagreement patterns (Leifeld, 2017). Through DNA, it is possible to create three main types of networks (Leifeld, 2017). The *affiliation* network describes the relationship between actors and concepts at a given time. The *congruence* network shows how actors co-support or co-reject a concept: the thicker the tie, the higher the number of times two actors share the same opinion on that concept. Similarly, the *conflict* network shows the negative relation between actors and concepts, highlighting the most controversial arguments. Thus, analysing actors' relations through DNA can help identify potential conflicts among actors over time.

Whereas the implementation of urban policies occurs at the local level, policy-making at the national level can, to a certain extent, influence local-level discourses and practices (Lidmo et al., 2020). This influence largely depends on

the ability of national-level policy-making to provide a clear legal framework, which can be voluntary or binding (ibid.). This legal framework is debated in national parliaments, the official communication channels of national governments' decisions to the broader public (Bhattacharya, 2020: 231). In the EU, national governments have an additional reference layer when making decisions on domestic policies. By translating global climate targets into guidelines for the EU Member States (MS), the EU constitutes a 'government of governments' that provides an in-between political arena wherein each MS takes political responsibility for common issues (Scharpf, 2009: 181). The EU–MS relational system considers actors, bodies, and institutions, building a highly interconnected structure of distributed responsibility among different levels (Betsill and Bulkeley, 2006).

Nevertheless, the structure of such a model is relatively unstable, which affects debates at the national level whereby even the most mainstream political parties can feature internal disagreements and insecurity on what action to take (Hooghe and Marks, 2018). Thus, the complexity of EU–MS relations can create occasions for conflicts at the national level beyond domestic problems. One cause of conflict can be the introduction of novel arguments resulting from a policy decision at the EU level. Because novel arguments cannot always be immediately ascribable to a specific political orientation, actors lack a political direction by which to express a clear policy preference on these arguments (Kammerer and Ingold, 2023). Consequently, it is possible to find politicians belonging to opposing political parties sharing similar beliefs or even agreeing on a novel issue (Bhattacharya, 2020). Conversely, disagreements can also be generated from the bottom. Especially in times of crisis, recent research has highlighted that national parliament members do consider public opinion when arguing their position (Degner and Leuffen, 2020). All these considerations make parliamentary debates a vibrant arena for analysing and depicting discursive conflicts among actors and tracing their evolution in political decisions concerning EU affairs.

The cases of Germany and Italy in the context of EU policies on urban greening and biodiversity

In 2019, the EU drafted the European Green Deal (EGD) to embrace globally agreed-upon emission reduction targets and to set the guidelines for a strategy that simultaneously promotes just and inclusive economic growth 'to protect,

conserve and enhance the EU's natural capital' (EC, 2019: 2). The key areas of interventions refer to agriculture, biodiversity, energy, mobility, and the built environment. Successively, the EU Biodiversity Strategy for 2030 (BDS 2030) aims to operationalize the EGD key area of biodiversity by setting nature at the centre of climate policies (EC, 2020). With the persuasive title of 'Bringing nature back into our lives', the strategy proposes to systematically integrate 'healthy ecosystems, green infrastructure and nature-based solutions' into urban planning (ibid.: 13). These three notions permeate the urban greening and biodiversity interventions in the EU context. Healthy ecosystems generally refer to an ideal, desirable future (Costanza and Mageau, 1999); conversely, green infrastructure (GI) and nature-based solutions (NbS) are more action-oriented solutions, whereby GI refers to a utilitarian framework mainly for human well-being, and NbS focus on nature and the involvement of people (Haase, 2021: 308). GI and NbS belong to a broader discourse that deploys nature and natural elements to simultaneously achieve emission reduction targets, quality of life, and biodiversity protection in cities (ibid.: 315). However, activists have denounced the risks of misusing such brand-new and controversial notions (Seddon et al., 2021; Melanidis and Hagerman, 2022). For example, many private corporations have constructed a narrative of sustainability around NbS while keeping their business-as-usual activities (FOEI, 2021). These misuses have raised a profound debate around the equal and just distribution of benefits supposed to be created through the implementation of solutions that foresee nature as a driving element for urban development (e.g. Cousins, 2021).

Research has highlighted a wide variety of reactions to EU decisions from different national contexts and the political parties composing the national parliaments, underlining the communicative power of these bodies (Auel and Raunio, 2014). Germany and Italy can be considered the two countries that best exemplify the northern and southern politico-economic models coexisting in the Eurozone, thus giving insights into the growing divergence among the EU Member States (Piattoni and Notermans, 2021). These two countries, both members of the G7, have a strong image in the global arena. While Germany is a federation of states, Italy is defined as a devolved state with a relatively strong central government where only some responsibilities are transferred to the local level. Nevertheless, this centralized tendency does not apply to environmental policy and planning: in fact, both countries' governance structures underwent a process of decentralization of competencies from higher levels towards local ones in the early 2000s (ESPON, 2018). Being parliamentary republics, their national legislations are decided within a bicameral system

composed of a lower (parliament) and an upper (senate) house (Parline, n.d.). Because the Bundestag and Camera dei Deputati have similar structures, comparing the two parliaments is possible (see Table 1).

Table 1: Germany and Italy data comparison.

	Germany	Italy
Socio-economic data		
Population, 2023 [million] (Eurostat, 2024)	84.4	58.9
People living in cities, 2022 [%] (World Bank Open Data, 2018)	77.6	71.6
Country territory occupied by settlement, 2021 [%] (Eurostat, 2022)	37.2	39.1
Public debt, 2023 [% of GDP] (Eurostat, 2023)	64.6	142.4
Urban greening–related data		
Public green space per inhabitant [m²/inh.] (Maes et al., 2019: 55)	30	15
Contribution to the Green Climate Fund [billion USD] (GCF, 2023)	1.7	0.3
EU-related data		
European Regional Development Fund, allocated [billion EUR] (EU, 2021)	10.9	26.6
Citizens trusting the EU [%] (EU, 2023)	68	69
Subscribed capital at the CEB funds [%] (CEB, 2023)	16%	16%
Government-related data		
Constitutional levels	Federation	Devolved
Parliament system	Bicameral	Bicameral
Parliament members [n] (Parline, n.d.)	736	400

Source: Author.

Compared to other EU Member States, the Bundestag presents and debates a higher share of EU legislation on its floor, which translates into a higher politicization of EU affairs than in other countries (Auel and Raunio, 2014). Re-

search on Camera dei Deputati debates has highlighted that environmental issues have always had a marginal role in Italian politics, but in recent years, attention given to climate change has increased consistently, especially in connection with natural disasters (Ghinoi and Steiner, 2020). Concerning urban greening and biodiversity, Germany and Italy are among the top five European contributors to the Green Climate Fund, showing a specific commitment towards greening policies[1] (GCF, 2023). Regarding their differences, Germany presents a generally high ratio of square metres of public green space per inhabitant, while this ratio in Italy is rather low (Maes et al., 2019). Because Germany and Italy present differences only in a few aspects, this research follows a 'most similar systems design approach' (Bozonelos et al., 2022).

Applying DNA to Italian and German national parliament debates

Using a multi-case-study analysis, this paper deploys discourse network analysis (DNA) to investigate the different responses to the EGD and BDS 2030 in national parliamentary debates. Although the usual primary data for DNA are newspaper articles (Leifeld, 2013), recent applications of the methodology have shown its potential for parliamentary debates by using verbatim reports of the parliamentary sessions (Bhattacharya, 2020; Ghinoi and Steiner, 2020). I analyse the debates on urban greening and biodiversity policies in the parliaments of two EU Member States: the Bundestag in Germany and the Camera dei Deputati in Italy.

The first documents related to urban greening and biodiversity in the German context are the green paper *Grün in der Stadt* and the white paper *Stadtgrün* drafted in May 2015 and April 2017, respectively. Both documents elaborate on the importance of urban greening and biodiversity becoming an integral part of German city planning with a social, ecological, and economic function (BMUB, 2015: 93) and provide guidelines for introducing more greening in cities to counteract the climate crisis (BMUB, 2017). The coalition contract between the CDU/CSU and SPD parties then led to the drafting of the *Masterplan Stadtnatur* in 2019, whereby nature in cities is considered relevant for supporting biodiversity and educating young people about health, social cohesion, and adaptation to climate change (BMU, 2019: 1–2). The masterplan

1 Germany is in first place, while Italy is in fifth.

adjusts the concept of greening in cities (*Stadtgrün*), which focuses on the future life of citizens, towards nature in cities (*Stadtnatur*), which instead targets the broader ecosystem of plants, animals, and insects as well (ibid.: 3). In 2019 and its update in 2021, the Federal Climate Change Act (KSG) was drafted to legally adopt the EGD at the national level. It represents the broadest and most mandatory targets for future developments in Germany, primarily by setting targets for carbon dioxide (CO_2) and greenhouse gas (GHG) emissions reduction.[2] Since the German Environment Agency (UBA) considers urban greening and biodiversity interventions as a way to capture or reduce CO_2 and GHG emissions (Reise et al., 2022), solutions that rely on natural elements such as GI and NbS have acquired relevance in the climate change debate in Germany. Lastly, the National Strategy for Biological Diversity 2030 is the most recent document concerning urban greening and biodiversity, delineating an action plan for 2024–2026 supporting these interventions to become part of city planning (BMUV, 2023: 68–69).

The first document related to urban greening and biodiversity in the Italian context is Law Number 10/2013,[3] which states regulations for preserving urban green areas of historical and cultural significance and indications for developing new areas. The law supports local initiatives that propose urban green developments in any form[4] and declares the formation of the Committee for the Development of Public Greening.[5] One of its main goals is drafting a national plan to establish criteria and guidelines for realizing permanent green and tree-lined areas.[6] The principles within this law were translated into the National Strategy for Urban Greening, drafted in 2018. This strategy elaborates on the need to produce a plan addressing urban greening for protecting and fostering biodiversity through a systemic approach (CSV, 2018: 48). Solutions relying on nature, such as GI and NbS, are mentioned for their ability to address complex ecosystems (ibid.: 49) and tackle air pollution in cities (ibid.:

2 §3, Bundes-Klimaschutzgesetz, 2019. Bundesrepublik Deutschland.

3 LEGGE 14 gennaio 2013, n. 10. Norme per lo sviluppo degli spazi verdi urbani, 2013. Gazzetta ufficiale della Repubblica Italiana 1.

4 §6c and §6d, LEGGE 14 gennaio 2013, n. 10. Norme per lo sviluppo degli spazi verdi urbani, 2013. Gazzetta ufficiale della Repubblica Italiana 1.

5 §3, LEGGE 14 gennaio 2013, n. 10. Norme per lo sviluppo degli spazi verdi urbani, 2013. Gazzetta ufficiale della Repubblica Italiana 1.

6 §3c, LEGGE 14 gennaio 2013, n. 10. Norme per lo sviluppo degli spazi verdi urbani, 2013. Gazzetta ufficiale della Repubblica Italiana 1.

131). The documents presented show urban greening and biodiversity interventions as tools for CO_2 and GHG emissions reduction. Additionally, after the EGD, the notion of ecological transition was potently used in Italy, leading to the renaming of the Ministry of the Environment to the Ministry of the Ecological Transition in 2021. Lastly, the Italian Biodiversity Strategy 2030 highlights the role of biodiversity in fostering health, society, and the economy, pushing for more direct and continuative actions to increase knowledge, conservation, and valorization of ecosystems (MASE, 2023: 2–3). It is noteworthy that fostering biodiversity in Italy is still conceptualized as a proxy to bring benefits for human society rather than for nature itself.

The paragraphs above serve to identify the most suitable data according to DNA, namely (1) the period within which the verbatim reports should be searched and (2) which keywords should be used. Therefore, the time frame between 1 January 2013 and 1 June 2023 was selected to search the verbatim reports. This period is long enough to grasp a debate's main concepts and arguments and observe the evolution of discourse coalitions (Nagel and Satoh, 2019: 1685). Additionally, the data were subdivided into two distinct snapshots corresponding to the periods before (T1) and after (T2) the December 2019 publication of the EGD. This subdivision serves to identify whether similarities or differences in the discourse coalitions exist over time based on the external input from the EU (Leifeld and Haunss, 2012: 391). The keywords selected for the German case refer to urban greening, CO_2 and GHG reduction, climate and biodiversity protection, and urban development; [7] for Italy, the chosen keywords were less specific due to the impossibility of conducting a proper Boolean search in the Camera dei Deputati database.[8] In total, 49 and 48 documents were found, respectively. This sample size is comparable with other research using DNA to analyse parliamentary debates (e.g. Bhattacharya, 2020:

7 The German documents were found in the Dokumentations- und Informationssystem für Parlamentsmaterialien (DIP) of the Bundestag. The following string was used: *(A) (Klimawandel) und (Klimaschutz) und (CO2-Abscheidung und -Speicherung oder Treibhausgas) und (Biodiversität) und (Stadtentwicklung); (B) (Masterplan Stadtnatur – Maßnahmenprogramm der Bundesregierung für eine lebendige Stadt oder Stadtgrün); (C) (Naturbasierte Lösung).*

8 Only Assembly-related documents were selected. Four searches were conducted at Banche dati/Dibattiti in testo integrale of the Camera dei Deputati website (*A) clima, emissioni, verde OR biodiversità; (B) verde urbano (exact phrase); (C) soluzioni basate sulla natura; (D) sviluppo urbano sostenibile.*

232). An ad hoc selection concentrated the analysis on 12 documents per country (see Nagel and Bravo-Laguna, 2022). The criteria for this selection considered (1) the main governing periods, i.e. when the government is not concentrated on election campaigns or coalition formation negotiations, and (2) the monthly concentration of verbatim reports identified through the keywords.

The coding of the documents was adapted to the specificity of the parliamentary debates. Actors were categorized according to their position (government, majority, opposition) and political affiliation (from far right to far left). Each statement is categorized as a concept reflecting how actors express themselves on the issue at stake and the meaning those actors attribute to it. In parliament debates, all speakers have the same amount of (limited) time to express themselves on an issue. Each political party must divide its time among its members, whereby governing parties exploit their agenda control to profit from the time allocation (Giannetti and Pedrazzani, 2016). Due to this imbalance, the opposition parties tend to focus on counteracting the majority's proposals and present straightforward suggestions for improvement. Conversely, the speeches of the majority include comparatively vague arguments and mainly present the positive aspects of a proposal. Consequently, most of the statements of disagreement were found in the opposition speeches. In this case, a disagreement value was attributed to the majority's arguments compared to the opposition parties' or vice versa. Using the Java software Discourse Network Analyser version 3.0.10, 1,413 statements grouped into 197 concepts were coded for the documents analysed.[9] These were organized among eight sectors, following the EGD key areas (agriculture, biodiversity, energy, mobility, and the built environment) with the addition of EU and global relationships; technical, legal, and social measures; and urban greening. The use of the same sectors and concepts for the coding of both cases makes the comparison possible.

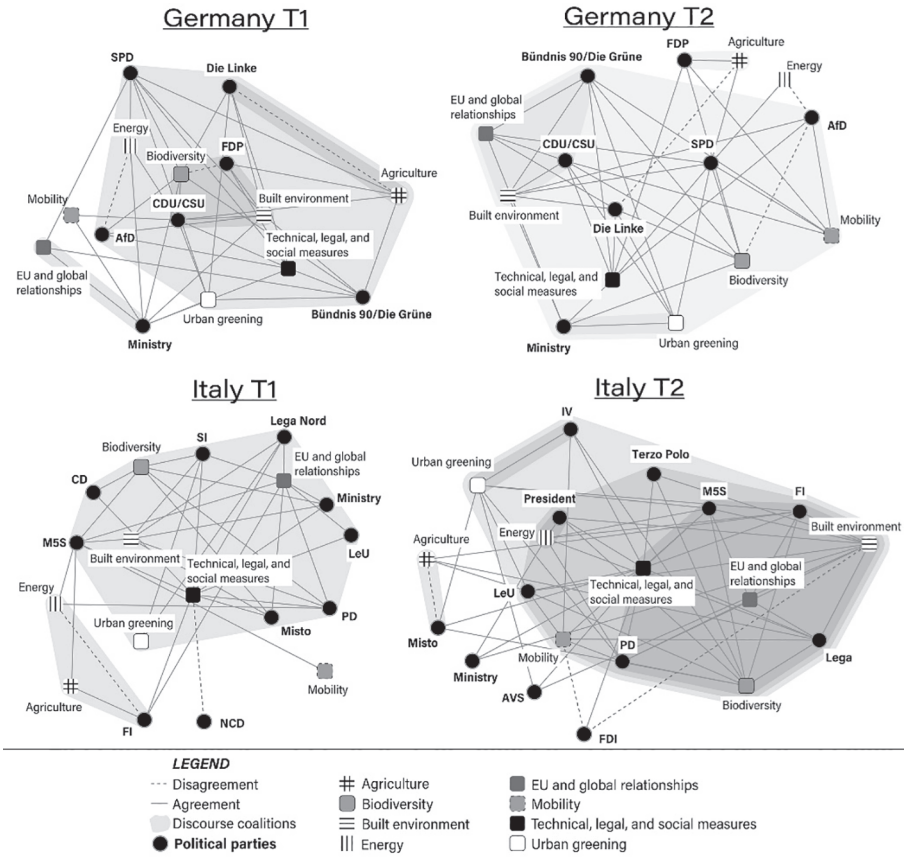
Discourse coalitions in German and Italian national parliaments

The data collected and coded as described in the preceding subsection are analysed by combining congruence and conflict networks to show both shared and conflicting arguments using the subtraction function (Leifeld and Haunss,

9 I thank Rebecca Dedeck for help in coding the German case.

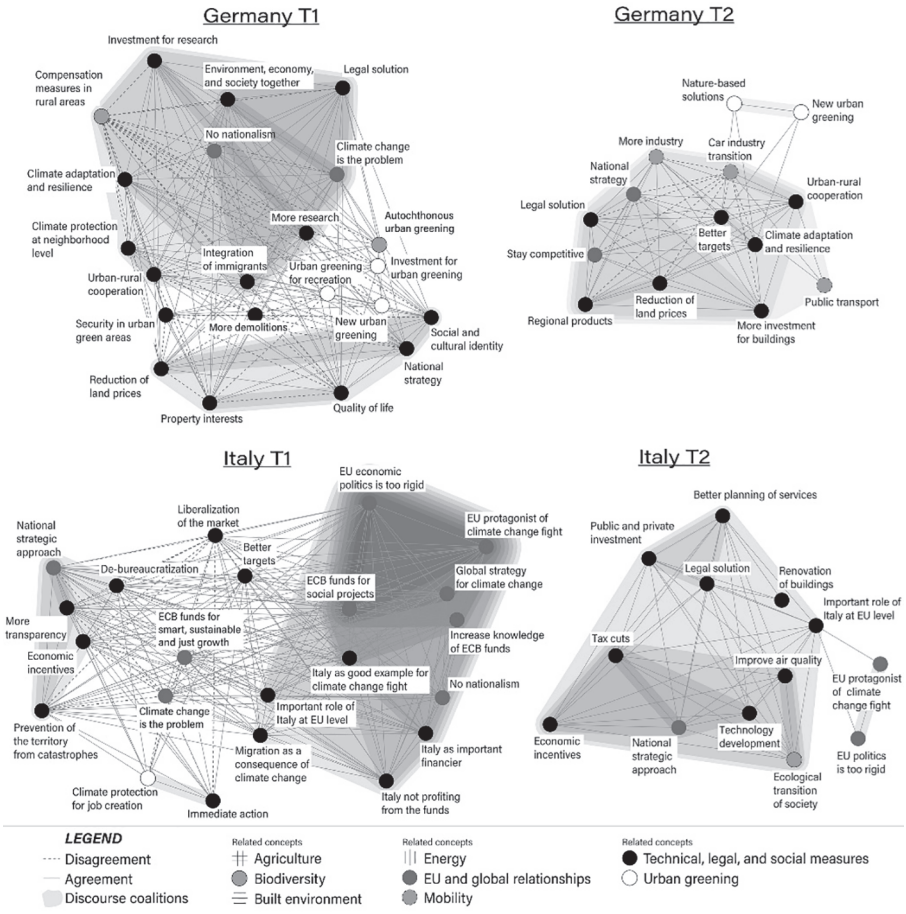
2012). The results were clustered through the Girvan-Newman method and visualized using the software program Visone (version 2.26) and are depicted in Figure 1 and Figure 2.

