Environmental Policy and Governance

WILEY

Environmental Policy and Governance

RESEARCH ARTICLE OPEN ACCESS

Regulations 'Under the Weather': Legal Factors of Stability and Change for the Implementation of Natural Stormwater Management in Finland

Francesco Venuti[1] | Aleksi Heinilä[2] | Peter R. Davids[3]

[1]Faculty of Social Sciences and Business Studies, UEF Law School, University of Eastern Finland, Joensuu, Finland | [2]Environmental Law, Faculty of Law, University of Turku, Turku, Finland | [3]Department of Spatial Planning, Chairgroup of Land Policy and Land Management, TU Dortmund University, Dortmund, Germany

Correspondence: Francesco Venuti (fvenuti@uef.fi)

Received: 20 June 2024 | **Revised:** 10 December 2024 | **Accepted:** 15 January 2025

Funding: This work was supported by Academy of Finland, 352943.

Keywords: climate change adaptation | governance | nature-based solutions | policy arrangement approach | role of law | stormwater management

ABSTRACT

The implementation of natural stormwater management (SWM), namely SWM carried out through nature-based solutions (NBS), is still problematic despite their benefits in climate change adaptation. Private landownership is commonly cited as the factor limiting extensive NBS. However, the Finnish model demonstrates that, regardless of whether the needed land is private or public, implementing actors face numerous legal challenges in efforts to carry out SWM using NBS. We study the Finnish SWM and land use planning frameworks to uncover the legal barriers to and drivers of NBS implementation as well as the interaction of the frameworks with the wider governance setting. By doing so, we highlight the need for a regulatory approach to NBS that will facilitate their uptake. We first explore how the Finnish legal framework regulates natural SWM. Secondly, we use the policy arrangement approach (PAA) and the framework on stability and change in flood risk management to combine the results of the legal analysis with the findings from a series of interviews with urban planners from several Finnish municipalities. This in turn enables us to visualise how the law interacts with the broader governance system to limit and shape the options for implementing natural SWM. The main factors of stability (namely, keeping the status quo) for NBS include the lack of regulations and unclear and fragmented SWM responsibilities. The main factors encouraging change include cities' acquisition or ownership of public land, an integrated governance approach to SWM, the Green Area Factor (GAF), pilot projects and stormwater working groups.

1 | Introduction

In the absence of adaptive measures, by the end of this century flooding resulting from more frequent and extreme weather events triggered by climate change will have sizable negative impacts in Europe at large (Dottori et al. 2023), and Finland will be no exception (Jurgilevich, Räsänen, and Juhola 2021). Engineered solutions alone cannot ensure protection from the consequences of an uncertain and increasingly harsher climate. In this context, nature-based solutions (NBS) represent a promising alternative or, more realistically, a more sustainable addition to traditional, grey infrastructure (e.g., Sowińska-Świerkosz and García 2022; Turconi et al. 2020). Nature-based solutions are actions that are able to tackle multiple societal challenges while also supporting biodiversity protection (Raymond et al. 2017; Cohen-Shacham et al. 2016). A plethora of research has demonstrated cross-sectoral positive outcomes of NBS implementation, spanning stormwater management (SWM) (Kõiv-Vainik et al. 2022; Jakubínský et al. 2021), biodiversity improvement (Key et al. 2022) and carbon sequestration (Keesstra et al. 2018).

This evidence highlights the broad opportunities to adapt to climate change by scaling up NBS using a holistic approach to maximise the co-benefits they offer (Ferreira et al. 2021; Seddon et al. 2021). The literature on flood risk management recognises the positive outcomes of integrating NBS as preventive measures in risk management strategies (Löschner et al. 2021; Seher and Löschner 2018) and advocates the inclusion of NBS in urban planning (Ferreira et al. 2021; Kumar et al. 2020).

Despite the multiple NBS' benefits, their implementation remains limited in flood risk contexts due to the wide range of challenges that potential practitioners face (Raška et al. 2022). Van den Ende et al. (2023) stress that implementing actors in the Dutch context do not generally take the initiative in mainstreaming nature-based adaptive measures due to the absence of an institutional framework clarifying responsibilities and expediting innovative practices. Similarly, barriers arising from the uncertainty about who is responsible for implementing or monitoring NBS have been observed, respectively, in France and Italy (Gimenes-Maranges et al. 2020) and England (Keech, Clarke, and Short 2023). Limited collaborative governance has been obstructing NBS in several countries by inhibiting cross-sectoral communication (Dorst et al. 2022). Finally, public actors might not have available land if the land is in the hands of private landowners and thus protected by property rights. This situation is often cited as the main reason for the NBS limited application (Potočki et al. 2022; Ferreira et al. 2021; Hartmann, Slavíková, and McCarthy 2019). Nature-based solutions require more land than traditional infrastructure. When this land is private, the competent authorities, such as municipalities, are forced to find ways to either cooperate with landowners, include them in the decision-making process, or negotiate agreements to compensate them after acquiring their land (Bogdzevič and Kalinauskas 2021; Potočki et al. 2022). In these instances, the discordance between private and public interests makes the process of land allocation too costly and complicated. Thus, even when municipalities are committed to integrating adaptation in their land use strategy, implementing NBS might not be feasible if the opportunities for doing so lie in private land (Thaler et al. 2023; Snel et al. 2020).

Shortages of available land undoubtedly influence the opportunities for deploying NBS, but rather than being 'the' problem, it is only one of the problems. Our analysis of the Finnish model confirms the findings of the literature on NBS for SWM, showing that a range of barriers to their implementation exist. In Finland, the major hindrance is the lack of space per se in already built areas rather than private ownership of space. Indeed, it is not uncommon for Finnish municipalities to own a large portion of the land within their jurisdiction. Finnish cities have traditionally been able to rely on a comprehensive set of land policy instruments that make land acquisition and the related negotiations easier (Valtonen, Falkenbach, and Viitanen 2018). These apparently favourable circumstances have not, however, translated into extensive, integrated and systematic implementation of NBS. Therefore, the Finnish case particularly relevant as it allows us to shed light on other, concurrent challenges.

In fact, in addition to questions of property ownership and rights, NBS present several legal challenges that implementing actors struggle with even when they own the land. Bogdzevič (2023) points out how the slow adoption of NBS might stem from the lack of a legal perspective in current multi- and interdisciplinary research. Bogdzevič emphasises the lack of a cross-sectoral approach as a fundamental hindrance to NBS implementation for flood and stormwater management. Consequently, Bogdzevič calls for a contextual reading of EU legal sources and policies, arguing that the legal grounds enabling adoption of NBS are already present at the Union level. Against this background, a clearer overview is needed of the distinct legal and administrative challenges attending NBS implementation in urban areas. Drawing upon the research calling for a legal approach to NBS (Bogdzevič 2023), this contribution analyses the legal and administrative matters related to the implementation of NBS for SWM in Finland. The analysis extends beyond the private ownership problem and takes up obstacles related to both private and public land.

Understanding the ways out of the current situation, one characterised by limited implementation of natural SWM, requires mapping the unique legal and administrative setting creating lock-ins. Accordingly, the research will proceed to identify the legal instruments in place as well as the opportunities they provide for or constraints they impose on NBS for SWM. To this end, the land use planning and SWM legal frameworks must first be analysed to illustrate how the relevant legal instruments are applied and operate. Secondly, the governance settings as a whole must be examined, as regulations serve a broad web of interactions and processes, which have their own logic and effects (Hartley and Howlett 2021). To understand how the law influences the governance settings and vice versa, this research will go on to map the interactions in the array of discourses, actors, resources and rules of the game in those settings (Arts, van Tatenhove, and Leroy 2000). Finally, by identifying what interactions stimulate or hinder the implementation of NBS, the analysis distinguishes the forces stimulating change from those that reproduce the 'stabilising' effects of the locked-in situations. Stability is generally a desirable societal goal but, if stability turns into rigidity, the resulting system may hinder the adoption of innovative practices.

This contribution seeks to enrich the international theoretical debate on NBS by presenting legal-doctrinal and empirical findings from Finland that illustrate a range of legal and administrative factors influencing NBS implementation. In doing so, this contribution also seeks to identify viable governance strategies enabling wide integration of natural SWM into urban planning and thus fostering a hybrid SWM approach. These aims will be addressed in terms of the following research questions:

1. How do legal instruments regulate the implementation of natural SWM on private and public land in Finland?
2. How does the resulting legal and administrative framework interact with the wider governance setting in relation to NBS implementation?
3. How can such interactions be conceptualised as factors of stability and change hindering or supporting the implementation of NBS on private and public land?

Informed by these questions, we show how the lack of a regulatory approach to NBS, namely the absence of clear regulations taking NBS explicitly into consideration, affects SWM and urban planning in the Finnish municipalities of Helsinki, Espoo, Vantaa, Turku, Tampere, Lahti and Oulu.

SWM and planning in these communities cut across both administrative sectors and scales, easily leaving the different actors' responsibilities ambiguous. We explore how the consequent fragmentation results in organisational problems and the lack of a cross-sectoral perspective at the municipal level. These conditions make it harder to adopt natural SWM, slow down climate adaptation and favour business as usual. We define natural SWM as SWM carried out through NBS, such as retention ponds, ditches, rain gardens, green roofs and other relevant green measures.

We use a mixed-method approach consisting of legal doctrinal analysis and interviews conducted with urban planners from each of the municipalities cited. To integrate the results of the legal analysis with the interview findings, we draw on the policy arrangement approach (PAA) (Arts, van Tatenhove, and Leroy 2000) and the framework on stability and change in flood risk management (Wiering, Liefferink, and Crabbé 2018). This combination of theoretical lenses has been used successfully to analyse responsibility shifts in the governance of flood risk management (Rauter et al. 2020). Thus, it can be equally effective in evaluating how the legal-administrative settings and the allocation of responsibilities support or hinder natural SWM implementation on available land. Significantly, our approach will enable us to illustrate the complexities that limit and shape the options for implementing natural SWM.

The paper is structured as follows: Section 2 sets out the principal theoretical concepts guiding the research, while Section 3 outlines the methods used. Section 4 is divided into two parts. Section 4.1 illustrates the results of the legal analysis, while Section 4.2 integrates those results with the findings from the interviews, highlighting the relationships between the legal and administrative settings and the other dimensions of the PAA. Building on these findings, the analysis goes on to describe the consequences of these relationships, classifying their implications for NBS implementation as factors of either stability or change. In Section 5, we conclude, summarising the key findings, emphasising the need to adopt a regulatory approach that will hasten the uptake of NBS and identifying the main characteristics of that approach.