Figure 1: Subtracted discourse coalitions for Germany (above) and Italy (below) in two snapshots: before 2019 (T1) and after 2019 (T2) at the macro level of the eight sectors.



Source: Author.

Figure 2: Subtracted discourse coalitions for Germany (above) and Italy (below) in two snapshots: before 2019 (T1) and after 2019 (T2) at the micro level of the 197 concepts.



Source: Author.

Figure 1 shows discourse coalitions for the snapshots T1 and T2 at the macro level of the eight sectors. Networks were extracted from the Discourse Network Analyser software as two-mode based on concepts and political parties. Only the concepts with a betweenness above 0.2% are visualized. Figure 2 depicts the same discourse coalitions but at the micro level of the 197 concepts. Here, networks were extracted from the Discourse Network Analyser software as one-

mode based on concepts and sectors. Only the concepts with a betweenness above 0.5% are visualized.

Concerning the German case, discourse coalitions are relatively visible in T1 between concepts referring to the built environment and technical, legal, and social measures sectors (Figure 2). At the level of sectors, the two main coalitions see the government (ministry) isolated, standing mainly for the EU and global relationships (Figure 1). It can be observed that urban greening and biodiversity-related concepts are not ascribable to any specific coalition; still, these are in disagreement with other concepts, such as property interest support and compensation in rural areas (Figure 2). In the urban greening and biodiversity debate, the two centre-right parties, the FDP and CDU/CSU, disagree (Figure 1). Interestingly, these two parties are the parliamentary groups that most intensively address urban greening and biodiversity.

In T2, the concepts related to biodiversity form a clear coalition in contrast with others, especially mobility and agriculture (Figure 2). The more participative opposition of the AfD increases conflictual relations compared to T1 (Figure 1). Instead, agreement on concepts related to urban greening is generally shared by all parties, with more intense support from the government (Figure 1). In this debate, the AfD, although recognizing the importance of urban greening and biodiversity per se, vigorously pursues other fossil-fuel-friendly priorities. By accusing the majority of being too ideological in their environmental politics, this party rather pushes for the built environment and mobility-related concepts (Figure 2).

For T1 in Italy, three discourse coalitions can be observed: concepts related to (1) existing governance modes for the territory, (2) relationships between Italy, the EU, and other institutions, and (3) the need for immediate action and economically adequate climate protection (Figure 2). The second of these coalitions includes the highest number of concepts, revealing a direct invested interest in working on the image of Italy at the EU level (Figure 2). The isolated FI, the centre-right party, argues for agriculture and against energy sectors while not making any relevant contribution to urban greening and biodiversity (Figure 1). In general, concepts related to urban greening and biodiversity are not addressed, while conflicts are visible between market liberalization, transparency, and de-bureaucratization measures (Figure 2).

In T2, the visible discourse coalitions are reduced to two; one is centred on the role of the EU in guiding local actions, and the other on the activities themselves (Figure 2). However, conflicts are generally absent here. Like the German AfD, FDI is the main conflictual party, whereas the technical, legal, and social

measures sector is the most debated (Figure 1). In line with the arguments of Ghinoi and Steiner (2020), no evident discussion about urban greening or biodiversity sectors has been observed in both T1 and T2. If mentioned, concepts related to these sectors are embraced in a human-centred discourse (e.g. urban greening for human health).

The five 'latent conflicts' of prioritization

The results above show the German and Italian political parties' general agreement on the importance of supporting interventions related to urban greening and biodiversity. Following this logic, there is no apparent obstacle to their implementation. Nevertheless, conflicts are visible at the interface between urban greening and biodiversity concepts and others. In these cases, conflicts arise when limited resources force political parties to set priorities, whereby other more pressing issues surpass urban greening and biodiversity interventions. This prioritization explains how these actors more or less consciously deploy a set of discursive strategies to delay or divert the decision. I use the four discursive strategies of climate delay proposed by Lamb et al. (2020) as a heuristic tool to interpret the results from the DNA driven by the prioritization logic. Due to the specificity of the political arena of the national parliaments, a fifth set of strategies was added (see Table 2). Understanding the act of prioritization as the primary source of conflict among political actors, I conceptualize the absence of conflict in urban greening and biodiversity policies by presenting five 'latent conflicts' and the related discursive delay strategies. These conflicts are a meta-categorization of the discourse coalitions identified through the DNA methodology that express the intentions of parliament members to prioritize one concept over others. These five 'latent conflicts' are explained in the following paragraphs.

Table 2: Discursive strategies based on Lamb et al. (2020) and the related elements of conflict.

Strategy category	Discursive strategy	Elements of conflict
Redirect responsibility	Individualism	Change should be at the individual level
	Whataboutism	Other countries should adjust
	Free-rider excuse	Change cannot be pursued because of loss of competitiveness
Push non-transformative change	Technological optimism	Faith in technology for change
	Fossil fuel solutionism	Change is not needed as existing fossil fuel solutions work perfectly
	All talk, little action	Promises of change, but no action follows
	No stick, only carrot	Incentivize change through economic measures and silence the downsides
Emphasize the downside	Appeal to social justice	Change would create costs for the society
	Appeal to well-being	Change would diminish citizens' quality of life
	Policy perfectionism	Change can't be too ambitious, and caution is needed
Surrender	Change is impossible	Surrender or adapt because change is too complex
	Doomism	No matter what can be done, it is too late for change
Play the debate (parliamentary-debate-specific strategy)	Battles over meaning	Confusion or difference in meanings attributed to the same notion
	Protagonism	Criticize or second an argument by saying that its party already fought for it before
	Same day, another concept	Criticize the action of the government in general or introduce a new concept

Source: Author.

The first identified conflict, 'Immediate action or step-by-step?', is rooted in the broader mismatch between politics and policy in the perception of a problem (Heinelt, 2007) and, in particular, in the different spatial and temporal logic of a local politics of urgency versus the slow pace of global environmental-related challenges linked to climate change (Haarstad et al., 2023). While moderate parties follow a rather positivistic approach by arguing for the need to foster innovations and technology (*Technological optimism*) to combat climate change through the support of economic measures, such as incentives or tax exemptions (*No stick, only carrot*), left parties, to the contrary, tend to counteract this type of argument by calling for immediate action. These parties argue that humankind is dependent on nature and advocate for more natural solutions, pointing out the connection between climate change and biodiversity loss. However, the complexity of dealing with climate change is often argued by right-wing parties to justify the impossibility of change (*Change is impossible*) and the promotion of already existing technologies based on fossil fuels (*Fossil fuel solutionism*) or, at most, the support of a step-by-step approach (*Policy perfectionism*). This argument also pinpoints the high costs of urban greening and biodiversity interventions, which would burden society and the market (*Appeal to social justice*). Also, the frightening and pessimistic perspective of left-wing parties, as argued by right-wing parties, is often accused of creating panic and being counterproductive, reinforcing immobility arguments (*Doomism*).

The 'Is your future better than mine?' latent conflict reflects tensions between different ideas of urban futures. Even if everyone agrees on the importance of urban greening and biodiversity, dedicated areas for natural solutions within the city boundaries often clash with other ideas of the urban, such as the smart city, with a focus on technology and economy, or the compact city, with an emphasis on densification and mobility (Lidmo et al., 2020). Strategies deployed refer to a high faith in technology (*Technological optimism*), which all parties share, or to strategies that tend to obscure the downsides by highlighting the benefits for all (*All talk, little action*). Because some urban future ideas include market-based solutions that tend to commodify assets and resources, conflicts are located in both contexts' limitations and opportunities offered by the neoliberal paradigm of the current market (Ravazzi, 2021). In this sense, new alternative urban futures are embedded to a certain extent in strong path dependencies beyond right or left orientations.

The latent conflict 'You said Z, but what about X and Y?' regards a general mismatch between majority statements and those of the opposing parties. Interestingly, it was observed that right-wing parties usually bring up the topic

of urban greening and biodiversity in the debate as an excellent solution to improve the quality of life in cities (Germany) or to help prevent natural catastrophes (Italy). Left-wing parties do not oppose this kind of statement; they instead criticize the late response of the right-wing parties in supporting urban greening and biodiversity actions (*Protagonism*), and then either welcome their decision or propose additions. In Germany, during T2, the right-wing opposition disagrees with the arguments on urban greening and biodiversity of the majority by commenting on the inadequacy of the government's general conduct rather than criticizing the proposals per se. Similarly, the opposition may introduce new arguments with the aim of destabilizing the decision or pushing back responsibilities (*Same day, another concept*). These arguments usually refer to rather vague ideas and general notions, such as the ecological transition of society in the case of Italy, which are often difficult to counteract.

The latent conflict 'For humans or for nature?' pertains to the use of specific concepts, criticizing the different meanings each party gives to the same notion (*Battles over meaning*). In some cases, the parties accuse each other of wrongly using the notion of nature. A clear difference between urban greening and biodiversity interventions for the benefit of people or nature can be observed. It is noticeable that the advent of the EGD and the BDS 2030 has introduced a specific sensitivity among actors on this issue. During the Covid-19 pandemic, the debate around urban greening and biodiversity became relatively active in terms of mental and physical health. However, discourses on citizens' safety and on economic support to industry dominate the discourse on urban greening and biodiversity (*Appeal to well-being*). These events – the drafting of the EGD and BDS, as well as the onset of Covid-19 – prove the importance of external influences on domestic discourses, which may lead to a reshuffling of the actors' relations and the consequent formation of new coalitions. Misconceptions of wording are also found with other notions. For instance, democracy is often questioned in the Italian case, as the majority is accused of skipping some decisional steps in order to implement partial climate change–related plans (*Same day, another concept*).

The last identified conflict, 'Whose fault is it?', concerns the relationship with the EU or with other Member States, which causes intense polarization among parties in both cases. Here it is possible to recognize approaches of collaboration and harmony, as well as command, control, and open conflict, and even manipulation where acting against other countries is prioritized over addressing domestic problems. In many cases, these discourses on the relationship with the EU undermine the translation of the debate into effective reg-

ulations or policies. Italian parties' tones are usually rather autoreferential in referring to the relationship with the EU: the main objective is to regain the EU institutions' trust in the country and reaffirm the power and right of Italy to become a protagonist in the EU scene. The pressure of dealing with the EU is lower in Germany, translating into milder tones, referring mainly to searching for the solution to the problem outside the country (*Whataboutism*). Conflictual discourses regarding EU institutions are usually deployed by liberals and democrats, leading to the generation of nationalist beliefs (Marks and Wilson, 2000). This push against the 'outside' when acting for change is supported by concepts of protecting one's own cultural identity and by arguments of preserving the domestic economy's competitiveness (*Free-rider excuse*).

Conclusion

This chapter has proposed analysing national parliamentary debates in order to unravel conflicts among political parties that may explain the reasons for inaction in implementing urban greening and biodiversity interventions. A discourse network analysis (DNA) was deployed to identify reasons for conflicts by detecting different discourse coalitions over 10 years, from 2013 to 2023. DNA proved to be beneficial in highlighting more formally than other policy discourse analysis approaches (1) the arguments and concepts of conflict around urban greening and biodiversity policies and (2) actors' coalitions that either hinder or support the implementation of such policies (Leifeld and Haunss, 2012). Comparing two EU Member States of global relevance, Germany and Italy, provided a lens for grasping the complexity of urban greening and biodiversity policy-making. Interestingly, the analysis has revealed that little conflict exists per se on this topic at the national level. Conversely, actors prioritize solutions differently, whereby urban greening and biodiversity interventions are evaluated as being of relatively low priority compared to interventions within other policy fields. While DNA offers a quantitative evaluation of the debate and highlights network dynamics between actors and concepts, the strategies proposed by Lamb et al. (2020) provide an additional qualitative lens to interpret the results. Thus, five 'latent conflicts' were identified as the product of an implicit and explicit prioritization of policy agendas that follow politicians' constructed storylines to hinder effective implementation and justify inaction.

Among the five types of latent conflicts, the 'Whose fault is it?' conflict is the most intense. This is quantitatively visible in the number of concepts related to the EU institutions, as depicted in Figure 2. Qualitatively, the subdivision into the two snapshots, T1 and T2, shows that this conflict persists, although with different arguments and intensities, demonstrating diverse reactions of the two countries to EU-level guidelines (Auel and Raunio, 2014). Together with external events (e.g. Covid-19), the introduction of the EGD has proven to be decisive in discourse coalition rearrangements, resulting, in turn, in new polarizations on urban greening and biodiversity policy-making. Specifically, conflicts with the EU increased in Germany in T2, symbolizing a heightened sensitivity towards such topics. In Italy, the intensity of this conflict remained stable. Still, the topic shifted from trust and collaboration towards tension and distancing, whereas urban greening and biodiversity stayed in the background and mainly remained connected to discourses related to human benefits. In both cases, nationalists and Eurosceptics have increased their dissent against the EGD, in favour of domestic actions rather than multilevel collaboration. This is relevant for urban greening and biodiversity in particular, and for climate change in general, as such wicked problems are not affected by administrative boundaries and instead require a strong collaboration that transcends human-created boundaries.

The two conflicts 'For humans or for nature?' and 'You said Z, but what about X and Y?' are also highly controversial. The former fundamentally questions the argumentations of the proposer, while the latter refers to tactics to introduce new concepts with the aim of increasing complexity in the debate and blocking decisions. Interestingly, conservative parties have taken the initiative of introducing concepts related to urban greening and biodiversity. In contrast, progressive parties tend to speak of other concepts, such as housing and social justice, when counteracting the propositions from the majority. This is the case for Germany in T1, when the CDU/CSU highlighted the necessity of implementing more urban greening and biodiversity interventions, and the Green Party replayed the importance of strengthening the provision of social housing. A similar dynamic occurs in the Italian case, but in T2. This dynamic is linked to the majority's power to steer the agenda, while the opposition parties, with less time at their disposal, limit their speech to counteract the majority's argumentations. This counteracting usually takes the form of redirecting to other subjects of accusation instead of arguing on the same subject. In this case, no differences in political affiliation are observable.

Lastly, the latent conflicts 'Immediate action or step-by-step?' and 'Is your future better than mine?' are the least intense. A reason could be that opinions on the best approach and best urban future to pursue are firmly rooted in parties' beliefs and values, which are difficult to change. Conversely, the concepts generated from these beliefs are questioned rather than the beliefs themselves. This reflects the results that show a general agreement on the importance of urban greening and biodiversity. At the same time, no real suggestion on how to proceed is proposed; decisions are instead kept for an indefinite next meeting. Finally, it is noteworthy that these five latent conflicts are also linked to the specific format of the parliament debates. Since the imbalance in time allocation favours the majority, it was observed that the opposition must convey its ideas in a more precise and straightforward fashion. In contrast, the majority parties tend to remain vague.

Political discourses are a network phenomenon (Leifeld, 2017: 302). National debates on urban greening and biodiversity should not be treated as separate from other policy fields. While political actors tend to focus on the issue at hand, the complexity of urban greening and biodiversity is consistently intertwined with questions of land use, responsibility, materiality, and ideology. As shown in the German and Italian cases, the vagueness of the arguments on which actors agree even risks worsening any attempt to implement urban greening and biodiversity policies due to particular contextual situations and the complexity of the concepts used. By assuming the existence of multiple realities and considering the institutional dimension of discourse as its ability to shape society (Hajer, 1995), discourse analysis and DNA create space for properly interpreting the ambiguity of environmental politics, whereby discourse analysis is not simply a descriptive tool but can represent power dynamics among actors embracing conflict as a motor of (or brake to) change (Hajer and Versteeg, 2005; Leifeld, 2017). Further research could investigate the relations between parliamentary debates and practical implementations locally by identifying key actors and conflict types related to socioecological changes. Also, the analysis might benefit from defining more snapshots – for instance, during shifts in legislatures – to provide a more fine-grained picture that may show different types of agreement and disagreement (e.g. conceptual, opportunistic) and highlight additional conflicts related to the use of concepts in political debates during the election period.

References

Auel, K. and T. Raunio (2014) Debating the state of the union? Comparing parliamentary debates on EU issues in Finland, France, Germany and the United Kingdom. *The Journal of Legislative Studies* 20.1, 13–28.

Betsill, M.M. and H. Bulkeley (2006) Cities and the multilevel governance of global climate change. *Global Governance* 12.2, 141–59.

Bhattacharya, C. (2020) Gatekeeping the plenary floor: Discourse network analysis as a novel approach to party control. *Politics and Governance* 8.2, 229–42.

BMU (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit) (2019) Masterplan Stadtnatur: Maßnahmenprogramm der Bundesregierung für eine lebendige Stadt. https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Naturschutz/masterplan_stadtnatur_bf.pdf.

BMUB (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit) (2015) Grün in der Stadt – Für eine lebenswerte Zukunft. Grünbuch Stadtgrün. https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/ministerien/bmub/verschiedene-themen/2015/gruenbuch-2015-dl.pdf.

BMUB (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit) (2017) Weißbuch Stadtgrün. Grün in der Stadt – Für eine lebenswerte Zukunft. https://www.bmwsb.bund.de/SharedDocs/downloads/Webs/BMWSB/DE/publikationen/wohnen/weissbuch-stadtgruen.pdf.

BMUV (Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz) (2023) Ziele- und Maßnahmenkatalog zur Nationale Strategie für Biologische Vielfalt NBS 2030. https://dialog.bmuv.de/bmu/de/home/file/fileId/810/name/Ziele-%20&%20Ma%C3%9Fnahmenkatalog%20zur%20NBS%202030.pdf.

Bozonelos, D., J. Wendt, C. Lee, J. Scarffe, M. Omae, J. Franco, B. Martin, and S. Veldhuis (2022) *Introduction to comparative government and politics*, ASCCC OERI, Sacramento, CA. https://socialsci.libretexts.org/Bookshelves/Political_Science_and_Civics/Introduction_to_Comparative_Government_and_Politics_(Bozonelos_et_al.).

CEB (Council of Europe Development Bank) (2023) CEB half-year financial report 2023: Condensed interim financial statements as at 30 June 2023 (Unaudited). https://coebank.org/media/documents/2023_CEB_Interim_Financial_Report.pdf.

Costanza, R. and M. Mageau (1999) What is a healthy ecosystem? *Aquatic Ecology* 33.1, 105–15.

Cousins, J.J. (2021) Justice in nature-based solutions: Research and pathways. *Ecological Economics* 180, 106874.

CSV (Comitato per lo Sviluppo del Verde) (2018) Strategia nazionale del verde urbano: Foreste urbane resilienti ed eterogenee per la salute e il benessere dei cittadini. Ministero dell'Ambiente e della Tutela del Territorio e del Mare. https://www.mase.gov.it/sites/default/files/archivio/allegati/comitato%20verde%20pubblico/strategia_verde_urbano.pdf.

Degner, H. and D. Leuffen (2020) Crises and responsiveness: Analysing German preference formation during the Eurozone crisis. *Political Studies Review* 18.4, 491–506.

EC (European Commission) (2019) Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF.

EC (European Commission) (2020) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: EU Biodiversity Strategy for 2030: Bringing nature back into our lives. https://eur-lex.europa.eu/resource.html?uri=cellar:a3c806a6-9ab3-11ea-9d2d-01aa75ed71a1.0001.02/DOC_1&format=PDF.

ESPON (European Observation Network for Territorial Development and Cohesion) (2018) COMPASS – Comparative analysis of territorial governance and spatial planning systems in Europe. Applied Research 2016–2018. Final report. https://archive.espon.eu/sites/default/files/attachments/1.%20COMPASS_Final_Report.pdf.

EU (European Union) (2021) 2021–2027 ERDF and ESF+ initial allocations. https://cohesiondata.ec.europa.eu/2021-2027-Finances/Copy-of-2021-2027-ERDF-and-ESF-initial-allocations/ye46-pszx.

EU (European Union) (2023) Standard Eurobarometer 100 – Autumn 2023. https://europa.eu/eurobarometer/surveys/detail/3053.

Eurostat (2022) Urban-rural Europe – Introduction. Eurostat: Statistics Explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Urban-rural_Europe_-_introduction#Area_and_population.

Eurostat (2023) Government debt down to 90.3% of GDP in euro area: Second quarter of 2023. Euroindicators. https://ec.europa.eu/eurostat/documents/2995521/17725721/2-23102023-BP-EN.pdf.

Eurostat (2024) Facts and figures on life in the European Union. https://european-union.europa.eu/principles-countries-history/key-facts-and-figures/life-eu_en.

FOEI (Friends of the Earth International) (2021) Chasing carbon unicorns: The deception of carbon markets and 'net zero'. https://www.foei.org/publication/chasing-unicorns-carbon-markets-net-zero/.

GCF (Green Climate Fund) (2023) Status of pledges and contributions: Initial resource mobilization and first replenishment: GCF-1. https://www.greenclimate.fund/document/status-pledges-all-cycles.

Ghinoi, S. and B. Steiner (2020) The political debate on climate change in Italy: A discourse network analysis. *Politics and Governance* 8.2, 215–28.

Giannetti, D. and A. Pedrazzani (2016) Rules and speeches: How parliamentary rules affect legislators' speech-making behavior. *Legislative Studies Quarterly* 41.3, 771–800.

Grimm, N.B., S.H. Faeth, N.E. Golubiewski, C.L. Redman, J. Wu, X. Bai, and J.M. Briggs (2008) Global change and the ecology of cities. *Science* 319.5864, 756–60.

Haarstad, H., J. Grandin, K. Kjærås, and E. Johnson (eds.) (2023) *Haste: The slow politics of climate urgency*. University College London Press, London.

Haase, D. (2021) Integrating ecosystem services, green infrastructure and nature-based solutions – New perspectives in sustainable urban land management. In T. Weith, T. Barkmann, N. Gaasch, S. Rogga, C. Strauß, and J. Zscheischler (eds.), *Sustainable land management in a European context: A co-design approach*. Human-Environment Interactions series, vol. 8, Springer, Cham.

Hajer, M.A. (1993) Discourse coalitions and the institutionalization of practice. In F. Fischer and J. Forester (eds.), *The argumentative turn in policy analysis and planning*, Duke University Press, Raleigh, NC.

Hajer, M.A. (1995) *The politics of environmental discourse: Ecological modernization and the policy process*. Clarendon, Oxford.

Hajer, M.A. and W. Versteeg (2005) A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. *Journal of Environmental Policy & Planning* 7.3, 175–84.

Heinelt, H. (2007) Do policies determine politics? In F. Fischer and G. J. Miller (eds.), *Handbook of public policy analysis: Theory, politics, and methods*, Public

Administration and Public Policy series, CRC; Taylor and Francis, Boca Raton, FL.

Hooghe, L. and G. Marks (2018) Cleavage theory meets Europe's crises: Lipset, Rokkan, and the transnational cleavage. *Journal of European Public Policy* 25.1, 109–35.

Hulme, M. (2009) *Why we disagree about climate change: Understanding controversy, inaction and opportunity*. Cambridge University Press, Cambridge.

Kammerer, M. and K. Ingold (2023) Actors and issues in climate change policy: The maturation of a policy discourse in the national and international context. *Social Networks* 75, 65–77.

Lamb, W.F., G. Mattioli, S. Levi, J.T. Roberts, S. Capstick, F. Creutzig, … and J.K. Steinberger (2020) Discourses of climate delay. *Global Sustainability* 3, 1–5.

Leifeld, P. (2013) Reconceptualizing major policy change in the advocacy coalition framework: A discourse network analysis of German pension politics. *Policy Studies Journal* 41.1, 169–98.

Leifeld, P. (2017) Discourse network analysis: Policy debates as dynamic networks. In J.N. Victor, A.H. Montgomery, and M. Lubell (eds.), *The Oxford handbook of political networks*, Oxford University Press, Oxford.

Leifeld, P. and S. Haunss (2012) Political discourse networks and the conflict over software patents in Europe. *European Journal of Political Research* 51.3, 382–409.

Lidmo, J., Á. Bogason, and E. Turunen (2020) The legal framework and national policies for urban greenery and green values in urban areas: A study of legislation and policy documents in the five Nordic countries and two European outlooks. Nordregio Report 2020/3. https://doi.org/10.6027/R2020:3.1403-2503.

Maes, J., G. Zulian, S. Günther, M. Thijssen, and J. Raynal (2019) Enhancing resilience of urban ecosystems through green infrastructure (EnRoute). Final report. Scientific and Technical Research series, Publications Office of the European Union. https://doi.org/10.2760/689989.

Marks, G. and C.J. Wilson (2000) The past in the present: A cleavage theory of party response to European integration. *British Journal of Political Science* 30.3, 433–59.

MASE (Ministero Dell'Ambiente e della Sicurezza Energetica) (2023) Strategia nazionale biodiversità 2030. Governo Italiano. https://www.mase.gov.it/sites/default/files/archivio/allegati/biodiversita/2_snb_2030_marzo_23.pdf.

McDonald, R.I., M.L. Cobert, M. Hamann, R. Simkin, and B. Walsh (2018) Nature in the urban century: A global assessment of where and how to conserve nature for biodiversity and human wellbeing. The Nature Conservancy. https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_NatureintheUrbanCentury_FullReport.pdf.

Meadowcroft, J. (2011) Engaging with the politics of sustainability transitions. *Environmental Innovation and Societal Transitions* 1.1, 70–75.

Melanidis, M.S. and S. Hagerman (2022) Competing narratives of nature-based solutions: Leveraging the power of nature or dangerous distraction? *Environmental Science & Policy* 132, 273–81.

Nagel, M. and C. Bravo-Laguna (2022) Analyzing multi-level governance dynamics from a discourse network perspective: The debate over air pollution regulation in Germany. *Environmental Sciences Europe* 34.1, 62–80.

Nagel, M. and K. Satoh (2019) Protesting iconic megaprojects: A discourse network analysis of the evolution of the conflict over Stuttgart 21. *Urban Studies* 56.8, 1681–1700.

Parline (n.d.) The IPU's Open Data Platform. https://data.ipu.org/content/parline-global-data-national-parliaments (accessed 31 January 2024).

Piattoni, S. and T. Notermans (2021) Introduction to 'Italy and Germany: Incompatible Varieties of Europe?'. Special issue, *German Politics* 30.3, 301–18.

Pörtner, H.O., R.J. Scholes, J. Agard, E. Archer, A. Arneth, X. Bai … H.T. Ngo (2021) IPBES-IPCC co-sponsored workshop report on biodiversity and climate change. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES); Intergovernmental Panel on Climate Change (IPCC). https://www.ipbes.net/sites/default/files/2021-06/20210609_workshop_report_embargo_3pm_CEST_10_june_0.pdf.

Ravazzi, S. (2021) Explaining the contradictory creativity of neoliberalism: Evidence from the economic development agendas of four European second-tier cities. *Journal of Urban Affairs* 43.10, 1492–1512.

Reise, J., A. Siemons, H. Böttcher, A. Herold, C. Urrutia, L. Schneider, … and M. Davis (2022) Nature-based solutions and global climate protection: Assessment of their global mitigation potential and recommendations for international climate policy. Öko-Institut Berlin; Ecologic Institute. https://www.umweltbundesamt.de/publikationen/nature-based-solutions-global-climate-protection.

Scharpf, F.W. (2009) Legitimacy in the multilevel European polity. *European Political Science Review* 1.2, 173–204.

Schmid, N., S. Sewerin, and T.S. Schmidt (2020) Explaining advocacy coalition change with policy feedback. *Policy Studies Journal* 48.4, 1109–34.

Schmidt, V.A. and C.M. Radaelli (2004) Policy change and discourse in Europe: Conceptual and methodological issues. *West European Politics* 27.2, 183–210.

Seddon, N., A. Smith, P. Smith, I. Key, A. Chausson, C. Girardin, … and B. Turner (2021) Getting the message right on nature-based solutions to climate change. *Global Change Biology* 27.8, 1518–46.

World Bank Open Data (2018) Urban population (% of total population). https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?name_desc=false.

https://doi.org/10.1038/s44168-025-00249-y

Understanding, communicating, and imagining urban biodiversity in German and Italian cities

Alessandro Arlati [1] ✉ & Melanie Nagel [2,3,4]

Urban biodiversity has recently emerged as a key focus in urban planning discourse and is the cornerstone of the EU biodiversity strategy for 2030. This strategy proposes ambitious urban greening plans for cities with over 20,000 inhabitants to address urban biodiversity holistically. In their way of developing urban biodiversity-based imaginaries, future uncertainties, complex terminology, and data attainability hinder the efforts of small to large cities in addressing urban biodiversity satisfactorily. Based on comparative case studies of Heidelberg, Hanover, Cesena, and Florence, we developed explorative research that sources from urban, social, and political science methods that investigate the complexity of urban biodiversity between past experiences, present discourses, and future imaginaries. By analysing policy documents, urban actors' discourses, and the physical manifestation of the UGPs in these four cities, we argue that size does not matter. Instead, cultural and communication gaps should be addressed behind an underdeveloped and superficial public debate.

Nature has always played an important role in urban settlements. Based on the first studies on ecosystems in the urban context in the 1970s[1,2], urban biodiversity research started concentrating, among others, on how urban planning copes with natural elements within the built environment[3–5]. In the European context, the EU biodiversity strategy for 2030 (EU-BDS) provides a reference for urban planning in the member states to address urban biodiversity. The EU-BDS proposes a scenario for reversing the disappearance of green spaces, acknowledging that urban biodiversity plays a central role in increasing humans' physical and mental well-being. To accomplish this reversion, the EU-BDS is urgently calling for cities "with at least 20,000 inhabitants to develop ambitious urban greening plans (UGP) by the end of 2021" to bring nature back into our lives (Target 14, p. 13 ref. 6). A UGP represents an opportunity for cities to promote a holistic view of urban biodiversity by being properly integrated into urban planning, policies and practices across Europe (p. 7 ref. 7). The following year, the UGP was renamed the urban nature plan (UNP), reflecting the EU's evolving sensibility toward nature beyond just greenery[8]. Nevertheless, the what, who and how of integration are fundamental questions the EU-BDS does not thoroughly address. Additionally, there is the risk that the bland request from the EU does not represent a sufficient push for cities to engage in the draft of such plans. Especially for smaller cities, which are known to lack resources and expertise, draughting and implementing a UGP may be difficult. To obtain economic support from the national and the EU level, cities are asked to quickly develop narratives of innovations, often resulting in unrealisable promises[9]. Haarstad et al. recently developed a critical stance of this 'politics of urgency" according to which some actors' interests, valuable discourses and alternative possibilities may be discarded or left unseen in the name of quickly responding to urgent challenges (pp. 3–5 ref. 10). This approach tends to disregard conflicts and resistance in favour of an apolitical understanding of climate change-related actions[11].

According to Westman and Castán Broto, urban planning is living in an era in which cities are governed and designed following climate change-related narratives. By defining urban climate imaginaries as "collective discourses surrounding the urban that reflect the aspirations of [the] future", they argue that the formation of future imaginaries is a result of discursive practices, whereby certain visions of the future are more convincing than others (p. 80 ref. 12). As the future is, per definition, unknown, decisions on 'the" future to enact are not only the result of rational choices. Rather, actors decide based on a complex system of personal beliefs and interpersonal influences formulated as a narrative exercise to convince the hearing with the most credible scenarios[13]. Those most credible imaginaries pervade the discourse over valid alternatives that, lacking authoritative support, are automatically excluded from the debate[14]. Three decades ago, Maarten Hajer described the discursive process of environmental policies, arguing that "[a]ny understanding of the state of the natural (or indeed the social) environment is based on representations" (p. 17 ref. 15). His discourse-coalition

[1]HafenCity University Hamburg RTG 2725 "Urban Future-Making: Professional Agency Across Time and Scale", Hamburg, Germany. [2]Heidelberg University, Institute for Political Science, Heidelberg, Germany. [3]Heidelberg University, Heidelberg Center for the Environment (HCE), Heidelberg, Germany. [4]University of Tübingen, Geo and Environmental Research Center, Tübingen, Germany. ✉e-mail: alessandro.arlati@hcu-hamburg.de

approach suggests that groups of actors form coalitions when sharing common ideas, out of which convincing storylines are produced and reproduced[16]. With this perspective, the argumentative turn in policy analysis and planning understands actors' discourses as their ability to shape reality through which it is possible to explain reasons for action or non-action attributable to personal and shared beliefs of the world[17].

Thus, exploring the dynamics by which urban actors form discourse coalitions around urban biodiversity's future(s) is relevant to understanding how urban biodiversity planning can be transformed[4,5,10]. We have observed an exponential interest in urban biodiversity and climate change in urban studies, focusing especially on the reasons for the action and inaction of public administrations. The majority agree that the absence of an overarching vision and governance schemes allowing cross-collaboration are the main obstacles to urban biodiversity planning and implementation. However, how different narratives are discussed is rarely addressed in the urban planning literature (Supplementary Note 1).