2 | Theoretical Framework

Governance arrangements serve to stabilise a policy domain or governance setting (Leroy and Arts 2006) but themselves remain dynamic over time (van Tatenhove, Arts, and Leroy 2013). Even a stable governance setting requires continuous pressures between various dynamics to keep it stable (Beunen, Patterson, and Van Assche 2017; van Tatenhove, Arts, and Leroy 2013). The policy arrangement approach (PAA) allows us to map the interactions between the legal framework and governance dynamics (Arts, van Tatenhove, and Leroy 2000; Leroy and Arts 2006; van Tatenhove, Arts, and Leroy 2013), illustrating the current possibilities for the extensive development of natural SWM in Finnish cities. The framework has previously been applied in research on flood risk management (e.g., Kaufmann et al. 2016; Mees, Crabbe, and Suykens 2018; Rauter et al. 2020). The focal dynamics emerge from the interplay of four dimensions: discourses, actors, resources and rules of the game. The discourses consist of narratives and histories that influence governance settings; the actors form coalitions influencing the governance arrangement; the resources include power, knowledge, financial means or other types of resources that are available to influence governance settings; and the rules of the game comprise the formal and informal rules and procedures for policies and regulations (Arts, Leroy, and Van Tatenhove 2006). Together, these dimensions interwove and influence the setting of a governance arrangement, which can be described as a tetrahedron (see Figure 1). Mapping these notions provides us with insights into the role of the legal framework in establishing the governance setting of natural SWM in Finland.

The theoretical notions 'forces of stability' and 'forces of change' are shaped by the literature on institutional change (Beunen, Patterson, and Van Assche 2017; Lawrence, Suddaby, and Leca 2009; Tina Dacin, Goodstein, and Richard Scott 2002) and have also been applied in the research on flood risk management (e.g., Kaufmann and Wiering 2022; Boelens 2018; Raadgever, Booister, and Steenstra 2018; Wiering et al. 2017; Naess et al. 2005). Here, we combine these concepts with the PAA, as they capture the results that interacting PAA dimensions may have for NBS. They allow us to emphasise the current lock-in in NBS implementation, in which dynamics hinder solutions by promoting the status quo, and demonstrate how facilitating NBS implementation entails moving away from the dominant governance context. For each PAA dimension, barriers, or forces of stability, can be identified, as can enablers, or forces of change. Both types of forces arise from the continuous, reciprocal interactions between the four dimensions. For example, through discourses certain features of a phenomenon are prioritised on the basis of intrinsic principles guiding discourse development. In the process, the entry points used to address a particular issue are identified and become the building blocks of a particular policy approach (Hajer 1993). The water domain is characterised by the coexistence of many interests reflecting the extensive range of principles underlying water resources. The interests extend beyond flood and stormwater management to include, for example, pollution prevention and water security (Boelens 2018). This

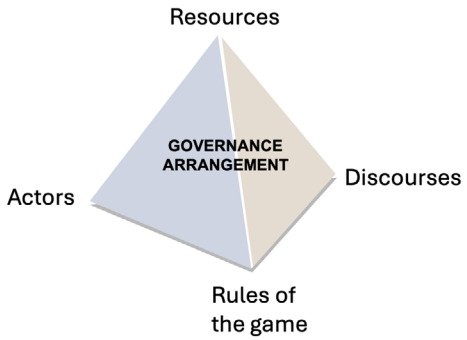

FIGURE 1 | The tetrahedron illustrates the connections of the dimensions constituting a governance arrangement; adapted from Arts, Leroy, and Van Tatenhove 2006.

complexity favours some interests over others (Van Rijswick et al. 2018) and is exacerbated by climate change, which makes it difficult to develop normative strategies to manage water while ensuring adaptation (Driessen and Van Rijswick 2011). For this reason, a constructive dialogue between different discourses is critical to establish effective rules of the game that echo the multiple interests at stake (Davids et al. 2024). Such a dialogue can also facilitate a process of social learning (Mostert et al. 2007). Concerning actors, their power relations influence the coordination of governance settings, which in turn contributes to shaping the legal framework. Diminishing trust in public actors can create a force of change, while strong, influential actors can utilise their steering power to either push or inhibit change. The rules of the game generally have a strong stabilising effect on the other PAA dimensions, but their power can also erode due to a decrease of legitimacy (Mattila and Heinilä 2022). Resources provide the ability to take action in certain ways and can create a strong epistemic community, while new expertise can contribute to a re-evaluation of the rules (Wiering, Liefferink, and Crabbé 2018; Wiering et al. 2017). By examining forces of stability and change in the Finnish SWM domain from the perspective of the rules of the game, this research can identify the legal barriers and drivers affecting NBS uptake and indicate the pathways out of the current lock-in.

3 | Methods

Finland represents an illustrative setting to examine natural SWM implementation, as the land acquisition challenge pointed out in the literature is generally not an issue. In Finland, both SWM-specific legislation and the practices implementing NBS are fairly new. Furthermore, Finland has not yet been subjected to the most severe SWM-related effects of climate change. The Finnish case can thus be viewed as a phase in the open-ended, social learning process aimed at mainstreaming NBS for climate change adaptation. The particular municipalities were chosen as they are seven of the 10 most densely populated Finnish urban areas and, as such, represent areas particularly sensitive to SWM-related issues. The cities are also representative of multi-scalar and -sectoral SWM governance frameworks. Multiple municipalities were included in the study to ascertain whether different dynamics are at work based on differences in city size, topography and administrative/organisational settings. The cities can be characterised as revelatory cases (Yin 2018). Indeed, the recent developments in SWM-specific legislation, combined with the mixed-method approach used to analyse the complexities in governing NBS, offer a new analytical lens on the adoption of natural SWM in Finnish urban areas (Yin 2018). The findings emerging from the interaction between national legislation and elements not dependent on cities' characteristics (such as the lack of regulations on NBS) can arguably be generalised beyond the case studies.

In this study, we apply legal doctrinal analysis to relevant Finnish legislation in the land use and SWM domains to analyse the salient rules, understand the relationships between these domains and highlight the opportunities for and obstacles to natural SWM implementation. Legal doctrinal analysis is a research method enabling scholars to describe rights, obligations and entitlements emerging from a legal system. It also allows scholars to systematically examine the body of rules regulating a certain legal domain (Hutchinson and Duncan 2012). Legal doctrinal analysis is the predominant method of legal research and is often combined with other, for instance empirical, methods. Here, we complement it with a series of semi-structured interviews conducted by the first author between October 2022 and April 2024 with 22 urban planners working in several municipalities. This method was chosen to collect the opinions of practitioners on what opportunities and obstacles the legal and administrative frameworks entail for natural SWM. Gathering the experiences of these in-the-field actors allowed us to explore the practical effects of the wider governance context on NBS implementation and examine the relationship between the rules of the game (i.e., the legal and administrative frameworks) and the other dimensions of the PAA. The distribution of participants was as follows: seven from Helsinki; three each from Oulu, Turku, Espoo and Vantaa; two from Tampere; and one from Lahti. At least one official was interviewed from each city studied. The interviewees were working in municipal planning at various stages of the process and in different capacities depending on the respective municipality's internal departmental division. In addition to SWM experts, the participants included members of master or detailed planning offices and urban greenery experts. For anonymity, their titles are not specified. The interviews were conducted either in person or via online meetings and lasted between 30 and 75 min. The format was based on a series of open-ended questions, each of which focused on a theme that emerged from our legal analysis. Depending on how pertinent a theme was in the interviewee's context, additional tailored questions were asked to gaining deeper understanding of the dynamics at work locally. Finally, the contents of the interviews were qualitatively analysed (Weber 1990) and, along with the results of the legal analysis, processed through the interpretative lens provided by the PAA and the framework on stability and change.

4 | Results

4.1 | The Rules of the Game

4.1.1 | The Finnish Land Use Planning Framework—Statutory Planning

In Finland, land use planning is currently carried out through a statutory, comprehensive and multi-level planning system set out in the Land Use and Building Act (LUBA 1999). The law defines the substantive boundaries for planning through flexible norms identifying the interests that must be observed when drafting land use plans (LUBA, ss 28, 39 and 54). The hierarchy of planning levels designates that more general plans guide the drafting of more detailed ones. The latter, in turn, supersede the more general plans. Ultimately, local detailed plans are the instruments regulating land use changes in urban areas as such land use must, by law, be based on a detailed plan.

At the state level, the National Land Use Guidelines seek to coordinate supranational and national interests and incorporate these into statutory land use planning. The guidelines formally steer the development of all land use plans. However, in practice they primarily influence the next level down in the hierarchy, regional planning (see Heinilä 2021). The current guidelines

(Finnish Government 2017) state the need to prepare for extreme weather events, floods and other climate change impacts. Regional plans set out the principles of regional land use and community structure, designating the areas considered necessary for regional development (or preservation).

Municipalities hold the most significant planning powers. The reasons for this situation can be traced to the Finnish Constitution (1999), which guarantees municipalities the right to self-government (s 121). Municipal planning is carried out through master plans and detailed plans. Local master plans provide the general foundation for detailed plans in urban areas. Detailed plans steer the actual land use activities and are the most binding instruments in the planning system. Property holders have, as a rule, both a right and an obligation to build according to the effective detailed plan (LUBA, s 58).

The municipalities' planning rights and duties are accompanied by comprehensive means of land acquisition, for example the right to acquire areas designated as public in detailed plans (LUBA, s 96). Generally, municipalities acquire the land to be used for urban development before detailed planning, often through voluntary means (Valtonen, Falkenbach, and Viitanen 2018). Furthermore, each city council can issue building ordinances, binding rules that complement detailed plans in regulating constructions within the municipality's jurisdiction. These ordinances are not applied if other regulations or legally binding municipal plans provide otherwise.

4.1.2 | The Finnish Land Use Planning Framework—Non-statutory Planning

Non-statutory instruments have also been used to a degree in land use planning, especially in the largest city regions. Here, these instruments take the form of MAL agreements (M denoting land use, A housing, and L transportation), introduced by the central government in 2011 (see Mattila and Heinilä 2022). In the agreements, state actors commit to specified infrastructure investments, while municipalities commit to certain objectives for the regions' spatial development. For example, in the MAL agreement for the Helsinki region the municipalities commit to planning 90% of new housing in certain zones and developing a specified amount of housing defined both in terms of gross floor area and number of units (MAL agreement for the Helsinki region 2020). These agreements promote urban densification, especially in areas with good public transport, an objective also found in LUBA.