While many concepts that refer to nature in the city exist, it appears beneficial for the purpose of this paper to refer to urban biodiversity as this concept is well-defined in the scientific literature; additionally, biodiversity is explicitly used in the EU-BDS. Departing from the understanding of urban biodiversity as "the variety and richness of living organisms […] and habitat diversity in and on the edge of human settlements" (p. xvii ref. 18), our urban planning perspective focuses on the interplay between natural elements and human beings. Following urban biodiversity research[19], we refer to urban biodiversity as the variety and richness of living organisms and habitats within the built environment and the perception that humans have about this relationship. We argue that approaching urban future imaginaries based on this definition of urban biodiversity from a discourse perspective can be beneficial in improving the understanding of how these futures are discussed and how they influence actors' imaginations and the physical environment. We refer to *urban biodiversity-based imaginaries* as collective discourses about desirable futures based on urban biodiversity debated among coalitions of urban actors in the present, informed by past experiences, and that materialise in future-oriented policy documents. The adjective "desirable" explicitly refers to the efforts of urban actors in building such imaginaries essentially "grounded in positive visions of social progress" (p. 4 ref. 20). Because cities with at least 20,000 inhabitants are directly addressed by the EU-BDS, and small- to large-sized cities have a higher share in Europe than in other continents[21], it seems worthwhile to explore these kinds of cities in this research. Therefore, we ask: *How do urban actors discuss the construction of urban biodiversity-based imaginaries and their translation into urban projects in small and large cities*?

With reference to the definition of urban biodiversity provided in this paper, we focus our analysis on the relationships between natural elements and humans within the built environment from a discourse perspective. Thus, we have organised our research into three dimensions to answer our research question (Fig. 1). First, we acknowledge that various urban actors have different perceptions of urban biodiversity, which are highly controversial because linked to subjective values rooted in each country's planning system and culture and each person's past[4,14]. By accounting for legal requirements and cultural beliefs, we want to investigate the context that determines how urban actors understand urban biodiversity in the first place. Second, the bargaining effort we intend to investigate implies a dialogical relation between these different understandings in the present as an attempt to shape reality[15]. Thus, we aim to study how urban actors form discourse coalitions to communicate urban biodiversity publicly and which strategy they use to discuss urban future imaginaries. Third, the result of the discussion is reflected in the physical manifestation of the urban actors' imaginations in urban planning documents[12,20]. Here, we look at how urban actors imagine urban biodiversity as the materialisation in the UGPs of urban biodiversity-based imaginaries and their influences on the urban environment.

With a relational perspective on urban biodiversity, our research design integrates different urban, social and political science methods. We conduct a comparative case study analysis to infer differences and similarities between small- and large-sized cities in the EU. The selection of the case studies focuses on identifying outstanding cities in planning and implementing urban greening. We refer here to this sample as committed cities. The final selection comprises Heidelberg and Hanover in Germany and Cesena and Florence in Italy (Fig. 2). First, we perform a policy document analysis to provide an overview of each city's policy context on different levels (national, regional and local). Second, we look into each city's current UGPs (June 2024) to understand how urban biodiversity is framed. The dynamics between the discourse and the diverse actors that are ideationally connected and form discourse coalitions are studied through a discourse network analysis (DNA), a combination of qualitative content and social network analysis (SNA). Discourse analysis studies language-in-use, which aims to understand how knowledge is produced and reproduced between actors through analysing written texts (p. 176 ref. 22). SNA is a method to visualise and study relational empirical evidence. The

Research sub-questions	*Temporalities*	*Keywords*	*Methods*
How do urban actors **understand** urban biodiversity?	Past	Experiences	■ Interviews ■ Document analysis
How do urban actors **communicate** urban biodiversity?	Present	Discourses	■ Discourse network analysis (DNA) ■ Interviews
How do urban actors **imagine future** urban biodiversity?	Future	Imaginaries	■ Document analysis ■ Spatial analysis ■ Interviews

Fig. 1 | Heuristic matrix to explore interlinkages between discourse, actors, plans and actions. This figure presents the heuristic matrix prepared for this paper to analyse how urban actors understand, communicate, and imagine urban biodiversity based on past experiences, present discourses, and future imaginaries. Each dimension is examined through the methods listed in the last column.

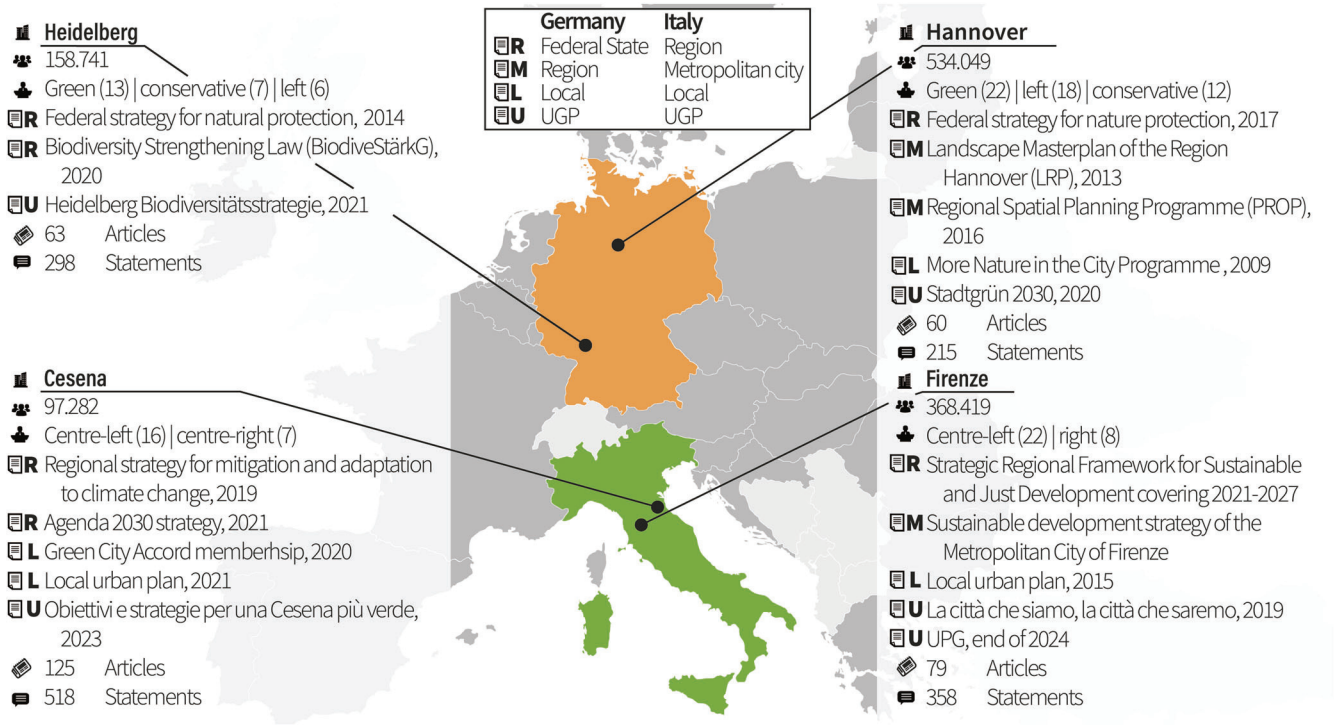


Fig. 2 | Final selection of the four case studies: Heidelberg, Hanover, Cesena, Florence. This figure shows the details of the four committed cities analysed in this paper: Heidelberg, Hanover, Cesena and Florence. For each city, data are reported as follows: population; political composition of the city council; policy documents at various levels; n. of newspaper articles analysed; n. of statement coded. The documents are categorised as follows according to the German and Italian systems: federal o regional (R), regional or metropolitan (M), local (L), and UGP (U).

information is visualised in network graphs, with nodes often representing actors (or other entities) and ties representing a relationship between them (such as communication, exchange or sharing of the same beliefs). DNA offers a new perspective to trace the coevolution of actors and issues dynamically over time[23]. This method allows the operationalisation of the content and the structure of the discourse on a respective issue[24]. Using local newspaper articles, we can trace the narrative evolution around urban biodiversity-based imaginaries of diverse urban actors forming discourse coalitions in the public debate. Through spatial analysis and fieldwork, we investigate how discourse influences the physical world by understanding the geography of the projects debated in the newspaper articles. Finally, the knowledge acquired through the methods above is validated and complemented through semi-structured interviews with the main actors involved in producing such imaginaries.

Results

Understanding urban biodiversity

Influenced by geographies, the object of urban biodiversity has changed considerably over time and, accordingly, the ways through which human beings have dealt with nature in the urban context[25]. Choosing a definition thus has implications on urban biodiversity planning concerning which forms of nature are included or excluded, by whom, and for what purposes (p. 308 ref. 4). This section provides information from policy documents—considering formal and informal planning—at different levels of governance—EU, national, regional and local—and expert interviews to identify current cultural influences and planning practices about urban biodiversity. For a thorough analysis of the national level, refer to Arlati[26].

Heidelberg is a city in the federal state (Bundesland) of Baden-Württemberg and one of the first members of the Alliance of Local Authorities for Biological Diversity. The federal state's strategy for natural protection has set objectives for protecting nature in the urban environment since February 2014 (pp. 14-15 ref. 27). It fosters the concept of the compact city (Stadt der kurzen Wege) as the main planning framework for urban development, which considers both the living quality of people and biodiversity (ibid., p. 34). On July 31, 2020, the federal state draughted the Biodiversity Strengthening Law (BiodiveStärkG), showing a strong commitment towards biodiversity at the federal-state level[28]. Referring to the National Strategy on Biological Diversity (Nationalen Strategie zur biologische Vielfalt) of 2007, Heidelberg is aligned with many other cities to reach the goals of this strategy by sharing the implementation between federal, state and local authorities. Noteworthy, 40% of Heidelberg municipal territory is occupied by an urban forest (Heidelberger Stadtwald). Together with the Neckar River, these two natural elements provide relevant leisure opportunities for people and space for nature to thrive. However, the urban forest and river system reduce the land for further urban development, increasing land use-related conflicts significantly. The national level is, however, mentioned as the reference point for the local biodiversity strategy. In its strategy, the city of Heidelberg states that achieving the goals and implementing the measures will be a joint task within the municipalities. This applies to the actors in the public sector and the public itself, which must be involved in implementing measures. Potential conflicts mentioned in the document highlight that species, nature, and climate protection goals can collide with those of a municipality's economic growth and housing development. In Heidelberg, the influences from the EU-BDS are not claimed in the documents analysed, as these were draughted before the publication of the European strategy. The interviewees from the landscape office and an environmental organisation (HE_1, HE_2, HE_3) defined biodiversity from a more practical perspective, giving various examples such as maintaining or increasing tree cover in the city, green roofs, selecting high-quality plants (in terms of biodiversity benefits), greening facades, greening open spaces and squares and removing sealed surfaces.

Hanover is the capital city of the federal state Niedersachsen (Lower Saxony) and became the Federal Capital of Biodiversity in 2011. It is a founding municipality of the Alliance of Local Authorities for Biological Diversity. Biodiversity refers to the Federal Agency for Nature Conservation (Bundesamt für Naturschutz) and includes species diversity, ecosystem

variety and genetic differences within species. Accordingly, providing clean water, fresh air, a stable climate and fertile soil is vital for human quality of life and survival. Animals, plants, fungi and microorganisms are essential in maintaining these conditions (p. 6 ref. 29). The topic of integration with other policy fields is highlighted in the federal state's strategy. The intermediary level of the Hanover Region provides additional instruments to guide landscape and spatial planning, stating that the landscape should be permeable to protect biodiversity and that cities should be structured by green corridors (p. 19 ref. 30). The 'More Nature in the City" programme launched in 2009 by the City of Hanover aimed to secure and improve biodiversity through sustainable use. As part of the federal 'Biodiversity" programme, Hanover has participated in the five-year cooperation project 'Cities Dare Wilderness" since 2016. At the same time, a pilot programme called Urban Greenery—Species-rich and Diverse (Stadtgrün—Artenreich und Vielfältig) within the "National Strategy on Biological Diversity at Municipal Level" had been implemented. Hanover's sensitivity towards urban biodiversity is attributable to both the EU-BDS and the white and green papers at the national level[31]. The head of the department of urban greenery defines urban biodiversity as primarily sustainable. This means that it should be planned from a long-term perspective, with more free spaces of high quality against their impact on nature conservation, species protection, and biodiversity. The aim is to preserve these green spaces equally with their effects on climate protection and climate change adaptation (HA_1). One interviewee (HA_2), an expert who has campaigned for biodiversity for many years as part of the insect alliance, refers to the UN definition of biodiversity, which includes diversity within species and ecosystems. Both areas are key recreational spaces in Hanover, providing residents and visitors with beautiful natural environments. Like Heidelberg, Hanover praises an important experience with the biodiversity topic mirrored in the richness of the interviewees' definitions.

Cesena is a city in the Emilia–Romagna region. The regional strategy for mitigation and adaptation to climate change mentions urban greening concerning air quality in urban development, while biodiversity is addressed only in areas outside the urban fabric[32]. A more direct connection is present in the Agenda 2030 strategy, which aims to plant 4.5 million trees in the next five years to support regional urban biodiversity[33]. At the local level, the action plan for sustainable energy and climate describes urban biodiversity as important to counter climate change-related disasters and to foster health and security[34]. In the current local urban plan, draughted with the neighbouring city to share the efforts and resources (CE_1b), biodiversity is addressed, mainly outside the urban environment, as in the regional policies. However, the interviewees have reported a more holistic understanding of urban biodiversity: from the public administration view, urban biodiversity is defined as infrastructure, thus providing services to the city, such as water and air systems (CE_1a; CE_1b), while from the citizen initiative, through the concept of habitat, suggesting that green spaces in the built environment function as contact between nature and other layers of the cityscape, such as mobility (CE_2). The interviews also revealed that a unique document addressing urban biodiversity planning at the local level is currently missing, whereby taking consistent action is difficult for the urban actors. This also hinders access to information for citizens who want to inform themselves about this topic. The public administration interviewee reported rather limited support from the regional level concerning urban biodiversity planning, which de facto contributes only economically (CE_1a). The necessity to gather experience pushed Cesena to look at the international context, subscribing to the Green City Accord on December 21, 2020. With the commitment to addressing urban planning with projects related to biodiversity, this subscription was vital for Cesena for three reasons: first, the funds offered by the accord were consistent and purposefully organised; second, it allowed them to share experiences in a network of cities; and third, it provided a set of quantitative indicators to benchmark its advancements practically (CE_1b).

Florence is the capital of the Tuscany region. At the regional level, policy objectives related to urban biodiversity are stated by the strategic regional framework for sustainable and just development covering 2021–2027. The aim is to foster an ecological transition for a greener Toscana to contrast climate change by supporting biodiversity in the urban context and reducing pollution (p. 35 ref. 35). At an intermediate level, the sustainable development strategy of the Metropolitan City of Florence suggests in one of its ten objectives to address climate mitigation and adaptation through reforestation and urban greening measures (p. 33 ref. 36). At the city level, the urban plan of Florence, although relatively old, considers private and public urban greening simultaneously as an integrated part of the planning process (p. 62 ref. 37). Although awareness seems to be relatively high, Florencethe interviewees described Florence as a complicated city that has to deal with several problems linked to its historical traditions. On the one hand, there is the presence of conservatism from politicians and professionals (FI_1), whereby historic gardens and landscapes should not be ruined by introducing new species or realising new greening respectively (FI_2). On the other hand, Florence has to deal with mass tourism every year: being a rather small and dense city, this creates considerable land use problems when planning for urban biodiversity, especially in the city centre. The EU Green Deal, in particular, is an important reference for Florence, which points to realising urban biodiversity under the flag of ecological transition and environmental justice. Through the engagement of citizens, implementing nature in the urban context becomes an occasion to share and live in the city as a tool of climate democracy (FI_1). The complexity of the urban environment of Florence and the need to valorise every square metre translates into the understanding of urban biodiversity as composed of big parks and small natural elements found within brick walls: urban biodiversity is considered thus a concept through which open spaces can be planned (FI_1; FI_2) or even left unplanned (FI_3).

Communicating urban biodiversity

Urban actors who share the same understanding form coalitions centred around storylines that strengthen their common interests (p. 65 ref. 16). This section presents our results from observing the dynamic evolution of the public debate from the local news using DNA with the support of expert interviews. Because of readability, the figures presented in this section depict only the year with the highest frequency of nodes and the last 12 months of data collection. A complete picture of the graphs year by year can be found in Supplementary Note 3.

In Heidelberg, several actors are involved in the debate on urban biodiversity conservation (Fig. 3). The Landscape and Forestry Department (Landschafts- und Forstamt) and the municipal administration are the primary driving forces, supported by the environmental organisation NABU and engaged citizens. The dominant concepts in the debate are 'urban greening for biodiversity" and 'for humans". The debate has gradually evolved, yet it has not reached the intensity initially anticipated. Notably, there is a discrepancy between the intended and actual use of public space, which has become a prominent issue in 2022. One interviewee highlighted the importance of the Landscape and Forestry Department but also pointed to internal conflicts with the Urban Planning Office when it comes to implementing or maintaining green spaces (HE_2). Another interviewee from an environmental NGO mentioned that there seemed to be a lack of communication and coordination between departments (HE_1). The interviewee further explained that in the conflict between housing and greenery in the city, the former always wins. According to the interviews, there has been a recent shift in public opinion, with citizens emphasising trees and greenery in urban areas since 2018–2020. One interviewee posited that urban planners frequently designed public spaces without incorporating green spaces, a practice that is no longer tenable today (HE_2). In the interviews, the importance of biodiversity had been pronounced, such as a leading manager (HE_2) from the landscape office stating, "… everyone agrees: We need more greenery; we need more trees. We must take a stand against … the overheating of our cities." It is important to mention that the public debate on biodiversity is not very extensive. The presence of the Stadtwald and of the green areas around the Neckar River probably generate a conviction that the existing green areas

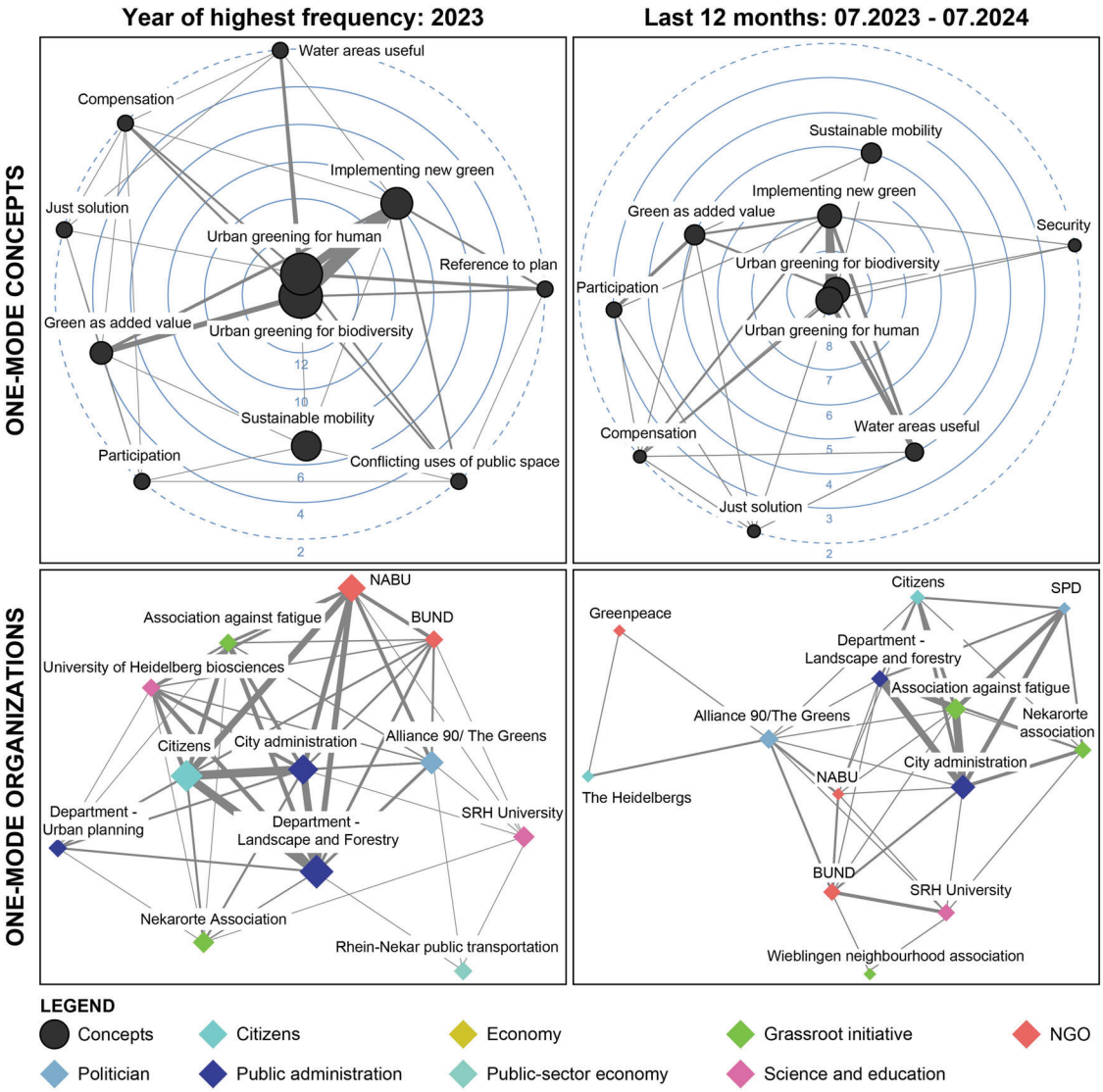


Fig. 3 | One-mode concept networks and organisation networks in Heidelberg. The figure depicts one-mode networks for the year with the highest frequency of nodes (left) and one-mode networks for the last 12 months of analysis (right) for Heidelberg. Only the top ten frequent nodes are visualised. The size of the nodes represents the frequency (number of times the concept or organisation appear in the articles in the respective time). The strength of the links is bigger according to the edge weight (number of concepts the actors share with each other or the number of actors that mention the same concepts in the respective time). The organisations are citizens (cyan), economy (yellow), grassroots initiative (green), NGO (red), politician (light blue), public administration (blue), public-sector economy (light green), and science and education (pink) (Supplementary Note 3).

suffice. Even if we look at which public areas are being discussed, there are only a few areas in the old city centre (Fig. 8).

In the case of Hanover, the dominant concepts are the 'conflicting use of public spaces' and 'urban greening for biodiversity conservation' (Fig. 4). The discussion then moved on to the proposition that green spaces are crucial for biodiversity conservation. The discourse analysis revealed that the Department of Environment and Urban Greenery (Fachbereich Umwelt und Stadtgrün) plays a pivotal role in the debate, demonstrating notable engagement and influence. The findings of our interview with a department representative in question corroborate this impression. The situation in Hanover is characterised by a positive tradition, with a significant number of historic gardens and a culture that supports and appreciates them. Furthermore, greening activities are supported in both the debate and practice by a diverse range of actors, including political parties, the media, and citizens. The discourse is developing from a very limited (2020) to a differentiated discourse (2024). One expert in a leading position in the Department of Environment and Urban Greenery (HA_1) confirmed a high level of awareness of green issues or ecological concerns in urban society. Hanover is a city of gardens, with the Eilenriede and the Herrenhausen Gardens, for example, and many other historic green spaces and parks (HA_3). The interviewee defined urban biodiversity and emphasised the importance of native plants. Although urban greenery has a high status in the consciousness of citizens, it is crucial to know which plant species are present. Another interviewee (HA_2) recalled that funding has also been made available for biodiversity, and positions for maintenance and care have been created. Adequate administrative infrastructure and a supportive political climate are crucial for submitting applications and implementing biodiversity measures. According to this person interviewed, the Krefeld study in 2018, an important scientific study documenting a dramatic decline in insect biomass in Germany, brought the issue of insect mortality to the attention of the general public and the insect alliance was founded (HA_2). This insect alliance is characterised by considerable support and influence and a notable level of visibility (HA_2). The insect alliance has focused on clear communication and unites different urban

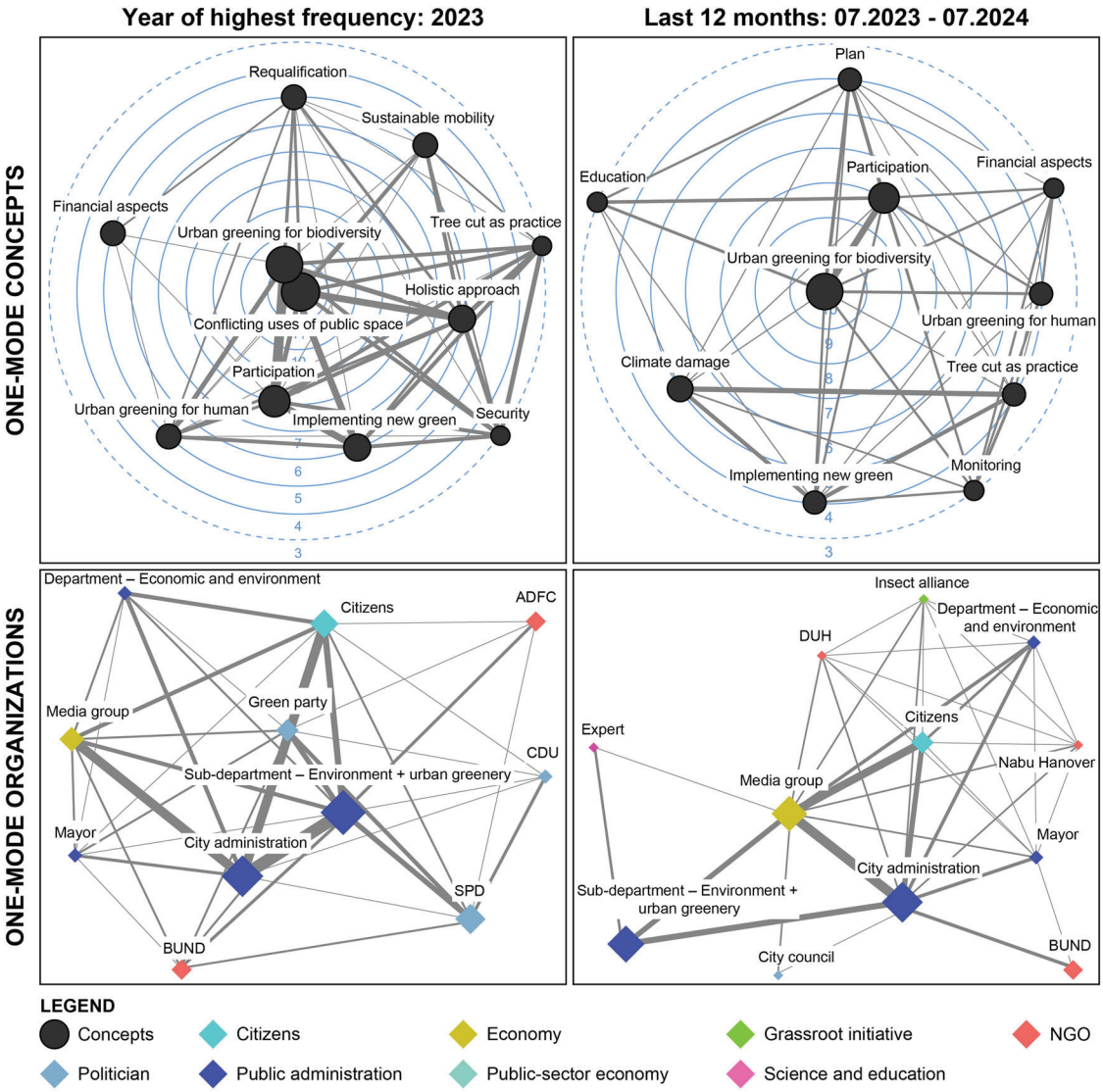


Fig. 4 | One-mode concept networks and organisation networks in Hanover. The figure depicts one-mode networks for the year with the highest frequency of nodes (left) and one-mode networks for the last 12 months of analysis (right) for Hanover. Only the top ten frequent nodes are visualised. The size of the nodes represents the frequency (number of times the concept or organisation appear in the articles in the respective time). The strength of the links is bigger according to the edge weight (number of concepts the actors share with each other or the number of actors that mention the same concepts in the respective time). The organisations are citizens (cyan), economy (yellow), grassroots initiative (green), NGO (red), politician (light blue), public administration (blue), public-sector economy (light green), and science and education (pink) (Supplementary Note 3).

actors who joined voluntarily without any membership fee under a common logo (HA_3).

Since 2020, the importance of biodiversity has permeated the discourse in Cesena, probably linked to the awareness derived from the subscription to the Green City Accord (Supplementary Fig. 13). In this period, actors frequently mention the concepts of 'participation" and 'implementation of new green" projects to underline the necessity to cooperate and expand and enhance city green areas. The discourse coalition in the debate comprises various actors: the public administration and other political groups (e.g., PD Cesena) play a dominant role (Fig. 5 bottom). Another important organisation is the Citizens Council for the Environment (Consulta per l'Ambiente (CpA)), which was formed with the help of the public administration (Supplementary Fig. 13, year 2021). Through this council, which has mainly a consulting function but can propose new ideas, economic actors, NGOs, and citizens can be directly involved in the decision-making about environmental topics. At this point, we can observe a rather broad coalition of actors in the debate about urban biodiversity-related arguments, including politicians, public actors, and laypersons. Interestingly, Cesena is the only case linking urban biodiversity as a measure to address health issues, probably related to the COVID-19 pandemic. In 2022, concepts of 'security" and 'requalification" have acquired more importance, while social-related concepts (such as 'participation" and 'other imaginaries") are less central (Fig. 5 top-left). This happened at the expense of a more consistent involvement of the CpA, as reported in an interview with the citizen initiative (CE_2). The NGOs were particularly active but suffered from a too-ideologic perspective that led to many proposals being discarded; similarly, economic actors saw their pragmatism as being outclassed by such actors and lacked the time and resources to keep being involved voluntarily (CE_2). At this stage, the debate seems more centralised around the public administration and its departments, whereby citizens and grassroots initiatives are even disjointed from the main coalition (Fig. 5 bottom-left). In 2023, the biodiversity topic has gradually left the debate, favouring greater attention to 'disaster prevention" linked to a great flood that occurred in the Region. This concept was used in the local elections of May 2024, creating

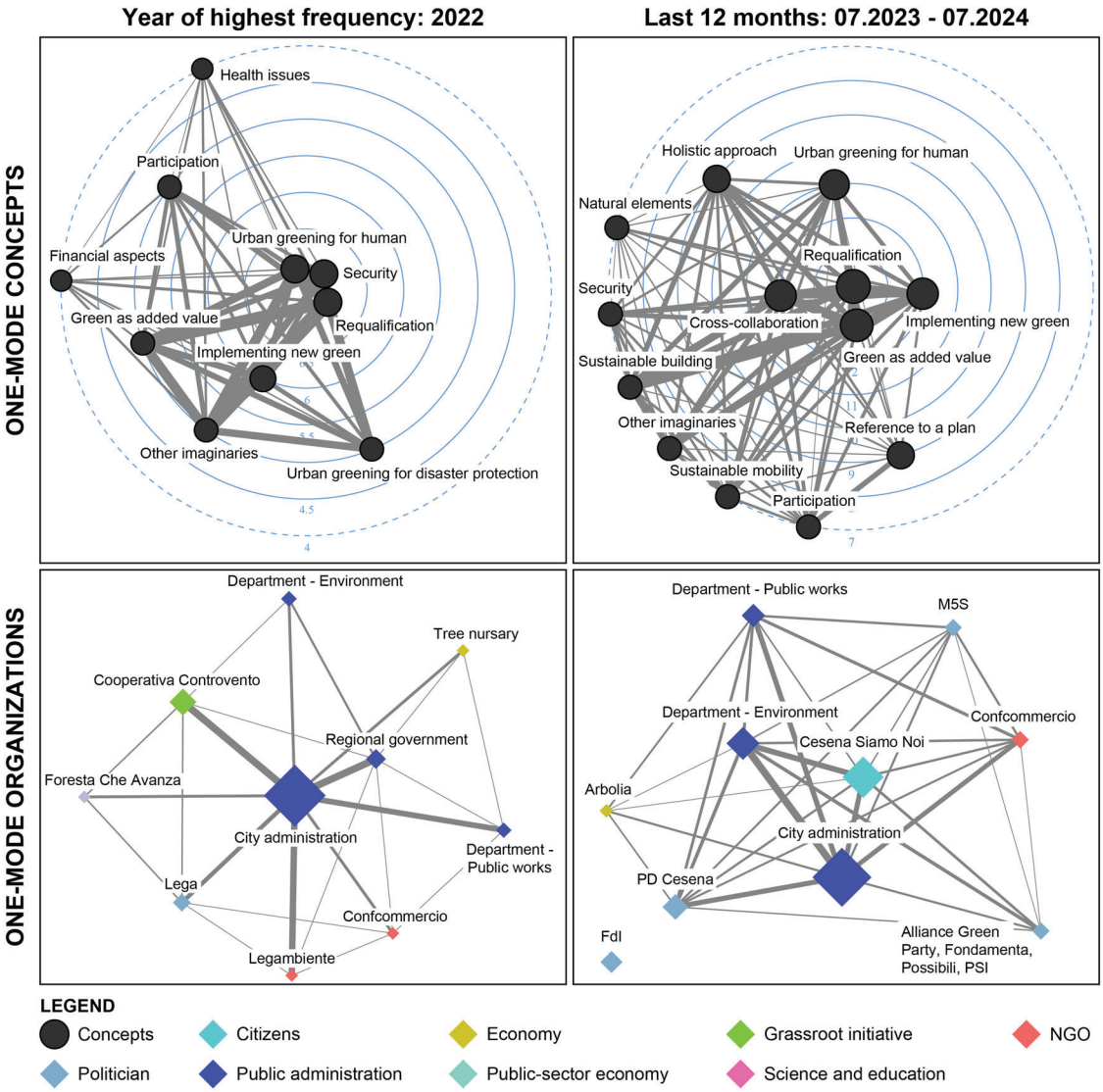


Fig. 5 | One-mode concept networks and organisation networks in Cesena. The figure depicts one-mode networks for the year with the highest frequency of nodes (left) and one-mode networks for the last 12 months of analysis (right) for Cesena. Only the top ten frequent nodes are visualised. The size of the nodes represents the frequency (number of times the concept or organisation appear in the articles in the respective time). The strength of the links is bigger according to the edge weight (number of concepts the actors share with each other or the number of actors that mention the same concepts in the respective time). The organisations are citizens (cyan), economy (yellow), grassroots initiative (green), NGO (red), politician (light blue), public administration (blue), public-sector economy (light green), and science and education (pink) (Supplementary Note 3).

relevant divides in the political parties. In the last year of analysis, we witnessed a reversed trend when 'cross-collaboration" returned as a central concept, showing the need to involve other organisations in greening measures (Fig. 5 top-right). The discourse coalition is highly diversified, including different levels of governance and political parties. This reflects the willingness of the newly elected government to maintain a relationship with the citizens and the CpA. However, the interviews depict a scenario where citizens reactively engage with urban biodiversity, thus perceiving the work of the public administration as an attack on urban green spaces (CE_1a).