These instruments are, however, legally detached from the statutory planning system. Being agreements between the municipalities and state government agencies in which public participation is not included, they have been criticised as being undemocratic (Bäcklund et al. 2018). They may also compete with the statutory planning system, even if their objectives are largely similar (Heinilä and Partinen 2022, 82–83, see Mattila and Heinilä 2022). The measures agreed on in the agreements are very detailed and concrete compared to LUBA's material provisions. Thus, such measures may replace the more abstract legal framework in steering development in the cities concerned. However, the growth-oriented and ambitious densification efforts contained in the agreements may also pose a challenge from the point of view of climate adaptation measures.

4.1.3 | The Finnish SWM Framework

In Finland, SWM is mainly regulated by the Flood Risk Management Act (FRMA 2010), the Government Decree on Flood Risk Management (GDFRM 2010), the Water Services Act (WSA 2001) and LUBA. The FRMA implements the EU Floods Directive (EC 2007), prescribing the compilation of preliminary flood risk assessments (including stormwater floods), the mapping of flood risks and hazards and the creation of flood risk management plans (FRMPs). The GDFRM operationalises these provisions and, notably, clarifies that FRMPs can comprise natural solutions such as flood retention areas (GDFRM Section 5(1)(2)). Unlike in the case of fluvial flood risk management planning (a responsibility of state authorities), municipalities are responsible for planning the management of stormwater flood risk (FRMA, ss 5 and 19). This planning primarily concerns existing densely built areas, but stormwater data produced within the FRMP framework can also benefit the planning of new densely built areas.

The WSA and LUBA were amended in 2014 to improve their effectiveness against extreme weather conditions, promoting climate adaptation. A new chapter headed 'Organisation and management of stormwater sewers' was introduced in the WSA (chapter 3a). Similarly, a chapter titled 'Stormwater management' was included in LUBA (chapter 13a), which had previously lacked any reference to the concept. Several LUBA provisions, however, *de facto* promote adaptive measures. For instance, a building site designated by a plan or a building permit must be located in an area that ensures there is no danger of flooding or landslide (LUBA, s 116).

In addition to the state-level regulations, regional, master and detailed plans influence how SWM can be carried out (sustainably) in urban areas. Furthermore, city administrations can approve SWM plans to facilitate the organisation of municipal SWM. For the purpose of this paper, it is important to note that SWM plans can influence both grey and green infrastructure. These plans must take into account the detailed plan and need to fulfil the requirements of functionality, safety and comfort even when the frequency of heavy rains increases. Beyond these regulatory instruments, larger cities often adopt SWM programmes which, while not binding, aim at operationalising SWM at the municipal level.

Assigning to cities a central role in SWM is arguably the most effective choice—cities being the most impermeable, and thus at-risk, areas in the event of stormwater flooding and the actors establishing the spatial conditions for SWM. In designating SWM responsibilities, LUBA states that municipalities are responsible for organising SWM in detailed plan areas. Municipalities may also opt to organise SWM in areas not covered by such plans (LUBA, s 103i). Cities must also ensure that the municipal SWM system is implemented as required by the land use designated in the detailed plans. Finally, LUBA (s 103c) sets out four general goals for SWM. The first is to develop SWM in a planned way. The second aims at absorbing and delaying stormwater at the

source. According to the third goal, SWM should prevent harm and damage caused by stormwater to the environment and real estate, acknowledging climate change in the long term. Phasing out mixed sewers is the fourth goal.

On the scale of a single property, it is the property holder who is responsible for SWM (LUBA, s 103e). Additionally, property holders have an obligation to connect the property to the municipal system unless stormwater can be absorbed on the property without causing nuisance.

The *municipal SWM system* refers to all the areas and structures intended for SWM, except for the stormwater drainage network. The latter, unlike the rest of the SWM infrastructure, is regulated by the WSA and is the pipeline infrastructure often owned by the local water services provider (WSP). WSPs take care of local communities' water supply, wastewater management and SWM in the areas defined by the municipalities. The distinction drawn in the law between water service providers and municipalities reflects the significance that WSPs have in the context of the WSA. This distinction has both organisational and practical consequences. From the organisational standpoint, WSPs subsist as either joint municipal authorities or companies owned by the local municipality. Therefore, they are entities separate from their related municipalities. The SWM system resulting from this setting entails the co-existence of two kinds of SWM infrastructure. One is the open-air, natural SWM infrastructure (e.g., ditches and retention ponds) owned and managed by the municipality. The other is the underground, engineered network of stormwater drainage owned and managed by the WSP. From a practical standpoint, by separating the stormwater pipeline network from the open-air SWM system, the law contributes to creating a situation where stormwater is subject to different rules based on where it is located. When stormwater hits the ground, it is regulated by LUBA. If and when it enters the stormwater drainage system, it falls under the WSA and the responsible actor is the WSP. If stormwater is, at some point, conveyed back to the surface, it is again regulated by LUBA.

The current legal framework also provides the opportunity for the city to take direct responsibility for the stormwater pipeline network, thus eliminating the dual management. The choice a city makes in this regard has various implications for NBS that are discussed in Section 4.2.4. Alternatively, a municipality may decide that the WSP will take care of SWM in a certain area (WSA, s 17a). If a property is located in such an area, it must be connected to the WSP's infrastructure, although exemptions might be granted on certain conditions (WSA, ss 17b and 17c).

4.1.4 | Spatial Plans in the SWM System

Even though LUBA defines the concept of municipal SWM system (referring to the actual areas and structures used for SWM), the SWM system *as a whole* is, in practice, much more extensive. It includes, for example, the land use plans laying the foundations on which the more detailed SWM planning is based. As several scales (e.g., master planning, detailed planning and technical SWM planning) come into play, the responsibilities for SWM planning tend to be scattered across actors within a given municipality.

The degree to which SWM is considered in planning varies by the level and scale of the plan. In regional planning, the plans' purpose and scale are such that concrete area allocations for SWM would be exceptional. Local master and detailed plans are the main instruments through which SWM is carried out in land use planning. Local master plans are the appropriate scale for general SWM planning, especially when detailed plans cover such small areas that managing stormwater at that scale would be ineffective or, at best, costly. Furthermore, master plans may contain specific regulations guiding detailed planning. For example, they may prescribe that sufficient areas have to be reserved for natural SWM and NBS when drafting detailed plans.

Detailed plans provide the basis and set the limits for (technical) street plans (indicating how to manage stormwater runoff in street areas), as well as stormwater plans and public area plans. Detailed plans covering SWM-sensitive areas are critical as they represent the planning instrument in which the space and regulations for SWM structures, including nature-based ones, are specified and allocated. These features make detailed plans particularly important for NBS, since natural SWM is not required by state-level regulations and often entails particular space requirements. Therefore, where detailed plans fail to take natural SWM into consideration, carrying out SWM naturally is extremely difficult, if not impossible.

4.2 | Discussing Rules and the Wider Governance Context: Interactions and Implications for NBS

In the following sections, we illustrate how the relevant legal and administrative matters, or rules of the game according to the PAA (Arts, van Tatenhove, and Leroy 2000), interact with the other PAA dimensions to impact NBS and natural SWM in Finland. Drawing upon Wiering, Liefferink, and Crabbé (2018), we classify as factors of stability those interactions whose result represents an obstacle to natural SWM or which otherwise favour the status quo. In turn, we define as factors of change those relations that promote natural SWM and stimulate NBS implementation. We complement the results of the legal analysis in Section 4.1 with the findings obtained through the interviews with Finnish urban planners. The interviews serve to connect the legal and administrative themes with the other dimensions of the PAA. The combination of analytical and empirical findings enables us to analyse how the legal and administrative frameworks, when coupled with certain elements belonging to the wider governance context, influence NBS implementation.

The findings discussed in each section are illustrated in a corresponding table. The first column of every table contains the legal and administrative component relevant for understanding the opportunities and barriers pertaining to natural SWM. For every legal and administrative assumption, one or more coupled factors, each conceptualised as a PAA dimension, are presented in the second column. The third column briefly describes the type of relation existing between each pair of elements. The fourth column classifies the result of such relations as a factor of either change or stability. Some dynamics are visible to various degrees in all cities, while others arise from or are referred to in specific municipal contexts. To highlight the latter, a fifth column indicating the focal cities has been added where relevant.

FIGURE 2 | Main legal-administrative factors of stability and change for natural SWM in Finland.

Figure 2 below summarises the key findings of our research. The main factors of stability include the lack of national regulations on NBS together with the non-binding nature of the SWM goals; the generic allocation to municipalities of the responsibility for SWM on public land; the lack of coordination between the actors involved, stemming from the multi-scalar and -sectoral character of natural SWM; the provision of a dual SWM system fragmenting the relative infrastructure and responsibilities; tradition-bound administrative practices and internal structures favouring grey SWM infrastructure; and the coexistence of conflicting land use interests. The main factors of change are the cities' ownership of and ability to readily acquire public land; to adopt an integrated governance approach to SWM; employ instruments for cross-sectoral collaboration; utilise the Green Area Factor (GAF); and promote pilot projects.

4.2.1 | Lack of Binding NBS Regulations and SWM Objectives

There are no laws directly regulating NBS in Finland. This circumstance negatively impacts NBS implementation from multiple angles (Table 1). Cities do not need NBS to comply with their legal obligation to manage stormwater, meaning that, hypothetically, they could use pipelines only. In turn, urban planners and project leaders are not incentivised to develop expertise on natural SWM, whereby they are likely to favour more established practices. From an economic perspective, this setting can prevent cities from allocating their budgets in ways that align with the typical financial needs of NBS. For example, municipalities are dissuaded from earmarking greater sums for maintenance departments than those usually required in grey infrastructure projects (interviewee 16, Espoo).

Despite the lack of binding regulations, one can find several indications that the law considers NBS as important means for SWM. NBS are critical, for instance, in achieving the SWM goals (LUBA, s 103c), which consequently function as factors of change. The second goal on runoff delay and stormwater absorption refers precisely to the main benefits that NBS deliver for SWM. The third goal on harm and damage prevention promotes natural SWM too. Here, NBS are mostly appropriate as they can prevent damage by regulating the quantity of stormwater runoff. They can also improve water quality, for instance through filtration, enabling a healthier environment overall. By including climate change among the possible sources of stormwater damage and recognising NBS' role in tackling it, this goal promotes change through more serious consideration of NBS for SWM. The fourth goal on the phasing out of mixed sewers supports NBS and responds to multiple concerns. From an economic perspective, mixed sewers convey huge quantities of wastewater to sewage treatment plants to process. From a public safety perspective, since wastewater represents a biohazard it very much ought to be kept away from humans and conveyed through pipes. In contrast, although its quality is deteriorating in many areas, stormwater does not pose the same risks to human health. Accordingly, it may be directly absorbed into the ground or conveyed through open channels, that is, managed through NBS.