In Florence, concepts of 'participation" and 'cross-collaboration" are central to the local debate of 2020, while the actual measures have a secondary importance. The public administration is very active in this process; this is the case for the government and specific departments (Fig. 6 bottom-left). From 2021 to 2022, the concepts of 'urban greening for humans" and 'biodiversity", the push towards 'requalification" projects and problems related to 'security" acquire more relevance, showing a more action-oriented discourse (Supplementary Fig. 14). This might be linked to the draft of the EU Green Deal and the EU-BDS at the end of 2020. Since 2022, more diverse types of organisations have started to participate in the greening discourse, building complex networks among them and reducing the centrality of the municipal actors (Fig. 5 bottom-left). While the debate seems multifaceted initially and mainly populated by governmental actors, it evolves into a more precise and concrete debate about 'financial aspects' and conflictual situations related to 'practices of tree cuts@ in which economic actors and politicians participate. The years from 2022 to 2024 correspond to some of the most conflictual situations, whereby groups of citizens react heavily to the actions of the public administrations (FI_1). Accordingly, a researcher interviewed specifies that citizens and grassroots initiatives lack the expertise to understand the operations of the public administrations (FI_2): political actors take advantage of this situation to oppose key decisions, such as the planting action in the urban centre and the tree cuts in 'Viale Redi and Viale Corsica' (Fig. 8). These approaches are explained by relative mistrust in the political class and a generally low awareness towards implementing natural elements in favour of more graspable topics such as mobility (FI_2). As a

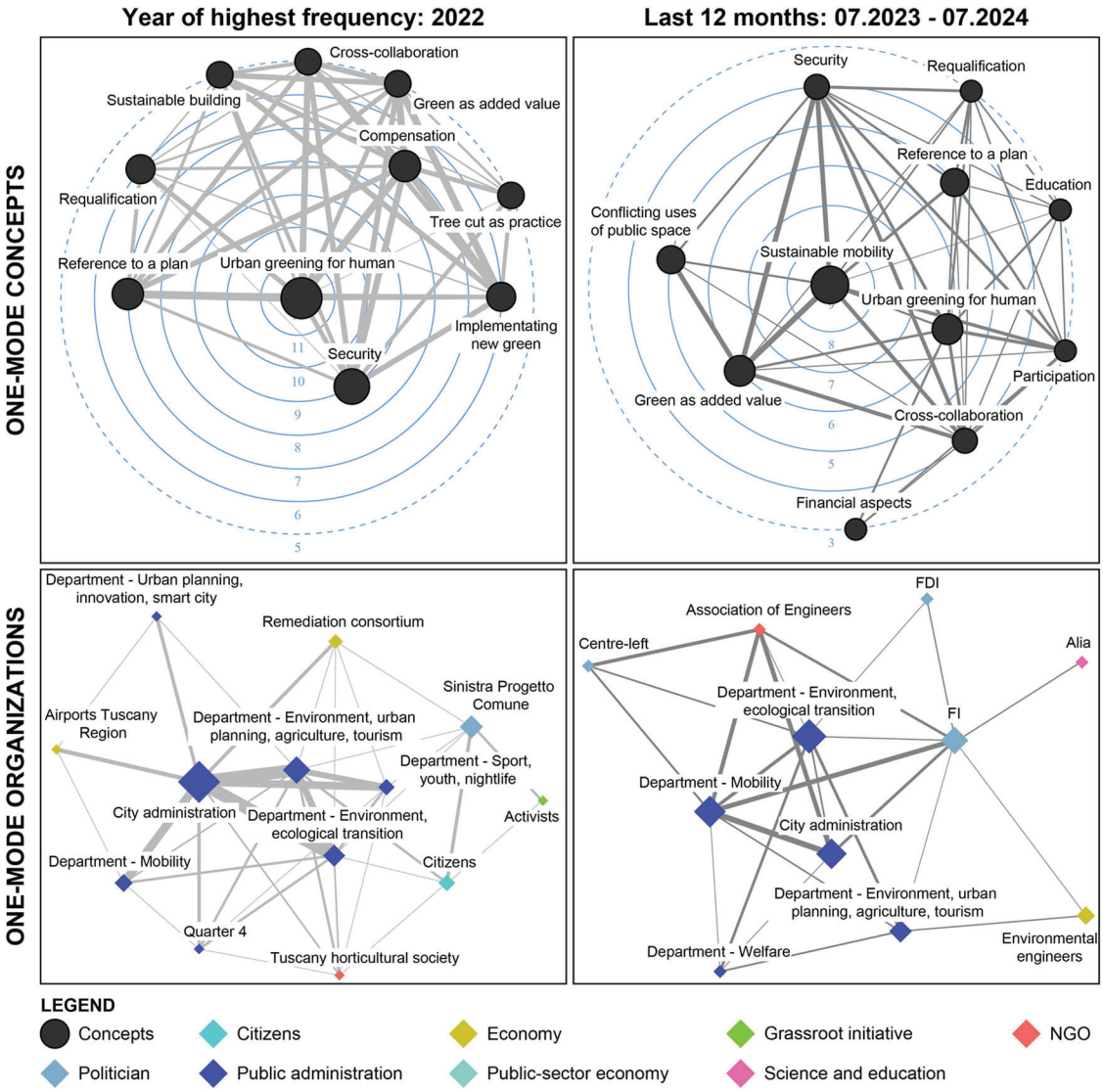


Fig. 6 | One-mode concept networks and organisation networks in Florence. The figure depicts one-mode networks for the year with the highest frequency of nodes (left) and one-mode networks for the last 12 months of analysis (right) for Florence. Only the top ten frequent nodes are visualised. The size of the nodes represents the frequency (number of times the concept or organisation appear in the articles in the respective time). The strength of the links is bigger according to the edge weight (number of concepts the actors share with each other or the number of actors that mention the same concepts in the respective time). The organisations are citizens (cyan), economy (yellow), grassroots initiative (green), NGO (red), politician (light blue), public administration (blue), public-sector economy (light green), and science and education (pink) (Supplementary Note 3).

result, we witnessed a shift in the last two years of analysis towards 'sustainable mobility" issues, while biodiversity is included as a side effect, as the prominence of the 'greening elements as added value' concept demonstrates (Fig. 6, top-right). This is also visible in the limited number of newspaper articles retrieved for 2024. This might explain the delay in implementing the UGP postponed to the end of 2024, as shown by the relative centrality of the 'reference to a plan' concept. However, in the last months of analysis, the debate started to be populated by many different actors, which reveals a new understanding of the complexity of urban biodiversity and the willingness to change trajectories.

Imagining future urban biodiversity

Following the definition of urban climate imaginaries as "collective discourses surrounding the urban that reflect the aspirations of future […] imaginaries, which are created in narratives and reproduced in policy documents" (p. 80 ref. 12), this section investigates how urban actors' imagination of urban biodiversity materialises into urban biodiversity-based imaginaries, merging data from the UGPs (Fig. 7), spatial analysis (Fig. 8), and expert interviews.

At the local level, Heidelberg has had a *Biodiversity Strategy* since 2021. This strategy includes the results from the Urban NBS project (2015–2019) to define strategies and approaches for urban biodiversity with the participation of different public actors and NGOs[38]. The Heidelberg biodiversity strategy aims to make the best use of available resources by identifying key areas for action for the species and habitats in and around Heidelberg and prioritising the actions needed to promote and protect biodiversity. The second cornerstone of the strategy refers to the proper integration of urban greening in urban planning and the support of biodiversity in the inner-city areas (ibid., p. 33). The biodiversity strategy is comprehensive and ambitious. It includes a detailed analysis of the status quo of flora and fauna, a relatively detailed action and time plan for the foreseen measures, and an indication of a communication strategy about the measures and the respective monitoring. Interestingly, this UGP does not entail a proper vision. Additionally, there is no mention of a participatory approach in

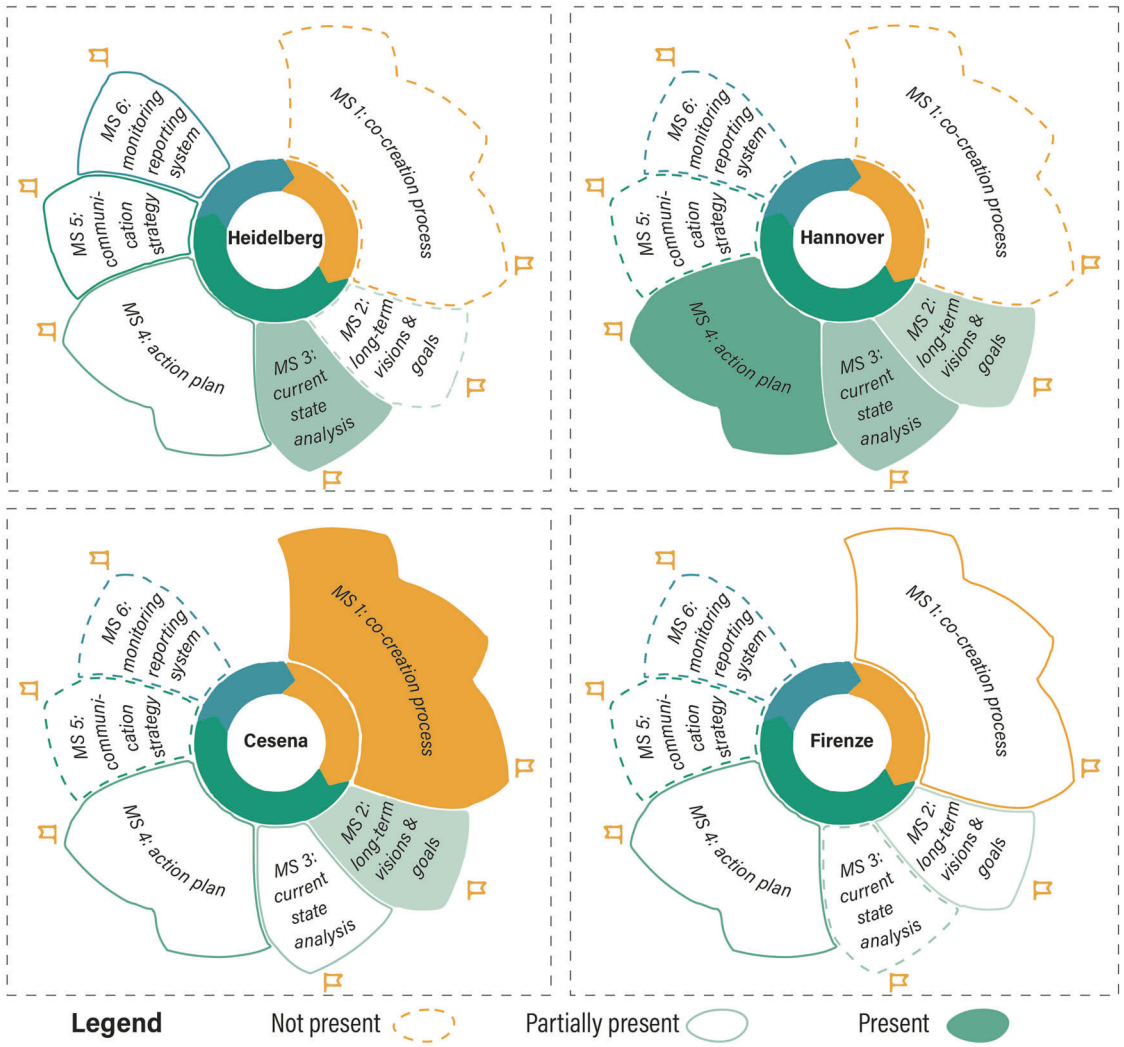


Fig. 7 | Analysis of the UGPs for the four case studies according to the six milestones of the UGP guidance. This figure shows to which extent the UGPs analysed for each city comply with the UGP guidance draughted at the EU level. The flags represent the six milestones described in the guidelines: the dotted lines denote an absence of the milestone; normal lines indicate that the milestone is partially present; filled areas signify a complete presence of the milestone. Florence performs worst because we refer here to the political programme and not to the UGP, which was not published when writing this paper.

draughting such a plan (Fig. 7). This could be a symptom of a rather silo situation, as discussed previously in the understanding and communicating sections. From our investigation in the spatial analysis (Fig. 8), we find that the main areas in the public discourse are on both sides of the river Neckar, a few places in the old city and other places more in the periphery of the city. When we visited these sites, we were left with the impression that they are not always green spaces that are convincing from a biodiversity point of view. For example, this is the case of the 'SRH Uni Campus" and 'Der Andere Park", where the natural elements are presented more in terms of aesthetics and human health rather than providing benefits for biodiversity. One interviewee from an environmental NGO (HE_1) explained that the biodiversity strategy focuses more on the agricultural spaces outside the city. Another interviewee, a leading manager of the landscape office (HE_2), referred to "Oasis", an idea that had been put forward by the mayor of Paris at some point and had been imported to Heidelberg by the mayor of Heidelberg. This idea translates into plans that envision implementing greenery in places that are not necessarily suitable for parks, especially obsolete traffic areas, school playgrounds or all kinds of areas that can contribute to a bioclimatic improvement in the city centre. The interviewee further explained that the most ecologically sensible way to create living space is through re-densification, limiting green spaces in the city and reducing fresh air corridors (HE_2). According to this conflict, "multifunctionality" would be the key term, meaning that different aspects must be considered. The city can no longer afford to use public space un-ecologically; this starts with selecting plant varieties that must be considered for biodiversity.

In December 2020, the municipality of Hanover draughted the concept for open spaces *Stadtgrün 2030*. It represents the result of the participatory process Mein Hannover 2030 to "keep Hanover as green as it is" (p. 4 ref. 31). Urban greening and biodiversity measures are fundamental to addressing climate change and protecting nature in the urban context (ibid., pp. 12–14), giving importance to nature-experiencing activities, education, and biodiversity. The plan is complete compared to the other cities: it presents a clear long-term vision divided into specific goals, it provides a thorough analysis of the status quo of ecosystems and proposes a detailed action plan for the next years to implement the measures (Fig. 7). Additionally, the plan offers a comprehensive framework that connects the UGP to various local and regional plans and regulations, highlighting the holistic feature of this plan and the willingness to consider different levels of action. One interviewee in a leading position (HA_1) of the urban greenery department explained that this document is the conceptual basis for further landscaping measures, i.e. the redesign and redevelopment of green links, green corridors, and town squares. The interviewee also explained that the Department of Urban Greenery is well-staffed. The person interviewed further pointed out a great appreciation among the population for urban greenery and a corresponding

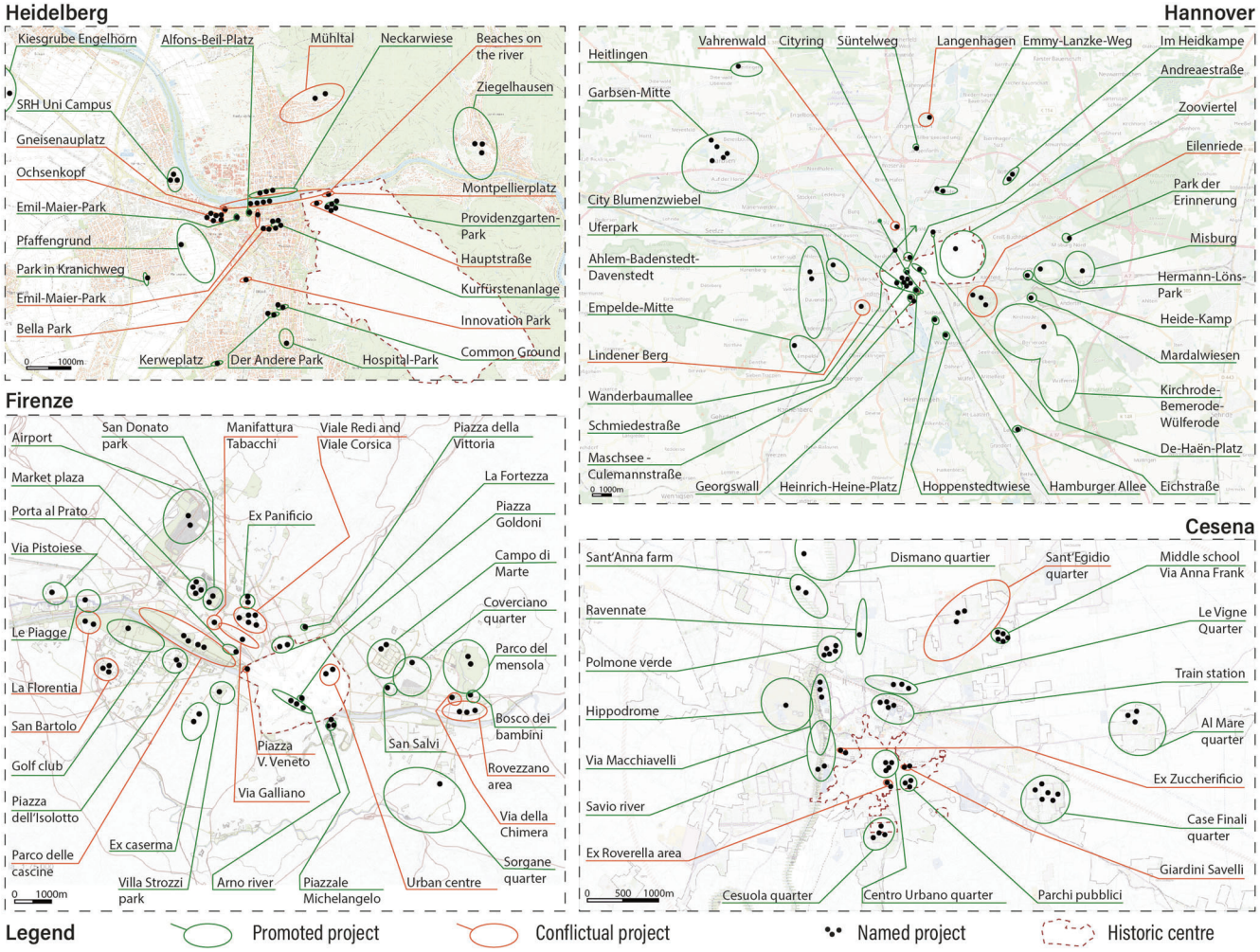


Fig. 8 | Spatialisation of the public debate in the four case studies. This figure shows the spatialisation of the public debate in Heidelberg and Hanover (top) and Cesena and Florence (bottom). The marked areas are the projects mentioned in the newspaper articles we analysed; the black dots show the number of articles where a project is mentioned. The areas in green correspond to the projects exclusively supported by the urban actors, while the red ones are characterised by various degrees of conflict (authors).

awareness of local politics that urban greenery has a high value. The interviewee also highlights Hanover's success due to 'Eilenriede", one of the largest city forests in Europe, offering numerous recreational activities, and 'Maschsee", an artificial lake south of the city centre (Fig. 8). These two projects are fundamental parts of the green corridor strategic approach of the landscape plan at the metropolitan level. The relatively low ratio of conflictual projects and their good distribution in the municipal area demonstrated the success of the communication aspect in Hanover, as described in the previous section. Another interviewee from the insect alliance (HA_2) referred to the conflict between creating urban housing due to rising individual people's demand and biodiversity and urban greening. Accordingly, housing issues are often the stronger ones in this conflict. However, the interviewees (HA_1, HA_2; HA_3) stated that the capacity of the urban greenery department is large enough to continue expanding future green spaces and maintaining and caring for existing ones. We can conclude here that the well-staffed urban greenery department, sufficient financial resources, and strong community support will ensure that the city's green spaces and biodiversity are maintained and enhanced in the future.