TABLE 1 | Interaction of the lack of binding NBS regulations and SWM objectives with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?
Lack of national regulations on NBS	Rules of the game: City's responsibility for municipal SWM	Natural SWM marginal and not required	Factor of stability: Compliance ensured by conventional practices
	Actors: Project leaders, planners, etc.	Planners might not be sufficiently encouraged to implement NBS	Factor of stability: More traditional approaches might be more easily accepted
	Resources: Knowledge	NBS awareness and expertise not needed	Factor of stability: Well-known practices are favoured
	Pipeline infrastructure	Natural infrastructure not legally required	Factor of stability: No formal reason to change methods
	Funds and budget	Traditional way of allocating budget, key units (e.g., maintenance) penalised	Factor of stability: Allocation of funds not aligned with NBS implementation needs
LUBA SWM objectives	Discourses: Absorption and delay at the source, prevent damage	Achievable especially through NBS	Factor of stability: Presented as 'goals', which are marginally binding and enforceable
	Resources: Natural SWM infrastructure	Focus on NBS' functions	Factor of change: Recognise NBS' role in a changing climate, facilitate consideration of NBS

Note: Gray shade indicates the highest value.

Implementing natural SWM is arguably a win-win solution, supporting the phasing out of mixed sewers and purifying low-quality stormwater. The problem with section 103c, however, lies precisely in the fact that its content is expressed in terms of mere 'goals', making them marginally binding and non-enforceable. From this perspective, the SWM objectives function as factors of stability rather than factors of change.

4.2.2 | SWM Programmes and Working Groups

An attempt to operationalise the SWM goals, especially the second one, can be recognised in the SWM priorities contained in (non-statutory) municipal SWM programmes. These provide guidelines on SWM-related activities within municipal borders and have been adopted by all the cities analysed. The latter generally share the same SWM priorities: stormwater should be absorbed at the source; where this is not possible, it should be conveyed away (preferably through natural means, otherwise through stormwater pipelines) to delay areas before being diverted to ditches or waterways; if this is not possible either, stormwater should be directly conveyed to the receiving watercourse through pipelines. Considering that the priorities are key in realising the SWM programmes and illustrate the municipalities' preference for NBS over grey infrastructure, the SWM programmes are a noticeable stimulus for natural SWM.

Yet, the programmes are merely guidelines and thus not binding. It is, therefore, likely that the oversight ensuring that the priorities are followed is less exacting than it would be if enforcement mechanisms were provided for non-compliance. When this consideration is combined with the fact that natural SWM is required only 'when possible', the programmes may instead even support grey infrastructure in highly urbanised areas (see Table 2). To understand how this may happen, one should first consider that to accommodate the influx of new residents and optimise space use, dense urban areas are often further densified. These densification processes generally translate into more paved areas and more stormwater runoff. If, for example, the stormwater ditches in one area have been covered and paved, planners in an adjacent area might be persuaded to do the same to the natural infrastructure present on their area. Indeed, they may not want to take the further risk related to the increased runoff resulting from covering the ditches in the first area. The same approach might be adopted by planners in a third adjacent area and so on, resulting in an overall increased risk for all the areas considered (interviewee 6, Helsinki). This example illustrates the importance of general planning in SWM. Furthermore, it emphasises how, in the absence of binding and strict requirements, decisions resulting in more impermeable surfaces might blur the feasibility of NBS in adjacent areas, leading planners to favour traditional infrastructure.

Common to all the SWM programmes examined is also the presence of a stormwater working group usually tasked with coordinating and monitoring the implementation of the programme. The existence of these groups is generally positive for natural SWM. They provide a forum in which the municipal

units involved in SWM can exchange relevant information, combine different perspectives and collaborate. All these activities stimulate NBS uptake (interviewees 13 and 20, Turku; interviewee 16, Espoo). Stormwater groups can even become bodies through which a 'pro natural SWM' identity emerges (interviewee 20, Turku). In such instances, the influence of NBS on the members' work increases and can potentially reach professionals in other branches of the municipality administration. However, stormwater groups may also suffer from ineffective communication among their members, characterised by arguing and disagreeing on how the responsibilities of SWM-related activities are divided (interviewee 6, Helsinki). These situations may not only result in the group disbanding but also prompt the municipality to renege on a common understanding on SWM and NBS. Yet, the reason for this failure does not lie in the group structure, its members or the internal structure of the municipality but rather in how the responsibility for SWM is assigned to municipalities.

4.2.3 | Cities' Responsibility for SWM

As mentioned before, LUBA assigns to municipalities the responsibility for SWM within their jurisdictions. However, LUBA neither specifies whether SWM should be handled through natural or technical means nor establishes how municipalities should coordinate their resources and internal organisation to carry out SWM. This flexible approach allows cities to organise SWM based on their morphology and administrative structure. The flexibility is not problematic for traditional, well-known and -tried SWM. Municipal administrative structures and processes reflect the requirements of and expertise on grey infrastructure.

In natural SWM, however, some issues can arise due to particular characteristics of NBS. For example, NBS present different features depending on where they are implemented (e.g., retention pond in a park or ditches on the side of the street); call for different expertise to be implemented; need more space compared to grey infrastructure; and require a great deal of maintenance. These considerations entail the involvement of multiple units and a need for more thorough planning. From this perspective, LUBA hinders NBS by failing to clarify responsibilities when planning and implementing natural SWM and to adequately allocate those responsibilities that it does clarify among the relevant municipal internal actors. The main consequences (see Table 3) of this setting include: perpetuating plan-making approaches that prioritise economic and technical issues and include the urban greenery units only in the end, when there is not enough space left to implement natural SWM (interviewee 6, Helsinki); being unable to distribute tasks and responsibilities, a problem exacerbated by the number of units that, in one way or another, are involved with SWM and thus could intervene (interviewees 9, 10, Oulu; interviewees 12, 13, 20, Turku; interviewee 15, Espoo); not having professionals able to coordinate SWM and prioritise NBS over pipelines (interviewee 3, Helsinki); and shunning close collaboration between units, thus contributing to keeping knowledge siloed (interviewee 6, Helsinki; interviewees 9, 10, Oulu; interviewee 12, Turku; interviewees 16, 17, Espoo).

The vagueness of the law, on the other hand, allows municipalities to organise SWM as they see fit. Consequently, there are instances where internal municipal structures are better aligned with the needs of natural SWM, albeit they are the minority. For example, Vantaa has tasked a water services unit with handling all the SWM-related issues. Its members ensure that SWM is

TABLE 2 | Interaction of SWM programmes and stormwater working groups with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
SWM programme	Discourses: SWM priorities	SWM priorities critical part of the programme	Factor of change: NBS prioritised over grey infrastructure	
	Discourses: SWM priorities apply only 'when possible'	Impermeability is increasing	Factor of stability: Feasible opportunities are growing ever fewer	Helsinki
Stormwater working group	Discourses: Members identify as the 'true believers' of natural SWM	Strengthening identity in favour of NBS	Factor of change: Potential impact on other parts of the organisation	Turku
	Actors: City internal organisational structure	Gathers members of relevant units	Factor of change: Facilitate information exchange and practices beyond silos	Espoo Turku
			Factor of stability: Ineffective communication	Helsinki
	Resources: Knowledge	Sharing relevant information on SWM	Factor of change: Favours collaboration between key units	Espoo Turku

Note: Gray shade indicates the highest value.

TABLE 3 | Interaction of the city's responsibility for SWM with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
City's responsibility for municipal SWM	Actors: For example, economic and technical, space and greenery units	Economic and technical issues solved first, space and greenery unit left with limited space and opportunities	Factor of stability: Units with technical infrastructure knowledge are favoured, natural SWM hardly visible	Helsinki
	Actors: Stormwater group with members from several units	Shunting responsibilities to other members leading to ineffective communication	Factor of stability: Group disbanded as unable to improve SWM issues	Helsinki
	Actors: Municipal internal organisation	Lack of professionals coordinating SWM	Factor of stability: Inappropriate staff setting in SWM-related issues	Helsinki
		Many units involved either way in SWM with different priorities at play	Factor of stability: Unclear and scattered responsibility as to natural SWM	Oulu Turku Espoo
		Water services unit tasked with handling stormwater-related matters	Factor of change: SWM taken into account throughout the process	Vantaa
		No mandate to implement NBS for SWM	Factor of stability: No units handling natural SWM	Turku
		Law is flexible, does not dictate any organisational models	Factor of stability: Favours traditional plan-making, hinders innovative methods	Turku
		Stormwater and green areas unit with SWM experts and landscape architects	Factor of change: Synergies between key experts facilitate NBS implementation	Tampere
		Stormwater and green areas unit as the main actor for, among other things, NBS	Factor of change: responsibilities pertaining to implementation of NBS for SWM are clear	Tampere
	Resources: Staff, budget and investments	Lack of professionals coordinating SWM	Factor of stability: Loop: meagre staff, makes it hard to see SWM as a priority, big budgets not activated and so on	Helsinki
	Resources: Traditional knowledge and approach in plan-making	Difficulties in information exchange, collaboration challenging	Factor of stability: Knowledge barriers, expertise remains siloed	Helsinki Oulu Turku Espoo
	Resources: Knowledge	Open dialogue between strategic units for NBS (e.g., maintenance and water services unit)	Factor of change: More likely to take decisions beyond siloed thinking	Vantaa
		Knowledge transfer between units involved in NBS implementation	Factor of change: Help in implementing shared and agreed NBS for SWM	Tampere

Note: Gray shade indicates the highest value.

taken into account throughout the planning process by participating in the development of all the detailed plans in the city. This approach facilitates cross-unit collaboration and shared decisions (interviewee 14, Vantaa). This practice largely derives from the decade-plus experience that Vantaa has with NBS for SWM. Over the years, the municipality has come to recognise the importance of open dialogue across departments. The city has realised how ensuring the collaboration between the actors involved with the phases before NBS implementation and those involved thereafter (such as the maintenance department) supports the adoption and multi-year upkeep of natural SWM (interviewees 18, 19, Vantaa).