With the Green City Accord subscription, Cesena became one of the first small cities in Italy to show commitment towards urban biodiversity. Based on the five spheres of action of the Green City Accord, the *Objectives and Strategies for a Greener Cesena* planning document was draughted in July 2023. This document was developed with the support of the CpA, relying on extensive participation. The UGP does refer to the EU regulations and to the Green City Accord but does not link to other levels of governance (Fig. 7). However, it represents a first attempt to holistically formulate precise targets for future orientation not only to urban biodiversity projects but also to air, quarter, waste management, and noise, demonstrating a holistic approach to the management of urban futures. Concerning the biodiversity sphere of action, this document contains targets by 2030 "to encourage the establishment of nature in the city" (translation by authors, p. 15 ref. 39). The UGP of Cesena has the form of a strategic document with an inventory of the existing natural species (although limited), while the action plan is sketched without the indication of a time horizon. The interviewees from the public administration pointed out that realising a UGP as defined by the EU guidance[40] would require more time, budget, and expertise (CE_1a). Building the inventory already consumed considerable resources as data acquisition is still onerous. At the same time, the analysed document includes important details that go beyond a general strategic document as it aims to differentiate types of green spaces precisely: doing that would allow for planning different levels of maintenance, from the playground to the urban forest and allocate resources accordingly (CE_1a; CE_1b). Looking at the projects debated in the newspaper articles, these are situated largely outside the city centre (Fig. 8). These interventions consist of rather large areas that address biodiversity with diverse objectives: some projects are thought for educative purposes or leisure (e.g., 'Savio river"), while others are purposefully for enhancing biodiversity (e.g., 'Polmone verde"). Most conflictual projects are the most recent ones, close to the centre, and

circumscribed to specific small areas or buildings. The reasons can be mainly adduced to the decreased participation visible during the period analysed (Fig. 5). Thus, engaging various urban actors and citizens more comprehensively in implementing the strategy is an important future step. Following a narrative that sees urban biodiversity to be curated as a child (CE_2), future efforts should invest in raising awareness and a sense of ownership towards the public spaces and nature they host, which is reflected in the vision proposed by the UGP analysed. The inventory is, therefore, only the first step, but preparing a real planning effort in the future is necessary to benefit from the information acquired (CE_1a; CE_1b).

The programme *The City We Are, The City We Will Be* represents the most up-to-date political statement on Florence's commitments to urban biodiversity. Urban biodiversity projects are presented for future projects and existing areas, from implementing new green elements (the air factories) to requalifying historical ones[41]. The programme is divided into a more strategic part with general goals and an action plan that specifies such goals (Fig. 7). Because of its status as a political programme, this document does not provide an adequate picture of the status quo and does not include a time plan for the implementation of the measures it proposes. This programme does not result from a participation process but clearly states the willingness to involve citizens more extensively in the future. In 2023, the draft of the UGP was announced and is expected to be ready by the end of 2024. The interviewees refer to a draughting process involving an ample range of urban actors, from landscape architects to medical doctors, with the vision of realising a holistic plan for the open spaces where public and private spaces are equally considered (FI_1; FI_2). In the fieldwork, it was noticed that in the historical centre, the few visible green elements are installed in private businesses, in pots as a traffic management device, and on private balconies or terraces (Supplementary Fig. 19). The UGP inventory was filled with an extended deployment of digital and human resources to identify all these elements. As the expert interviews state, data are paramount in correctly identifying the planning of measures and their consequent implementation. The spatialisation of the public debate shows a rather diverse set of projects equally distributed between outside and inside the urban centre (Fig. 8). Notably, compared to Cesena, Florence presents more conflictual projects, some located in the central part of the municipal territory ("Urban centre", 'Viale Redi and Viale Corsica"). Like Cesena, most conflicts are polarised around misinterpreting public administration actions, but in Florence, those are actively supported by political parties (Fig. 6). According to the interviewees, the reasons are attributed to the conservatism (FI_1) or the lack of interest of certain actors (FI_2). Although stated in the programme, the engagement of citizens is envisioned in classical terms as a consultation period after the UGP draughting (FI_1). A representative from the economic sector stated that public administration actors are advanced in understanding the importance of urban biodiversity, but citizens still cannot deal with such complexity (FI_3). The necessity of sensitising citizens to prevent a priori blockade and reduce mistrust towards the institutions is a future step to improve urban biodiversity in Florence (FI_2).

Discussion

The results above present how urban actors understand, communicate and imagine future urban biodiversity (for a summary, see Supplementary Fig. 20). Combining the three dimensions, we aim to shed light on how urban biodiversity-based imaginaries are debated in small and large cities and which influences these imaginaries have on the urban environment.

By looking at how urban actors *understand* the "nature around them" (p. 14 ref. 25), we have confirmed through the analysis of the UGPs and the interviews the existence of various definitions of urban biodiversity, ranging from practical examples (solutionism) to broader concepts of ecological networks (ecosystem) and elements of urban transformation (planning tool). Notably, the interviewees all confirmed a generally increase in the sensitivity towards urban biodiversity topics (HE_3; HA_3; CE_2; FI_2; FI_3). However, especially in the case of Heidelberg, the interviewees agree on a generally low political commitment towards such topics (HE_1a and HE_1b; HE_2), which results in urban biodiversity being outclassed by other issues[26]. This is due to various influences from the EU level through the EU-BDS, for example, or concerning natural disasters, such as the COVID-19 pandemic. The national and regional levels proved to be positively influential in the two German cases, while in Italy, these remain distant or are perceived as obstacles. The European and national are also mentioned for their funding programmes. The federal level is a reference point for planning directions in the two German cities, while the regional level in Italy was regarded in the interviews as non-supportive. If the document analysis and the interviews revealed the presence of funding schemes at the federal and regional levels, a lack of other types of support is reported in the Italian cases, such as expertise and further directions in planning urban biodiversity. As actual planning documents struggle to handle the future uncertainty and complexity of urban biodiversity[4], incremental urbanism and similar approaches might provide a solution[42]. Nevertheless, city administrations often lack the resources and expertise to invest in such complex processes, especially in smaller cities. Hanover, the biggest city in the sample, does not share these concerns. In this respect, Cesena shows how urban green spaces can be defined according to different degrees of naturality, leading to a more accurate allocation of maintenance resources (HE_1; CE_1b; FI_3). This seems fundamental in the absence of local public procurements and recent public budget cuts, as witnessed in Heidelberg, and in the light of a weak contribution of the regional level in Italy (HE_2). Last, if urban actors understand the importance of urban biodiversity, it is the opinion of the interviewees that work must be done to sensitise citizens. Because urban biodiversity-related measures do not yield immediate or observable results, as nature requires time for growth, the interviewees suggest the public administration should raise awareness of these aspects among citizens (HE_2; HA_3; CE_2; FI_3).

Second, we have identified different debate patterns in the public discourse about urban biodiversity in the four cities to infer how urban actors *communicate* urban biodiversity. Generally, we have observed a tendency towards mainly process-related concepts in Italy (e.g., 'participation" and 'cross-collaboration"). Conversely, the debate is dominated by more substance-oriented concepts in German cities (e.g., 'urban greening for biodiversity" and 'climate change"). The public administration plays a prominent role in fundamentally enabling the debate on urban biodiversity and fostering its implementation. Two reasons can be identified as contributing to this outcome. First, such interventions are implemented on public land. Second, the public administration represents the municipal planning interest. This suggests the potential to prioritise urban biodiversity in the political agenda[43], which is reflected in the discourses analysed (Figs. 3–6). Following 2022, the public debate becomes highly diversified with the participation of other types of actors. This demonstrates an increasing awareness of the complexity of addressing urban biodiversity projects, with significant implications for practical implementation[15]. However, the interviews and spatial analysis reveal further challenges. At the organisational level, the public administration still suffers from the silo effect: this is observable in Florence from the DNA results, and it was mentioned by the interviews for Heidelberg (HE_1a; HE_1b). Urban biodiversity usually loses against more pressing issues such as housing (Heidelberg) and mobility (Florence): these topics are more accessible for all urban actors, especially citizens. Additionally, discourses on historical heritage preservation of buildings and gardens hinder maintenance and requalification in Hanover and Florence. On the measure level, implementing mitigation or adaptation measures is sometimes a polarising issue, especially in Heidelberg and Florence. The tendency to understand urban biodiversity as fundamentally an adaptation measure leads to implementing green elements as a side effect ("green as added value"), whereby the focus lies on the building or the infrastructure. Concerning participation, we have identified the difficulties in engaging citizens. DNA revealed various conflictual reactions from citizens ascribable to typical NIMBY situations. This is mainly due to a top-down and siloed communication style, such as in Heidelberg (HE_2) and Florence (FI_1), and a lower awareness of these topics among the population in Cesena (CE_2). With the insect alliance,

Hanover anticipates these hindrances through intense communication and diffusion of knowledge (HA_2; HA_3). However, conflictual situations can result in beneficial discussions: the CpA in Cesena is a good example of a local initiative directly engaging citizens in defining plans and future interventions (CE_2).

Lastly, understanding and communicating urban biodiversity translates into urban biodiversity-based imaginaries built on diverse narratives of the future through which urban actors imagine future urban biodiversity. The UGPs analysed present various degrees of obligations and foci on urban biodiversity, but most remain at the strategic document level without fixing clear responsibilities. As other studies confirmed[44], these documents do not manage to fulfil the ambitious design of a UGP as per the EU-BDS. Smaller cities do not possess enough economic and human resources to engage in a real plan. In comparison, bigger cities struggle with integrating these UGPs into the overall planning framework and with the pressure of implementing urgent actions. These challenges could be attributed to the intrinsic indefinability of nature when producing such imaginaries, whereby "the term "green" is currently in danger of becoming inconsequential in everyday language" (p. 2 ref. 45). In such narratives, the concept of urban biodiversity is usually idealised, for which no conflicts and uncertainties are foreseen[46]. Thus, working with such a complex concept would require an effective communication strategy to show an alternative understanding of urban biodiversity that promotes conversations and allows conflictual situations rather than refusing them. This step is often overlooked due to the pressure cities face to urgently deliver tangible results in an era when time is no longer an available resource (FI_1)[42]. Urban actors in Heidelberg deploy mainly top-down communication (HE_2), while Florence is willing to share the plans with its citizens only after completion (FI_1). Similarly, although Hanover strongly focuses on communication, institutionalised participatory processes are not envisioned for the urban biodiversity or greening plans, but the process is open for citizens to provide new ideas (HA_1). Finally, the UGPs analysed vary considerably in their proposed measures, from general considerations to specific actions. Generally, the 'promoted' biodiversity-related projects in Fig. 8 are well-distributed among the municipal territory and have important spatial extensions, whereas the 'conflictual' projects are mainly in the centre and regard small areas (Supplementary Figs. 15–18). This is unsurprising, as having a completely natural element within the urban centres is worsened by density and land use conflicts (HE_1; FI_3). The fieldwork revealed a general tendency to prefer relatively curated forms of urban greening with few attempts to improve and manage biodiversity in these areas (Supplementary Fig. 19). This was also confirmed in the interviews, especially for Heidelberg, where, although the documents depict a virtuous case, the dynamics between the different urban actors involved in the strategy draft and its implementation correspond to a few interventions dealing with urban biodiversity in the inner city.

We are aware that the selection of the four cities represents a biased sample to a certain extent. These committed cities are used to a specific vocabulary and set of practices, which we could define as a 'discursive bubble". The selection was guided by the need to ensure the presence of data to work on, answering essentially methodological questions. Additionally, the selected cities share similar political orientations concerning their government constellation. Further research could compare cities within and outside this bubble to specifically look at how the discourse changes. This could show whether discussing urban greening and biodiversity is an elitist debate for most privileged cities only. The newspaper articles analysed tend to report the voices of specific actors, mainly affiliated with the public administration, which could falsify our conclusions on which actors are driving the debate on urban biodiversity. We have observed that media are seen with diffidence by many urban actors and are often misused; however, media could play a greater role in communication with the broader public. Additionally, the representations of the debates for the four cities are limited to the top concepts and organisations for simplicity. Unavoidably, this choice results in a partial view of the cases. However, the methods deployed in this explorative research complement each other to grasp the complexity of urban biodiversity-based imaginaries. Despite the difficulties in merging different scientific traditions, we suggest expanding future research in urban biodiversity by exploring the intersections between different disciplines and methods.

We are witnessing a cultural turn through which the dependency of human-made systems on ecological ones is becoming always more evident. The newly generated urban biodiversity-based imaginaries contain the promise to bring alternative ways of thinking into everyday planning to pursue the transformative change we crave[4]. On this line of thought, we have argued that the construction of urban biodiversity-based imaginaries should be analysed at the intersection between different understandings in the past, communication strategies in the present, and future narratives generated by urban actors. We have investigated cities of diverse sizes in two European countries with the same policy framework but inherent cultural, political and geographical differences. As argued above, we can state that the construction of urban biodiversity-based imaginaries has less to do with sizes and geographies but rather is dependent on urban actors and cultural dynamics. The understanding of urban biodiversity from different actors is vague and unclear, opening a too broad range of possibilities under which everything can be understood as such[14,45]. It is foremost a concept that suffers from an excessive level of scientific complexity and abstraction. While some urban actors can exploit vagueness to justify desirable urgent actions, an abstract idea is not appealing enough to convince others about its necessity[13,20]. This would eventually lead to abandoning those imaginaries for which it is difficult to create a convincing storyline. In this sense, good data collection and monitoring are necessary to support evidence-based decisions about the future. Thus, urban actors should plan for such investments, as these weigh considerably on the municipal budget, not only in economic terms: while the UGPs provide a credible and desirable vision of a biodiversity-based future, they lack a proper discussion on "how to bring the plans on the ground" (CE_1a). The regional level should be more active in supporting local public administration with more expertise, data provision, and transparency in communication rather than limited to funding schemes. Thus, good communication and awareness-raising strategies coupled with a robust data-driven vision remain important to including laypersons[5] to reduce the knowledge gap on urban biodiversity and mistrust towards institutions. This also means going beyond the current understanding of participatory processes based mainly on consensus and embracing conflicts[4]. It is advisable to create a body that mediates between the public administration and the citizens to engage them in the planning process, improve communication, and spread enthusiasm among urban actors (HA_3). In this sense, some of the interviewees call for a more active engagement of the public administration in allowing for shared decisions and spreading culture towards urban biodiversity. As Haarstad nicely hints, instead of being kept in the spiral of innovation and solutionism, urban actors should rather formulate *reimaginaries* where past, present, and future dialogue, thus avoiding the engagement with new branded concepts and addressing more fundamental cultural gaps (p. 186 ref. 47). This novel approach to urban planning, which prioritises and communicates the fostering of biodiversity, should result from a comprehensive strategy that acknowledges the intrinsic value of nature and its role in climate change adaptation and mitigation as well as biodiversity conservation. Rather than focusing on isolated policy areas, a more holistic approach (multifunctionality) is essential to develop a coherent plan for open urban spaces.

Methods

Case study selection procedure

The case study selection is meant to acquire a manageable set of committed cities concerning urban biodiversity planning and implementation in Europe (Supplementary Note 2). Different databases were consulted following recent studies concerning European municipalities and their commitment to defining policies for climate neutrality[48,49]. Successively, committed cities have been catalogued according to their participation in an EU-funded project from the Cordis Database, focusing on urban greening and biodiversity actions. Cities with a population below 20,000 were discarded per the EU-BDS. Germany and Italy present the highest number of cities that follow the criteria from these databases. Both economically prosperous countries

and influential in the world scenario as members of the G7, Germany and Italy represent an interesting lens that exemplifies the northern and southern socio-political situations in Europe[50]. In both countries, the state has delegated municipalities the responsibility of planning to address climate change locally[51]. Germany and Italy present similar polycentric configurations of urban centres with a high ratio of small- to large-sized municipalities, thus functioning as potential examples to analyse policy responses towards climate change in Europe. We refer to the categorisation of city sizes as in the study of (p. 4 ref. 49). Four cities were considered reasonable to have a certain degree of variability while being able to analyse the cases with enough depth[52]. Cities with particular statuses (such as capital cities or city-states) were discarded a priori and considered too special. The final selection was made according to the concept of matching cities that identified the pairs[53] considering the number of inhabitants, the political orientation of the public administration, the presence and the year of draughting the strategy or plan for urban biodiversity (see Fig. 2).

Policy document analysis

To identify the relevant documents at the regional and local levels that provide the contextual framework for the UGP draughting, we searched for 'biodiversity' + 'strategy OR plan' + 'name of the region/city'. Most of the documents were not easily retrieved from a simple Google search but had to be looked for on the respective websites of the responsible institutions. It is important to note that navigating through the institution's website was rather arduous. Some relevant documents were found only after reading the UGP, which reports on integration with other policy documents or were mentioned by the interviewees.

The UGPs were retrieved directly from the official websites of the four cities. Specifically, we have looked at the respective urban greening and biodiversity planning departments for the most updated plan or strategy. Once the UGPs were found, we thoroughly analysed these documents based on the elements a UGP should have according to the most up-to-date guidance[40]. We posed the following questions about the six milestones (MS): Was the plan designed based on a participatory process (MS1)? What urban imaginary does the plan or strategy propose, and how is urban biodiversity defined (MS2)? Is the strategy or plan mainly considering green areas, or does it contain references to biodiversity specifically, such as plants and animal species (MS3)? What goals are listed, and how are these prioritised and categorised in space and time (MS4)? Is there a communication strategy for the planned targets and interventions (MS5)? Is a monitoring strategy considered to report on the interventions' development and performance (MS6)? The results are presented in Fig. 7.

Discourse network analysis

The newspaper articles were searched in four local newspapers, namely 'Rhein-Neckar-Zeitung" for Heidelberg, 'Hanoversche Allgemeine Zeitung" for Hanover, 'CesenaToday" for Cesena, and 'FerenzeToday" for Florence. The use of local newspapers is a proven, accessible and reliable source, available online daily[54]. A possibly high circulation rate and press quality criteria must be considered when selecting the local newspaper. For the data collection, a period was chosen to search with specific keywords for the thematic articles. The EU Green Deal was draughted at the end of 2019, followed by the EU BDS 2030 in May 2020. Therefore, the year 2020 was chosen as a turning point in the EU context when talking about biodiversity was officially embraced by European institutions and policies. At the end of June 2024, the EU Nature Restoration Law was adopted by the European Parliament, making the draughting of a UGP obligatory. Thus, the period between January 2020 and June 2024 was chosen for the analysis as a transition phase of what we could define as 'the voluntary discourse on urban biodiversity' in the political debates in European cities.

For the German case studies, the keywords searched are "biodiversity" (Biodiversität) OR "urban greening" (Stadtgrün). For the Italian case studies, the search on the websites of the two newspapers was limited to "urban greening" (verde urbano) because of the difficulties in using Boolean strings. Having the same starting point allows us to deepen the specificities and analyse anomalies of the case studies. To code the newspaper articles, we created a codebook containing different deductively created categories; further categories are inductively added during the coding process. The categories are both general cross-case and case-specific categories. To manually code the newspaper articles, we used the software discourse network analyser (https://www.philipleifeld.com/software/software.html). In the coding process, four dimensions for each statement were categorised: 1) name of the actor, 2) affiliation of the actor, 3) concept, which is a general category of a statement, and 4) agreement or disagreement with this category. The newspaper articles were coded in the discourse network analyser (DNA) software version 3.0.10. Statements of actors in direct or indirect speech were coded with information on the actor, the organisations the actor is affiliated to, the concept, and agreement or disagreement on the concept. We analysed 327 newspaper articles in this period and coded 1465 statements organised into 35 concepts. The actors were divided into eight organisational types: public-sector economy, science and education, grassroots initiative, NGO, politician, government, economy and citizen.

The data coded in the dna software was successively analysed and visualised in the visone software version 2.28[55]. We built one-mode discourse networks for each city annually from January 2020 until June 2024. One-mode actor networks represent actors' networks connected by sharing concepts, and one-mode concept networks show concepts connected by actors sharing the respective concepts. We used the subtract function, which shows the congruence subtracted by the discrepancy between the nodes[56]. The position of the nodes is based on their degree of centrality; the size of the nodes represents the frequency of appearance in the respective newspaper articles, while the thickness of the ties is based on the edge weight, representing the number of times the actors mention these two nodes. For better visualisation, we use a threshold of the networks, and only the nodes with the ten highest degrees of centrality were selected for representation. Detailed information on organisations, concepts, and the complete yearly DNA is available in Supplementary Note 3. Supplementary Note 8 provides an overview of the organisations in their original language alongside the English translations used.

Spatial analysis

The spatial analysis was performed by identifying the geolocation of the projects mentioned in the newspaper articles. The maps in Fig. 8 show what we call spatialisation of the discourse. The portraited projects do not represent exhaustive inventories of all biodiversity-related areas in the four cities. Rather, they mirror the importance of projects that deserve to be advertised by the discussant (called 'promoted") or are objects of conflictual situations (called 'conflictual"). For more precise information about each project, see Supplementary Note 4. The authors conducted fieldwork to visit most of the identified projects and support the bi-dimensionality of the maps with real-world pictures (Supplementary Note 5).

Interviews

At least three interviews per city were conducted following a semi-structured questionnaire (Supplementary Note 5). The main scope of the interviews was to validate the findings collected through the other methods described above. The main actors mentioned in the newspaper articles were chosen as interviewees and thus are involved to some extent in the projects considered in the analysis. Through snowballing, other relevant interviewees were identified. The complete list of interviewees and further information are reported in Supplementary Table 5. The interviewees in each city belong to different types of organisations to grasp the impression of the context from various perspectives and include a broad spectrum of urban actors. The questions posed referred to 1) the personal definition of urban greening, 2) their role in the process of the plan or strategy development, 3) their impression of the public debate on urban biodiversity, 4) their ideas of the future work to be done concerning urban greening, and 5) the enquiry for further contacts. All interviews lasted between 40 and 60 min and were conducted in person, during the fieldwork, or via Zoom. All of them were recorded and transcribed. The coding was organised into five

macro-categories: the definition of urban biodiversity, the process of planning document draughting, the sensitivity of public opinion, future perspectives and challenges.

Data availability

Data is provided in the supplementary information file and it will be publicly available and can be accessed at the HafenCity Universität Hamburg repository.

Received: 6 December 2024; Accepted: 14 April 2025;
Published online: 29 April 2025

References

1. Sukopp, H. On the early history of urban ecology in Europe. *Preslia*, **74**, 79–97 https://doi.org/10.1007/978-0-387-73412-5_6 (2002).
2. McDonnell, M. J. The history of urban ecology. An ecologist's perspective. (edited by Niemelä, J.) In *Urban Ecology. Patterns, Processes, and Applications* (Oxford Univ. Press, 2011).
3. Ibsen, P., Kucera, D., Piper, S. & Jenerette, G. D. Urban Climate and the Biophysical Environment (edited by Nilon C. H. & Aronson M. F.) In *Routledge Handbook of Urban Biodiversity* (Routledge, 2023).
4. Bulkeley, H. et al. Cities and the transformation of biodiversity governance (edited by Visseren-Hamakers I. J. & Kok M. T. J.) In *Transforming Biodiversity Governance* **144**, 293–312 (2022).
5. Nilon, C. H. et al. Planning for the future of urban biodiversity: a global review of city-scale initiatives. *BioScience* **67**, 332–342 (2017).
6. EC. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU Biodiversity Strategy for 2030. Bringing nature back into our lives (Europeon Union, 2020).
7. Wilk, B., Schauser, I. & Vetter, A. Tackling the climate and biodiversity crises in Europe through Urban Greening Plans. Recommendations for avoiding the implementation gap. (ICLEI Europe, 2021).
8. EC. Urban Nature Platform. Available at https://environment.ec.europa.eu/topics/urban-environment/urban-nature-platform_en (European Comission, 2022).
9. Hodson, M., Evans, J. & Schliwa, G. Conditioning experimentation: the struggle for place-based discretion in shaping urban infrastructures. *Environ. Plan. C Polit. Space* **36**, 1480–1498 (2018).
10. Haarstad, H., Grandin, J., Krzyżak, J. & Johnson, E. Why the haste? Introduction to the slow politics of climate urgency (Haarstad H., Grandin J., Kjærås K. & Johnson E. *Haste)* In *The Slow Politics of Climate Urgency* (UCL Press, 2023).
11. Holgersen, S. The geography of the 'world's greenest cities': a class-based critique. In *Haste. The Slow Politics of Climate Urgency* (UCL Press, 2023).
12. Westman, L. & Castán Broto, V. Urban Climate Imaginaries and Climate Urbanism (edited by Castán Broto V., Robin E. & While A.) In *Climate* Urbanism (Springer Int. Publishing, 2020).
13. Beckert, J. What makes an imagined future credible? MPIfG Discussion Paper 24/5 (2024).
14. Brown, N., Rappert, B. & Webster, A. *Contested futures. A Sociology of Prospective Techno-Science* (Ashgate, 2000).
15. Hajer, M. A. *The Politics of Environmental Discourse. Ecological Modernization and the Policy Process* (Clarendon, 1995).
16. Hajer, M. A. Discourse coalitions and the institutionalization of practice (edited by Fischer F. & Forester J.) In *The Argumentative Turn in Policy Analysis and Planning* (Duke Univ. Press, 1993).
17. Fischer, F. & Forester, J. (eds.). *The Argumentative Turn in Policy Analysis and Planning* (Duke Univ. Press, 1993).
18. Müller, N., Werner, P. & Kelcey, J. G. Front matter (edited by Müller N., Werner P. & Kelcey J. G.) In *Urban Biodiversity and Design* (Wiley, 2010).
19. Nilon, C. H. & Aronson, M. F. (eds.) *Routledge Handbook of Urban Biodiversity* (Routledge, 2023).
20. Jasanoff, S. Future imperfect: science, technology, and the imaginations of modernity (edited by Jasanoff S. & Kim S.-H.) In *Dreamscapes of modernity. Sociotechnical imaginaries and the fabrication of power* (The Univ. Chicago Press, Chicago, 2015)
21. EU & UN-Habitat (eds.). *The state of European cities 2016. Cities leading the way to a better future* (European Commission, 2016).
22. Hajer, M. A. & Versteeg, W. A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives. *J. Environ. Policy Plan.***7**, 175–184 (2005).
23. Leifeld, P. Discourse Network Analysis: Policy Debates as Dynamic Networks. (edited by Victor J. N., Montgomery A. H. & Lubell M.) In *The Oxford Handbook Of Political Networks* (Oxford University Press, 2017)
24. Nagel, M. & Bravo-Laguna, C. Analyzing multi-level governance dynamics from a discourse network perspective: the debate over air pollution regulation in Germany. *Environ. Sci.***34**, 62–80 (2022).
25. Nilon, C. H. History of Urban Biodiversity Research and Practice. (edited by Nilon C. H. & Aronson M. F.) In *Routledge Handbook of Urban Biodiversity* (Routledge, 2023).
26. Arlati, A. National parliamentary discourses on urban greening and biodiversity implementation in Germany and Italy. In *Conflicts in Urban Future-Making. Governance*, *Institutions, and Transformative Change*, edited by Grubbauer M., Manganelli A. & Volont L. (Majuskel Medienproduktion GmbH, 2024).
27. Bundesland Baden-Württemberg. Naturschutzstrategie Baden-Württemberg. Biologische Vielfalt und naturverträgliches Wirtschaften – für die Zukunft unseres Landes. Ministerium für Ländlichen Raum und Verbraucherschutz, February 2014.
28. Bundesland Baden-Württemberg. Biodiversitätsstärkungsgesetz. Stärkung der biologischen Vielfalt. Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württenberg, 28.11 (2023).
29. Bundesland Niedersachsen. Niedersächsische Naturschutzstrategie. Ziele, Strategien und prioritäre Aufgaben des Landes Niedersachsen im Naturschutz. Niedersächsisches Ministerium für Umwelt, Energie und Klimaschutz, May 2017.
30. Region Hannover. Regionales Raumordnungsprogramm Region Hannover 2016, (2016).
31. Landeshauptstadt Hannover. STADTGRÜN 2030. Ein Freiraumentwicklungskonzept für Hannover, December 2020.
32. Regione Emilia-Romagna. Strategia di mitigazione e adattamento per i cambiamenti climatici della Regione Emilia Romagna (2019).
33. Regione Emilia-Romagna. Regional strategy "20230 agenda for sustainable development". Emilia-Romagna. Il futuro lo facciamo insieme (2021).
34. Comune di Cesena. PAESC Cesena. Piano d'azione per l'energia sostenibile e il clima (2019).
35. Regione Toscana. Quadro strategico regionale per uno sviluppo sostenibile ed equo. Ciclo di programmazione comunitaria 2021-2027. Available at https://www301.regione.toscana.it/bancadati/atti/Contenuto.xml?id=5242815&nomeFile=Delibera_n.78_del_03-02-2020-Allegato-A#:~:text=Il%20Quadro%20Strategico%20Regionale%20(QSR,operativi%20regionali%20della%20Regione%20Toscana (2019).
36. Città Metropolitana di Firenze. La città metropolitana di Firenze verso lo sviluppo sostenibile. 10 obiettivi metropolitani per il 2030. Available at https://www.mase.gov.it/sites/default/files/archivio/allegati/sviluppo_sostenibile/CM_Firenze_Agenda_Metropolitana_2030_Sviluppo_Sostenibile_2021.pdf (2022).
37. Comune di Firenze. Quadro conoscitivo. 4.4 Paesaggi e natura. Available at https://pianostrutturale.comune.fi.it/materiali/07PaesaggioNatura_2007/QC_4_4_Paesaggio_e_Natura_C.pdf (2015).

38. Stadt Heidelberg. Biodiversitätsstrategie Heidelberg. Eckpunkte – Ziele – Maßnahmen. Amt für Umweltschutz, Gwerbeaufsicht und Energie, 18 March 2021.
39. Comune di Cesena. Obiettive e strategie per una Cesena più verde. Relazione Green City Accord (2023).
40. EUROCITIES & ICLEI Europe. Urban Greening Plans - DRAFT. Guidance for cities to help prepare an Urban Greening Plan (European Commission, 2021).
41. Comune di Firenze. La città che siamo, la città che saremo. Programma di mandato 2019-2024 (2020).
42. Karvonen, A. & Bylund, J. Small measures, large change: the promise and peril of incremental urbanisation. (edited by Haarstad H., Grandin J., Kjærås K. & Johnson E.) In *Haste. The slow politics of climate urgency*, (UCL Press, 2023).
43. Haarstad, H., Grandin, J., Kjærås, K. & Johnson, E. (eds.). *Haste. The Slow Politics of Climate Urgency* (UCL Press, 2023).
44. Costadone, L. & Vierikko, K. Are traditional urban greening actions compliant with the European Greening Plans guidance?. *Urban For. Urban Green.***90**, 128131 (2023).
45. Breuste, J. *The Green City. Urban Nature as an Ideal, Provider of Services and Conceptual Urban Design Approach* (Springer, 2022).
46. Keune, H. et al. Defining Nature. (edited by Visseren-Hamakers I. J. & Kok M. T. J.) In *Transforming Biodiversity Governance* (Cambridge Univ. Press, 2022).
47. Haarstad, H. Climate imaginaries for urgent urban transformations. (edited by Haarstad H., Grandin J., Kjærås K. & Johnson E.) In *Haste. The Slow Politics of Climate Urgency* (UCL PRESS, 2023).
48. Reckien, D. et al. How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. *J. Clean. Product.***191**, 207–219 (2018).
49. Salvia, M. et al. Key dimensions of cities' engagement in the transition to climate neutrality. *J. Environ. Manage.***344**, 118519 (2023).
50. Piattoni, S. & Notermans, T. Introduction to 'Italy and Germany: Incompatible Varieties of Europe?. *German Polit.***30**, 301–318 (2021).
51. ESPON. COMPASS—comparative analysis of territorial governance and spatial planning systems in Europe. Applied Research 2016-2018 (2018).
52. Seawright, J. & Gerring, J. Case selection techniques in case study research. *Polit. Res. Quart.***61**, 294–308 (2008).
53. Kern, K., Grönholm, S., Haupt, W. & Hopman, L. Matching forerunner cities: climate policy in Turku, Groningen, Rostock, and Potsdam. *Rev. Policy Res.***40**, 1004–1025 (2023).
54. Nagel, M. & Schäfer, M. Powerful stories of local climate action: comparing the evolution of narratives using the "narrative rate" index. *Rev. Policy Res.***40**, 1093–1119 (2023).
55. Brandes, U. & Wagner, D. Analysis and visualization of social networks. (edited by Jünger M. & Mutzel P) In *Graph Drawing Software* (Springer, 2004).
56. Leifeld, P., Gruber, J. & Bossner, F. R. Discourse Network Analyzer Manual. Available at https://usermanual.wiki/Pdf/dnamanual.2049511603.pdf (2019).

Acknowledgements

We would like to thank Prof. Gernot Grabher and Dr Joachim Thiel for their consistent help in defining the structure of the paper and in the provision of theoretical and methodological support. A big thank goes to the reviewers and editors, who, with their precise and constructive comments, encouraged me to work further on the paper. Last but not least, I would like to express my gratitude to my colleagues of the RTG 2725, with whom I exchanged thoughts, problems, and solutions.

Author contributions

A.A.: conceptualisation, data coding, methodology, spatial analysis, visualisation, investigation, writing—original draft preparation. M.N.: conceptualisation, methodology, writing—reviewing and editing.

Funding

Open Access funding enabled and organized by Projekt DEAL.

Competing interests

The authors declare no competing interests.

Additional information

Supplementary information The online version contains supplementary material available at https://doi.org/10.1038/s44168-025-00249-y.

Correspondence and requests for materials should be addressed to Alessandro Arlati.