In Tampere, the stormwater and green areas unit not only participates in the development of all the detailed plans but is specifically tasked with, among other things, the implementation of NBS for SWM. By clearly assigning this competence, Tampere avoids fragmentation when implementing NBS and brings together different key professionals, taking advantage of expertise synergies. The resulting unit's decisions reflect a stronger shared vision on NBS, helping disseminate knowledge across planning units and guaranteeing that NBS implementation is taken seriously throughout the organisation (interviewees 21, 22, Tampere). Another advantage stems from being able to plan both the underground and above-ground SWM all in one unit (interviewee 21, Tampere). However, this dynamic does not derive from the unit as such. It is rather the consequence of a municipal decision, taken after the 2014 WSA and LUBA amendments, to take control of the stormwater drainage network, which until then was the direct responsibility of the WSP. This decision allowed the municipality to avoid the dual SWM regime, which is discussed below.

4.2.4 | Dual SWM Regime

As shown in Section 4.1.3, stormwater is regulated by either the WSA or LUBA depending on who owns the infrastructure through which it is running at any given moment. The WSA applies when stormwater runs through the WSP's pipelines. LUBA applies when stormwater runs through the municipal infrastructure. Cities can decide whether to opt for the dual regime or to gain control of the WSP's infrastructure and 'reunite' stormwater under LUBA. The dual regime can be a hindrance for NBS from multiple perspectives. Having two responsible actors at play means that their activities must be thoroughly coordinated. Their communication must be efficient and seamless if they are to operate the SWM system smoothly and safely (interviewee 12, Turku; interviewee 15, Espoo). These two actors rely on very different infrastructures that nevertheless have many interconnecting points that require careful oversight and administration (interviewee 16, Espoo). For example, having many locations where the two infrastructures are connected may make it hard to establish who is responsible when stormwater causes damage to surrounding areas (interviewee 12, Turku). In short, having two regimes complicates management from both technical and legal standpoints, discouraging innovations such as the introduction of NBS that would diversify the entire system (Table 4).

Given these potential complications, cities like Turku, Tampere and Oulu opted to acquire the WSP's stormwater infrastructure. The pipelines are now under the city's direct responsibility and the municipalities contract with the respective WSP for maintenance, since the WSP staff possess the relevant expertise. By doing so, cities can focus their human resources on developing NBS expertise and advancing the municipal SWM system (interviewee 21, Tampere) towards a fully integrated hybrid infrastructure approach. In Tampere, the choice taken appears to ensure higher efficiency of the municipal SWM system also from an economic perspective. In a dual regime, WSPs collect stormwater fees to maintain their pipelines. Hence, they have no incentives to change their infrastructure, creating a lock-in mechanism already observed in integrated water resources management (Fischhendler and Heikkila 2010). In a single discipline scenario, where cities are the only SWM actor, they may opt to charge property owners a stormwater fee designed to sustain both the

TABLE 4 | Interaction of the dual and single SWM regime with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
Double discipline on SWM (LUBA and WSA)	Actors: City and WSP	Constant coordination and info exchange required	Factor of stability: Complicates SWM system administration	Turku (old setting) Espoo
	Resources: Stormwater fee	Fee serves to maintain the pipeline infrastructure	Factor of stability: WSP has no incentive to change its infrastructure	
	Resources: Two distinct SWM infrastructures	Many interconnecting points between responsible parties	Factor of stability: Technically and legally complicates SWM system administration	Turku (old setting) Vantaa Espoo
Single discipline on SWM (only LUBA applies)	Resources: Stormwater fee	City owns pipeline infrastructure and collects stormwater fee	Factor of change: Fee used to maintain the whole SWM system, (pipes and open-air)	Tampere
	Actors: City and WSP	City takes advantage of WSP expertise by buying pipe maintenance as a service	Factor of change: City can focus in-house expertise on NBS for SWM	Tampere

Note: Gray shade indicates the highest value.

grey and the natural SWM infrastructure. This choice would contribute to increasing their budgets for NBS and thus encouraging their uptake (interviewee 21, Tampere). Generally, stormwater fees can be applied either indiscriminately to all the properties located in detailed plan areas or selectively when a property joins the SWM system. The implications for NBS arising from properties being connected to the SWM system are discussed below.

4.2.5 | SWM Responsibility of Private Property Owners and Exemption From Joining the Municipal System

Property holders must join either the open-air municipal SWM system or the pipeline network unless they can otherwise absorb stormwater on the property or manage stormwater appropriately with other measures. In other words, these exemptions open up the possibility for private landowners to manage stormwater naturally on their property. Despite the clear and straightforward wording of the sections, proving that one has met the requirements is not an easy task. This fact has a twofold consequence (see Table 5). On the one hand, it ensures that the SWM systems of the owners who have secured an exemption can actually function efficiently and achieve the expected results (interviewee 4, Lahti). They represent successful examples of NBS implementation and help showcase the potential of NBS. On the other hand, the difficulty of the inspections required and the consequent uncertainty regarding land use on the property might discourage some owners from applying for an exemption. From the perspective of NBS, this instance represents a lost opportunity to lighten the municipal system's overall stormwater load through natural means. The latter eventuality becomes even more likely when a municipality does not have enough human resources to guarantee timely inspections. Instances have been cited where the decision-making process might take as long as 2 years (interviewee 15, Espoo). When private owners do not implement NBS on their own initiative, the introduction of NBS on private lots can be encouraged through various mechanisms, including GAF.

4.2.6 | Green Area Factor (GAF)

GAF, a numeric figure expressing 'the ratio of the sored green area to lot area' (Climate-proof City 2014, 1), has been adopted in various ways in all the cities analysed. A distinct score is given to each of the elements in a list of green features (including NBS for SWM) potentially implementable on a private lot. The score varies on the basis of the green feature's ecological significance, functionality, landscape value and maintenance frequency. When a lot is planned, the sum of the green elements included in the project is weighed against a target minimum score. The latter depends on whether the purpose of the plot is classified as residential, services, commercial or industrial/logistics (Juhola 2018).

As such, GAF promotes NBS implementation, but it is through its inclusion in city building ordinances (Helsinki building ordinance 2023, s 31b(1), Turku building ordinance 2021, s 8a), that GAF impacts natural SWM even more (as long as no conflicting detailed plans are in place). The inclusion means that there is no longer any need for the city to include the GAF in a detailed plan as one of the requirements that private owners need to comply with. Additionally, the parties who want to obtain a building permit are now obliged to present a calculation demonstrating that their projects fulfil the target GAF level established for the building lot. These two consequences both represent factors of change for natural SWM (Table 6).

In Helsinki, however, no minimum amount of stormwater absorbed through GAF is required. The rationale behind using GAF is to stimulate the uptake of greenery rather than to maximise the ecosystem services that greenery produces (interviewees 6, 7, Helsinki). Here, GAF mainly reflects the sum of the green elements that have been implemented or planned on a lot. No priority is given to achieving the combination of the green elements that would optimise the delivery of ecosystem services, such as natural SWM (interviewees 7, 8, Helsinki). From this perspective, the way GAF is set to function in Helsinki also represents a factor of stability for NBS, as the efficiency of natural SWM is not optimised.

4.2.7 | City Landownership, Land Use Plans and MAL Agreements

Although not all the cities analysed own a great deal of municipal land in the first place, the tendency has been to implement NBS on public land (interviewee 4, Lahti; interviewee 18,

TABLE 5 | Interaction of private property owners' responsibility for SWM and the exemption from joining the municipal SWM system with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
Private owner's responsibility for SWM	Rules of the game: Exemptions from joining municipal SWM	Exemptions are strict and well-defined	Factor of change: Properties exempted can fully manage all stormwater otherwise Factor of stability: Some private property owners might be discouraged from applying	
Exemption from joining municipal SWM system	Resources: Municipal staff	Checking whether requirements are met requires a long time	Factor of stability: If staff is insufficient, timescale can discourage private property owners from applying	Espoo

Note: Gray shade indicates the highest value.

TABLE 6 | Interaction of GAF with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
Green area factor (GAF)	Rules of the game: Building ordinance	No need to mention GAF in detailed plans anymore	Factor of change: All private plots must include greenery	Helsinki Turku
	Discourses: Natural SWM among the main objectives	NBS for SWM critical to reach desired GAF value	Factor of change: NBS for SWM more included in planning	
	Discourses: No minimum limit of stormwater absorbed through NBS	GAF only calculates greenery, SWM not the only priority	Factor of stability: SWM efficiency not maximised	Helsinki
	Actors: Private owners	GAF must be complied with to obtain building permit	Factor of change: Privates required to implement greenery	Helsinki Turku
	Actors: City, private owners	GAF applies to both public and private properties	Factor of change: Favours extended NBS implementation	Oulu

Note: Gray shade indicates the highest value.

Vantaa). This means that cities first acquire the land they need and only then use it for NBS. Both courses of action represent factors of change for natural SWM in the form of reduced interference from private landownership in NBS implementation (see Table 7). However, there is a slight distinction between the two. In the first instance, when the city already owns the land earmarked for NBS, there is no need to negotiate with private landowners. In the second, municipalities can rely on a wide range of instruments to acquire private land (Valtonen, Falkenbach, and Viitanen 2018). Negotiations with private landowners might still occur, but at an earlier stage and not necessarily with a focus on land for NBS. In other words, a city first secures a certain amount of land for future development and only later decides whether and how much of it will be used for NBS.

Even where a city owns a great deal of municipal land, this does not necessarily mean that a sufficient portion of it will be reserved for NBS and natural SWM. Other priorities come into play, such as accommodating additional residential buildings (interviewees 1, 2, Helsinki). In practice, these other priorities are as strong as the pressures exerted by urbanisation and densification processes, which all the cities analysed are experiencing to an extent. Despite space is perceived as a scarce resource in all these cities, Tampere has been able, for several reasons (see e.g., Section 4.2.4), to keep natural SWM a priority throughout the municipality.

From the perspective of natural SWM, the problem of space is exacerbated by the lack of a regulatory approach to NBS. The coexistence of several land use interests and objectives at the urban level easily leads to a situation where, if certain measures are not legally required, economically more profitable land uses are favoured (interviewees 1, 3, Helsinki). These behaviours are even more pronounced where city growth is locked in by MAL agreements or is one of the main pillars of the city master plan, as in Helsinki (see Helsingin kaupunkisuunnitteluvirasto 2016, 182). This is not to say that such a plan works entirely against NBS, as it includes an objective geared toward establishing a network of green areas that promotes city-wide connectivity of NBS (interviewee 2, Helsinki). Rather, this example highlights how easily, in the absence of regulations, NBS implementation is overshadowed by growth prospects.

Pressures supporting residential land use rather than NBS are also present in detailed planning. However, according to all the interviewees, the space availability issue is more common in the case of old detailed plans. Old areas likely lack the space for NBS because they have been planned in times when natural SWM was not something to reserve space for and the need to adapt to climate change was not a concern. This makes it difficult, when updating old detailed plans, to find the space for NBS and grey infrastructure is easily preferred. Another interesting implication for NBS emerges with regard to detailed plans covering central urban areas. While overall it is simpler to implement NBS in peripheral areas, as there is likely more space available than in the inner city, space in the city is more valuable and more densely built. Thus, detailed plans for central areas can be more ambitious and more readily require that landowners implement NBS, since those who develop these areas have the financial resources to invest in innovative and more expensive interventions. This circumstance may then lead to measures favouring natural SWM and increasing the prestige of the area which, in turn, can translate into higher investment returns for private developers (interviewee 7, Helsinki).

TABLE 7 | Interaction of city's ownership of municipal land, city master and detailed plans and MAL agreements with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
City's ownership of municipal land	Rules of the game: Land acquisition	Land used for NBS is typically public	Factor of change: Reduced need for negotiating with private landowners	Lahti Turku Vantaa
	Resources: Space	The city owns a relevant share of municipal land	Factor of change: Reduced need for negotiating with private landowners	Helsinki Tampere
City master plan	Discourses: Growth targets	Focus on land's building potential	Factor of stability: Residential land use prioritised over NBS	Helsinki
	Discourses: Network of 'green fingers'	Promotion of interconnected green aeras	Factor of change: City-wide natural SWM is facilitated	Helsinki
	Resources: Space	Difficult to quantify NBS' benefits	Factor of stability: More profitable land uses are prioritised	Helsinki
Detailed plans	Rules of the game: SWM plan	SWM plans superseded by detailed plans	Factor of stability: If NBS not included already in detailed plans	
	Actors: Water services unit	Unit members participate in each of the detailed plans	Factor of change: Facilitates cross-departmental collaboration on SWM	Vantaa
	Actors: Stormwater and green areas unit	Unit members participate in each of the detailed plans	Factor of change: Ensures consistent consideration of NBS for SWM throughout the city	Tampere
	Resources: Space, especially in old areas	Need to account for different land uses, no space earmarked for NBS in old plans	Factor of stability: Limited space availability favours grey infrastructure	
	Resources: Knowledge	Awareness of NBS multi-benefits	Factor of change: Space optimisation through NBS implementation	
	Resources: Lack of knowledge	Lack of best practices examples from akin geographical contexts	Factor of stability: Grey infrastructure considered more reliable	Oulu
	Resources: Land value	Land value is higher in new central areas	Factor of change: Bigger investments favour innovative measures like NBS	
MAL agreements	Discourses: Growth targets	Focus on land's building potential	Factor of stability: Residential land use prioritised over NBS	

Note: Gray shade indicates the highest value.

Another instance where space contributes to the adoption of NBS is SWM plans. Detailed plans can be complemented by SWM plans, which must be aligned with the relevant detailed, street and public area plans. Thus, when the superordinate plans are already in place, there is arguably no more than a marginal opportunity left for developing a SWM plan consisting of NBS, as these require considerably more space. This means that, if NBS are to be used for SWM, they should be included already in the detailed planning phase, together with the street and public area plans.

Along with space, knowledge greatly impacts the inclusion of NBS in detailed plans. Despite the fact that NBS are not a wholly novel concept, the related expertise has not as yet spread as extensively as it might among the cities observed. Broadly speaking, the relevant knowledge (or lack thereof) can bear on either the technical feasibility of NBS or their effects and co-benefits. The former is illustrated by the case of Oulu, where the lack of knowledge on how to implement NBS favours stormwater pipelines. The absence of models and best practices makes it particularly difficult to implement NBS due to the specific needs the city has and the frigid climate in which it is located (e.g., a thick snow layer and extended ice cover for long periods of the year; interviewee, 11, Oulu). Consequently, grey infrastructure is preferred, as it is considered more reliable. On the other hand, awareness of NBS' co-benefits is often cited as one of the reasons facilitating the inclusion of NBS in detailed plans. This is due to the capacity of NBS to provide several ecosystem services simultaneously, helping to optimise the use of urban space, a key feature when space is scarce.

4.2.8 | Pilot Projects

Pilot projects constitute one of the practical ways through which planners and practitioners can develop knowledge on NBS and natural SWM. We consider pilot projects as particular plans aimed at implementing innovative land use planning approaches through early NBS adoption. Pilot projects incorporate strongly nature-oriented narratives and identities and can critically advance the expertise on natural SWM (interviewee 5, Helsinki; interviewee 12, Turku). No factors of stability for NBS have been identified (see Table 8). The projects observed contributed to increasing the acceptability of NBS among private actors by creating new economic opportunities for private landowners. More broadly, pilot projects can provide a space allowing municipal actors to experiment, exchange information, gain experience and enhance their knowledge as well as cross-unit collaboration. In turn, these outcomes can promote NBS by providing best practices and guidelines for future implementation and developing cross-sectoral approaches.

4.2.9 | Environmental Strategies and Policies

Table 9 shows the implications for NBS of the cities' environmental strategies and policies. Unsurprisingly, considering the array of benefits that NBS can produce for multiple environmental objectives, these documents generally act as factors of change (at least on paper). The non-binding nature of these documents precludes them from being enforced, diminishing their practical effect. However, they can still exhibit practical significance when combined with the expertise in institutionalising natural SWM practices gained by cities over the years. This is the case of Vantaa's SWM Working Methods (City of Vantaa 2014), which already 10 years ago started focusing on natural SWM and encouraging NBS (interviewee 18, Vantaa). At the same time, the non-binding nature of these strategies makes their applicability highly dependent on the context in which they are adopted. If the resources to deal with SWM-related issues are lacking, the messages contained in these policies risk becoming empty words and their potential remains untapped (interviewee 3, Helsinki).

TABLE 8 | Interaction of pilot projects with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
Pilot projects	Discourses: Provide a 'green identity' to the area	Economic opportunity created for existing private landowners	Factor of change: Increased acceptance of NBS for SWM	Helsinki
	Discourses: 'Stormwaters: from waste to resource!'	Contribute to changing perception on natural SWM	Factor of change: Increased acceptance of NBS for SWM	Turku
	Actors: City internal organisational structure	Gain experience on how to best collaborate between units	Factor of change: Promote approaches beyond siloed thinking	
	Resources: Knowledge	Learning-by-doing and room to experiment	Factor of change: Experience gained favours future NBS implementation	
		Create expertise through information exchange	Factor of change: Establish blueprint for NBS implementation through all stages (planning, implementation and maintenance)	

Note: Gray shade indicates the highest value.

TABLE 9 | Interaction of city's environmental strategies and policies with other PAA dimensions; implications for NBS and natural SWM.

Rule(s) of the game	Coupled PAA dimension	Relation or interplay description	Favours status quo (factor of stability) or NBS (factor of change)?	City
City's environmental strategies and policies	Discourses: Call for implementing NBS for SWM	NBS essential role in climate change adaptation	Factor of change: Stimulus for NBS uptake	
	Actors: Lack of professionals coordinating SWM	Inappropriate staff setting in SWM-related issues	Factor of stability: Policy's true potential for change remains untapped	Helsinki
	Resources: Knowledge	Expertise matured over the years combines with ambitious goals	Factor of change: Accelerate uptake of NBS for SWM	Vantaa

Note: Gray shade indicates the highest value.

5 | Conclusion

In this paper we have analysed how the Finnish governance setting as a whole influences NBS and natural SWM uptake. We have demonstrated that NBS implementation does not depend solely on who owns the land reserved for NBS. Rather, it depends on a number of simultaneously interacting legal and administrative factors, the actors involved in the process, the narratives embodied in the relevant rules and the various kinds of resources employed to realise natural SWM.

Our findings align with previous observations on the hampering role that the absence of specific rules (van den Ende et al. 2023), uncertain responsibilities (Keech, Clarke, and Short 2023; van den Ende et al. 2023; Gimenes-Maranges et al. 2020) and lack of cross-sectoral collaboration (Dorst et al. 2022) play in NBS implementation. However, our research focuses on a range of legal and administrative means, unpacking their relationship with different dimensions of the Finnish governance arrangement. We provide an integrated legal perspective on natural SWM, elucidated through the Finnish context, that identifies several legal challenges and highlights alternative legal pathways to enable natural SWM in a setting with neither generally accepted norms nor clear responsibilities on NBS.

In doing so, we show how in Finland the present regulations are 'under the weather' for several reasons beyond the legal challenges associated with private property. In particular, the main factors of stability, those hindering NBS implementation, include the lack of national regulations on NBS together with the non-binding nature of the SWM goals; the generic allocation to municipalities of the responsibility for SWM on public land; the lack of coordination between the actors involved, stemming from the multi-scalar and -sectoral character of natural SWM; and the presence of a dual SWM regime, which fragments the relevant infrastructure and responsibilities.

On the other hand, the main factors of change, or drivers of NBS uptake, are the cities' ownership of and capacity to readily acquire public land as well as their capacity to adopt an integrated governance approach to SWM stimulating hybrid infrastructure, utilise GAF and promote pilot projects. The role played by the stormwater working groups can be considered, in most cases, useful too. Interestingly, the stormwater working groups are informal groups established through municipal decisions to encourage collaboration between units in the absence of regulations for this purpose. This aspect typifies the present NBS governance setting, where the law falls short of providing structures and practices facilitating natural SWM nation-wide and the decisions positively affecting NBS implementation are confined to the local scale. Despite being a constructive result, given that NBS primarily deliver their benefits locally, this state of affairs is not enough if we are to take full advantage of NBS-related benefits. The law provides municipalities with the opportunity to adopt an integrated governance approach to SWM but the adoption depends largely on local decisions in both land use planning and SWM.

The legal void in which NBS are currently located exacerbates the negative impact that the coexistence of multiple land use objectives and purposes at the urban level have on natural SWM. When a formal regulation governing NBS utilisation is absent, urbanisation pressures, more profitable land uses, traditional engineering methods, business-as-usual relations and responsibilities scattered among the actors involved in planning all contribute to pushing NBS down the list of priorities in urban decision-making.

This research illustrates the consequences of the lack of a regulatory approach to NBS for natural SWM, highlighting the need for such an approach and enriching the NBS legal discussion. The regulatory approach to NBS needed to vitalise their wide, integrated and systematic implementation could encompass a cross-sectoral approach aimed at ensuring the optimal use of both urban space and natural resources by relying on NBS as a boundary concept between different disciplines (Davids et al. 2024). Furthermore, such an approach could provide a more articulated and concrete allocation of cities' responsibilities in line with natural SWM needs, enabling internal municipal structures capable to take up the challenges of natural SWM implementation.

Finally, a sound regulatory approach could establish the circumstances where NBS implementation is mandated or has to be prioritised, for example based on procedures demonstrating

that NBS are the best available technologies for SWM in a given scenario. This mechanism could facilitate the development of decentralised SWM and ensure that NBS-related interests are balanced with others (e.g., urban growth). More broadly, enacting binding regulations promoting NBS could help unlock the potential that these measures have to improve climate change adaptation at multiple scales.

In November 2024 (while the authors were processing the review for this publication), the Ministry of the Environment published a preliminary draft of a Land Use Act (Ministry of Environment 2024) which includes the land use planning part of LUBA. In the draft, the requirements for regional plans include taking into account both climate change mitigation and adaptation. As for master plans, the requirements include preparing for extreme weather events and the requirements of municipal SWM. Finally, the requirements for detailed plans include preparing for increasing extreme weather events and floods. NBS are not mentioned per se but the draft recognises the importance of master plans for SWM. Such provisions have the potential to promote collaboration between planning and SWM authorities as they partially help clarify the responsibilities of planners in SWM. Although a regulatory approach to NBS is still missing, these developments illustrate that the process we are witnessing is possibly moving in the right direction. Future research would do well to investigate and further elaborate the features of effective NBS regulations.

Acknowledgements

This work was supported by Transformative Cities, which has received funding from the European Union—NextGenerationEU instrument and is funded by the Academy of Finland grant number No 352943.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

Arts, B., P. Leroy, and J. Van Tatenhove. 2006. "Political Modernisation and Policy Arrangements: A Framework for Understanding Environmental Policy Change." *Public Organization Review* 6: 93–106. https://doi.org/10.1007/s11115-006-0001-4.

Arts, B., J. van Tatenhove, and P. Leroy. 2000. "Policy Arrangements." In *Political Modernisation and the Environment: The Renewal of Environmental Policy Arrangements*, edited by J. Tatenhove, B. Arts, and P. Leroy, 53–69. Dordrecht: Springer. https://doi.org/10.1007/978-94-015-9524-7.

Bäcklund, P., L. Häikiö, H. Leino, and V. Kanninen. 2018. "Bypassing Publicity for Getting Things Done: Between Informal and Formal Planning Practices in Finland." *Planning Practice and Research* 33: 309–325. https://doi.org/10.1080/02697459.2017.1378978.

Beunen, R., J. Patterson, and K. Van Assche. 2017. "Governing for Resilience: The Role of Institutional Work." *Current Opinion in Environmental Sustainability* 28: 10–16. https://doi.org/10.1016/j.cosust.2017.04.010.

Boelens, L. 2018. "Moving Towards a Flat Ontology of Institutional Innovation: Actor-Relational Lessons Learned From Early Water Management Perspectives." In *The Routledge Handbook of Institutions and Planning in Action (Chapter 6)*, edited by W. Salet. New York, NY: Routledge. https://doi.org/10.4324/9781315111230-6.

Bogdzevič, K. 2023. "Floods and Nature-Based Solutions. A Call for a Legal Approach." *Current Opinion in Environmental Science & Health* 36: 100521. https://doi.org/10.1016/j.coesh.2023.100521.

Bogdzevič, K., and M. Kalinauskas. 2021. "Sticks, Carrots and Sermons for Implementing NBS on Private Property Land." In *Nature-Based Solutions for Flood Mitigation: Environmental and Socio-Economic Aspects*, edited by C. S. S. Ferreira, Z. Kalantari, T. Hartmann, and P. Pereira, 469–487. Cham: Springer. https://doi.org/10.1007/698_2021_762.

City of Vantaa. 2014. "Vantaan Kaupungin hulevesien hallinnan toimintamalli." https://www.vantaa.fi/sites/default/files/document/Hulevesien_hallinnan_toimintamalli_0.pdf.

Climate-Proof City. 2014. "Developing a Green Factor Tool for the City of Helsinki." https://ilmastotyokalut.fi/files/2014/11/Developing_Helsinki_Green_Factor_Summary_13032014.pdf.

Cohen-Shacham, E., G. Walters, C. Janzen, and S. Maginnis. 2016. *Nature-Based Solutions to Address Global Societal Challenges*. Gland: IUCN. https://doi.org/10.2305/IUCN.CH.2016.13.en.

Davids, P. R., T. Hartmann, C. S. S. Ferreira, Z. Kalantari, and P. Pereira. 2024. "Multi-, Inter-, and Trans-Disciplinary Approaches to Nature-Based Flood Risk Management." *Current Opinion in Environmental Science & Health* 38: 100537. https://doi.org/10.1016/j.coesh.2024.100537.

Dorst, H., A. van der Jagt, H. Toxopeus, L. Tozer, R. Raven, and H. Runhaar. 2022. "What's Behind the Barriers? Uncovering Structural Conditions Working Against Urban Nature-Based Solutions." *Landscape and Urban Planning* 220: 104335. https://doi.org/10.1016/j.landurbplan.2021.104335.

Dottori, F., L. Mentaschi, A. Bianchi, A. Alfieri, and L. Feyen. 2023. "Cost-Effective Adaptation Strategies to Rising River Flood Risk in Europe." *Nature Climate Change* 13: 196–202. https://doi.org/10.1038/s41558-022-01540-0.

Driessen, P. P. J., and H. F. M. W. Van Rijswick. 2011. "Normative Aspects of Climate Adaptation Policy." *Climate Law* 2: 559–581. https://doi.org/10.1163/CL-2011-051.

EC. 2007. "Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the Assessment and Management of Flood Risks." OJ L288/27.

Ferreira, C. S. S., K. Potočki, M. Kapović-Solomun, and Z. Kalantari. 2021. "Nature-Based Solutions for Flood Mitigation and Resilience in Urban Areas." In *Nature-Based Solutions for Flood Mitigation: Environmental and Socio-Economic Aspects*, edited by C. S. S. Ferreira, Z. Kalantari, T. Hartmann, and P. Pereira, 59–78. Cham: Springer. https://doi.org/10.1007/698_2021_758.

Finnish Constitution. 1999. "Suomen Perustuslaki 11.6.1999." https://www.finlex.fi/fi/laki/ajantasa/1999/19990731.

Finnish Government. 2017. "Valtioneuvoston Päätös Valtakunnallisista Alueidenkäyttötavoitteista 14.12.2017." https://www.ymparisto.fi/sites/default/files/documents/VATpäätös14.12.2017_FI.pdf.

Fischhendler, I., and T. Heikkila. 2010. "Does Integrated Water Resources Management Support Institutional Change? The Case of Water Policy Reform in Israel." *Ecology and Society* 15: 4. https://www.jstor.org/stable/26268089.

Flood Risk Management Act. 2010. "Laki Tulvariskien Hallinnasta 24.6.2010/620." https://www.finlex.fi/fi/laki/ajantasa/2010/20100620?search%5Btype%5D=pika&search%5Bpika%5D=Laki%20tulvariskien%20hallinnasta%2024.6.2010%2F620.

Gimenes-Maranges, M., V. Pappalardo, D. La Rosa, J. Breuste, and A. Hof. 2020. "The Transition to Adaptive Storm-Water Management: Learning From Existing Experiences in Italy and Southern France." *Sustainable Cities and Society* 55: 102061. https://doi.org/10.1016/j.scs.2020.102061.

Government Decree on Flood Risk Management. 2010. "Valtioneuvoston Asetus Tulvariskien Hallinnasta 659/2010." https://www.finlex.fi/fi/laki/smur/2010/20100659?search%5Btype%5D=pika&search%5Bpika%5D=659%2F2010.

Hajer, M. 1993. "Discourse Coalitions and the Institutionalisation of Practice: The Case of Acid Rain in Great Britain." In *The Argumentative Turn in Policy Analysis and Planning*, edited by F. Fischer and J. Forester, 43–67. Durham: Duke University Press.

Hartley, K., and M. Howlett. 2021. "Policy Assemblages and Policy Resilience: Lessons for Non-Design From Evolutionary Governance Theory." *Politics and Governance* 9: 451–459. https://doi.org/10.17645/pag.v9i2.4170.

Hartmann, T., L. Slavíková, and S. McCarthy. 2019. "Nature-Based Solutions in Flood Risk Management." In *Nature-Based Flood Risk Management on Private Land: Disciplinary Perspectives on a Multidisciplinary Challenge*, edited by T. Hartmann, L. Slavíková, and S. McCarthy, 3–8. Cham: Springer. https://doi.org/10.1007/978-3-030-23842-1_1.

Heinilä, A. 2021. "Ylikunnallinen Maankäytön Suunnittelu Ja Maankäyttö- Ja Rakennuslain Kokonaisuudistus [Supra-Municipal Land Use Planning and the Land Use and Building Act Reform]." Ympäristöpolitiikan Ja-Oikeuden Vuosikirja XIV, 259–313.

Heinilä, A., and H. Partinen. 2022. "Valtakunnalliset Alueidenkäyttötavoitteet Ja Niiden Kehittäminen [Assessment report on the National Land Use Guidelines]." VAT-Esiselvityshankkeen Loppuraportti. Ympäristöministeriön Julkaisuja 2022:27. Ympäristöministeriö 2022.

Helsingin Kaupunkisuunnitteluvirasto. 2016. "Helsingin Yleiskaava. Selostus. Kaupunkikaava – Helsingin Uusi Yleiskaava." https://www.hel.fi/hel2/ksv/julkaisut/yos_2016-3.pdf.

Helsinki Building Ordinance. 2023. "Helsingin Kaupungin Rakennusjärjestys." https://www.hel.fi/static/rakvv/Rakennusjarjestys.pdf.

Hutchinson, T., and N. Duncan. 2012. "Defining and Describing What We Do: Doctrinal Legal Research." *Deakin Law Review* 17: 83–119. https://search.informit.org/doi/10.3316/agis_archive.20125043.

Jakubínský, J., M. Prokopová, P. Raška, et al. 2021. "Managing Floodplains Using Nature-Based Solutions to Support Multiple Ecosystem Functions and Services." *Wiley Interdisciplinary Reviews: Water* 8, no. 5: e1545. https://doi.org/10.1002/wat2.1545.

Juhola, S. 2018. "Planning for a Green City: The Green Factor Tool." *Urban Forestry & Urban Greening* 34: 254–258. https://doi.org/10.1016/j.ufug.2018.07.019.

Jurgilevich, A., A. Räsänen, and A. Juhola. 2021. "Assessing the Dynamics of Urban Vulnerability to Climate Change: Case of Helsinki, Finland." *Environmental Science & Policy* 125: 32–43. https://doi.org/10.1016/j.envsci.2021.08.002.

Kaufmann, M., H. Mees, D. Liefferink, and A. Crabbé. 2016. "A Game of Give and Take: The Introduction of Multi-Layer (Water) Safety in the Netherlands and Flanders." *Land Use Policy* 57: 277–286. https://doi.org/10.1016/j.landusepol.2016.05.033.

Kaufmann, M., and M. Wiering. 2022. "The Role of Discourses in Understanding Institutional Stability and Change–An Analysis of Dutch Flood Risk Governance." *Journal of Environmental Policy & Planning* 24: 1–20. https://doi.org/10.1080/1523908X.2021.1935222.

Keech, D., L. Clarke, and C. Short. 2023. "Nature-Based Solutions in Flood Risk Management: Unlocking Spatial, Functional and Policy Perceptions Amongst Practitioners in South-West England." *Nature-Based Solutions* 4: 100096. https://doi.org/10.1016/j.nbsj.2023.100096.

Keesstra, S., J. Nunes, A. Novara, et al. 2018. "The Superior Effect of Nature Based Solutions in Land Management for Enhancing Ecosystem Services." *Science of the Total Environment* 610–611: 997–1009. https://doi.org/10.1016/j.scitotenv.2017.08.077.

Key, I. B., A. C. Smith, B. Turner, et al. 2022. "Biodiversity Outcomes of Nature-Based Solutions for Climate Change Adaptation: Characterising the Evidence Base." *Frontiers in Environmental Science* 10: 905767. https://doi.org/10.3389/fenvs.2022.905767.

Kõiv-Vainik, M., K. Kill, M. Espenberg, et al. 2022. "Urban Stormwater Retention Capacity of Nature-Based Solutions at Different Climatic Conditions." *Nature-Based Solutions* 2: 100038. https://doi.org/10.1016/j.nbsj.2022.100038.

Kumar, P., S. E. Debele, J. Sahani, et al. 2020. "Towards an Operationalisation of Nature-Based Solutions for Natural Harzards." *Science of the Total Environment* 731: 138855. https://doi.org/10.1016/j.scitotenv.2020.138855.

Land Use and Building Act. 1999. "Maankäyttö- Ja Rakennuslaki 5.2.1999/132." https://www.finlex.fi/fi/laki/ajantasa/1999/19990132.

Lawrence, T. B., R. Suddaby, and B. Leca, eds. 2009. *Institutional Work: Actors and Agency in Institutional Studies of Organizations*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511596605.

Leroy, P., and B. Arts. 2006. "Institutional Dynamics in Environmental Governance." In *Institutional Dynamics in Environmental Governance*, edited by B. Arts and P. Leroy, 1–19. Dordrecht: Springer. https://doi.org/10.1007/1-4020-5079-8_1.

Löschner, L., T. Hartmann, S. Priest, and D. Collentine. 2021. "Strategic Use of Instruments of Land Policy for Mobilising Private Land for Flood Risk Management." *Environmental Science & Policy* 118: 45–48. https://doi.org/10.1016/j.envsci.2021.01.009.

MAL Agreement for the Helsinki Region. 2020. "Helsingin Seudun Kuntien Ja Valtion Välinen Maankäytön, Asumisen Ja Liikenteen Sopimuso 2020-31 8.10.2020." https://www.hel.fi/static/kanslia/Julkaisut/2022/MAL-sopimus-081020.pdf.

Mattila, H., and A. Heinilä. 2022. "Soft Spaces, Soft Planning, Soft Law: Examining the Institutionalisation of City-Regional Planning in Finland." *Land Use Policy* 119: 106156. https://doi.org/10.1016/j.landusepol.2022.106156.

Mees, H., A. Crabbe, and C. Suykens. 2018. "Belgian Flood Risk Governance: Explaining the Dynamics Within a Fragmented Governance Arrangement." *Journal of Flood Risk Management* 11: 271–280. https://doi.org/10.1111/jfr3.12330.

Ministry of Environment. 2024. "Alueidenkäyttölaki Luonnos." Hallituksen Esitys Eduskunnalle. https://api.hankeikkuna.fi/asiakirjat/1da1364f-7d29-41ff-89df-2d81853befbf/59ac8d20-2d8d-450a-bc64-ae64f636d7b4/KIRJE_20241114130842.PDF.

Mostert, E., C. Pahl-Wostl, Y. Rees, B. Searle, D. Tàbara, and J. Tippett. 2007. "Social Learning in European River-Basin Management: Barriers and Fostering Mechanisms From 10 River Basins." *Ecology and Society* 12: 16. https://www.jstor.org/stable/26267838.

Naess, L. O., G. Bang, S. Eriksen, and J. Vevatne. 2005. "Institutional Adaptation to Climate Change: Flood Responses at the Municipal Level in Norway." *Global Environmental Change* 15, no. 2: 125–138. https://doi.org/10.1016/j.gloenvcha.2004.10.003.

Potočki, K., T. Hartmann, L. Slavíková, et al. 2022. "Land Policy for Flood Risk Management: Towards a New Working Paradigm." *Earth's Future* 10: e2021EF002491. https://doi.org/10.1029/2021EF002491.

Raadgever, G. T., N. Booister, and M. K. Steenstra. 2018. "Flood Risk Governance." In *Flood Risk Management Strategies and Governance*, edited by G. T. Raadgever and D. Hegger, 101–108. Cham: Springer. https://doi.org/10.1007/978-3-319-67699-9_9.

Raška, P., N. Bezak, C. S. S. Ferreira, et al. 2022. "Identifying Barriers for Nature-Based Solutions in Flood Risk Management: An Interdisciplinary Overview Using Expert Community Approach." *Journal of Environmental Management* 310: 114725. https://doi.org/10.1016/j.jenvman.2022.114725.

Rauter, M., M. Kaufmann, T. Thaler, and S. Fuchs. 2020. "Flood Risk Management in Austria: Analysing the Shift in Responsibility-Sharing Between Public and Private Actors From a Public Stakeholder's Perspective." *Land Use Policy* 99: 105017. https://doi.org/10.1016/j.landusepol.2020.105017.

Raymond, C. M., N. Frantzeskaki, N. Kabisch, et al. 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.

Seddon, N., A. Smith, P. Smith, et al. 2021. "Getting the Message Right on Nature-Based Solutions to Climate Change." *Global Change Biology* 27: 1518–1546. https://doi.org/10.1111/gcb.15513.

Seher, W., and L. Löschner. 2018. "Balancing Upstream-Downstream Interests in Flood Risk Management: Experiences From a Catchment-Based Approach in Austria." *Journal of Flood Risk Management* 11: 56–65. https://doi.org/10.1111/jfr3.12266.

Snel, K. A. W., P. A. Witte, T. Hartmann, and S. C. M. Geertman. 2020. "The Shifting Position of Homeowners in Flood Resilience: From Recipients to Key-Stakeholders." *WIREs Water* 7: e1451. https://doi.org/10.1002/wat2.1451.

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.

Thaler, T., P. Hudson, C. Viavattene, and C. Green. 2023. "Natural Flood Management: Opportunities to Implement Nature-Based Solutions on Privately Owned Land." *WIREs Water* 10: e1637. https://doi.org/10.1002/wat2.1637.

Tina Dacin, M., J. Goodstein, and W. Richard Scott. 2002. "Institutional Theory and Institutional Change: Introduction to the Special Research Forum." *Academy of Management Journal* 45, no. 1: 45–56. https://doi.org/10.5465/amj.2002.6283388.

Turconi, L., F. Faccini, A. Marchese, et al. 2020. "Implementation of Nature-Based Solutions for Hydro-Meteorological Risk Reduction in Small Mediterranean Catchments: The Case of Portofino Natural Regional Park, Italy." *Sustainability* 12: 1240. https://doi.org/10.3390/su12031240.

Turku Building Ordinance. 2021. "Turun Kaupungin Rakennusjärjestys." https://www.turku.fi/sites/default/files/atoms/files/rakennusjarjestys_1.3.2021_0.pdf.

Valtonen, E., H. Falkenbach, and K. Viitanen. 2018. "Securing Public Objectives in Large-Scale Urban Development: Comparison of Public and Private Land Development." *Land Use Policy* 78: 481–492. https://doi.org/10.1016/j.landusepol.2018.07.023.

van den Ende, M. A., H. L. P. Mees, D. L. T. Hegger, and P. P. J. Driessen. 2023. "Mechanisms Influencing Mainstreaming of Adaptation in Spatial Development: Case Studies in Three Dutch Municipalities." *Journal of Environmental Planning and Management* 66: 2903–2921. https://doi.org/10.1080/09640568.2022.2092724.

Van Rijswick, H. F. M. W., J. Edelenbos, P. Hellegers, M. Kok, and S. Kuks. 2018. "Ten Building Blocks for Sustainable Water Governance: An Integrated Method to Assess the Governance of Water." In *Transboundary Water Cooperation*, edited by P. Wouters, H. Chen, and J. E. Nickum, 40–57. Abingdon: Routledge. https://doi.org/10.4324/9781315267654.

van Tatenhove, J., B. Arts, and P. Leroy. 2013. *Political Modernisation and the Environment: The Renewal of Environmental Policy Arrangements*. Dordrecht: Springer. https://doi.org/10.1007/978-94-015-9524-7.

Water Services Act. 2001. "Vesihuoltolaki 9.2.2001/119." https://www.finlex.fi/fi/laki/smur/2001/20010119?search%5Btype%5D=pika&search%5Bpika%5D=Vesihuoltolaki%20.

Weber, R. P. 1990. *Basic Content Analysis*. 2nd ed. Thousand Oaks: SAGE Publications. https://doi.org/10.4135/9781412983488.

Wiering, M., M. Kaufmann, H. Mees, et al. 2017. "Varieties of Flood Risk Governance in Europe: How Do Countries Respond to Driving Forces and What Explains Institutional Change?" *Global Environmental Change* 44: 15–26. https://doi.org/10.1016/j.gloenvcha.2017.02.006.

Wiering, M., D. Liefferink, and A. Crabbé. 2018. "Stability and Change in Flood Risk Governance: On Path Dependencies and Change Agents." *Journal of Flood Risk Management* 11: 230–238. https://doi.org/10.1111/jfr3.12295.

Yin, R. K. 2018. *Case Study Research and Applications: Design and Methods*. 6th ed. Thousand Oaks: SAGE Publications.