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Nature-Based Solutions and Public Participation: Unpacking Tensions in Sustainable City Development in Northern Europe

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Abstract

Securing the acceptance of nature-based solutions (NbS) in urban greening is central for addressing current social, environmental, and climate-related challenges. To achieve this, participatory planning processes are increasingly encouraged in NbS projects. However, challenges often arise, as NbS and public participation are not always seamlessly compatible. Based on a cross-case, qualitative content analysis of project organizers' experiences in seven urban NbS planning projects in Northern Europe, we unpack three social tensions that can limit the role of participatory NbS: (1) tensions between the openness or "closedness" of environmental and participatory objectives; (2) tensions between the increasing time demands for participatory NbS processes and limitations for largely project-based NbS delivery; and (3) tensions between the roles of expert and lay knowledge. We illustrate these tensions through our cases, showing the challenges that they create for project organizers, both in terms of implementing NbS projects, as well as the risks that they have for broader NbS and participatory goals. We use the experiences and learnings from our cases to suggest paths that can help planners balance these tensions and potentially lead to more inclusive and transformative NbS planning models.

Keywords: nature-based solutions (NbS); participatory NbS; NbS mainstreaming; NbS projectification; urban sustainability transition

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1. Introduction

Nature-based solutions (NbS) are defined by the European Commission as actions "inspired by, supported by and copied from nature," which provide environmental, social, and economic benefits, while fostering broader societal transformations for sustainability through "locally adapted, resource-efficient and systemic interventions" [1] (p. 4). In urban green spaces, these interventions include green roofs, green walls, connected parks, and other ways to enhance the quality of natural habitats and increase human–nature interactions [2]. While NbS have made progress in becoming systematized, e.g., through cataloguing and standardization [2–4], scholars have called for a critical reframing centered on their ability to deliver their societal pledges [5].

Such calls advocate a shift from predominantly technical and normative approaches to a more critical, transdisciplinary view that better acknowledges the complexity of sustainability discourses [6] and NbS' potential to support socio-ecological transformation [7]. This implies broadening the focus from technical expert knowledge to include other forms of knowledge (e.g., knowledge from different disciplinary perspectives, lay knowledge, tacit knowledge, etc.), and expanding the involvement of a wide range of actors in the lifecycle of NbS. In practice, this is achieved through participatory approaches to enhance reflexivity in NbS planning and foster long-term sustainability through lasting partnerships, management, and governance [8–13].

However, reframing NbS through participation is neither easy nor straightforward. Echoing broader debates in participatory planning [14–17], several NbS studies have highlighted challenges in relation to structural barriers [18,19], the depth and quality of participation [9,10,13], and the achievement of social outcomes [8]. These studies point to the need for critical research that moves beyond simply promoting the value and ideals of participation for reframing NbS. These demands look further than the implementation of participatory ideals in demonstration NbS projects—often highlighting short-term "successes"—towards understanding the conditions and strategies that support their long-term mainstreaming and impact.

This paper aims to advance the mainstreaming of participatory NbS by moving beyond idealized notions of participation and critically examining tensions that arise in the implementation of participatory ideals in NbS projects. For this purpose, we adopt a critical–pragmatic approach [20] and conduct cross-case analyses of participatory experiences from seven urban NbS projects in Northern Europe. These experiences are discussed in relation to the literature on planning sustainability transitions and participatory practices in NbS.

In the next section, we present the core elements of our conceptual framework for interpreting tensions in participatory NbS. We then introduce our cases followed by a brief description of the methodology and detailed discussion of the results according to three key tensions. Our results highlight the challenges associated with the project-based nature of NbS and their reliance on external funding. We argue that, while such "projectification" has helped to proliferate urban NbS interventions, it has also exacerbated challenges related to participation. We conclude with a discussion that advances ideas and practices of participation in NbS by questioning the projectification of NbS and emphasizing the need for participatory NbS approaches that reconcile long-term ecological sustainability with democratic approaches in planning.

2. Theoretical Overview

We base this paper on theoretical underpinnings and practical implications of NbS in the Northern European context of democratic planning approaches and principles, following the theoretical traditions of participatory, communicative, and collaborative planning [21–23], hereafter referred to as "participatory planning". For the application of NbS, we interpret participatory planning in the context of European Union (EU) initiatives including the "human-centered city," European Green Deal, and New European Bauhaus [24–26], which aim to support social and ecological sustainability. To operationalize participatory planning and EU principles of sustainability, co-creation is promoted as the preferred method for developing NbS in the EU, becoming a core concept for NbS and positioning NbS as a tool of participatory environmental governance and socio-ecological transformation [27–30]. According to the state of the art of social NbS research, two key areas identified for future research relate to mainstreaming NbS (e.g., [31–33]) and ensuring that NbS discourses remain focused on sustainability (e.g., [5,34–36]). Altogether, these set the theoretical orientation of this research.

The following sections expose the abovementioned theoretical strands, policy contexts, and key concepts that underpin the social analysis of NbS projects. We begin by introducing NbS projects as technical and expert-based (i.e., technocratic) processes. This is followed by critiques prompting calls for more participatory models. We then describe a new wave of participatory NbS and the challenges encountered in their implementation.

2.1. NbS Projects as Technical and Expert-Driven Processes

Definitions of NbS have been developed by expert technical communities, academics, and policymakers, indicating a technocratic trajectory of development, despite often alluding to societal benefits. The European Commission defines NbS as "actions which are inspired by, supported or copied from nature" with potential to provide "co-benefits for health, the economy, society and the environment" as well as "innovation opportunities" [1] (p. 4). Similarly, the International Union for Conservation of Nature (IUCN) refers to NbS as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" [37] (p. 1); see also [38]. Accordingly, NbS have reached the status of an umbrella concept relevant to a range of sustainability frameworks, as it relates to technical and expert-driven initiatives [5].

The documented cases of NbS range from the technical cases—related to farming and food production, green surfaces and building components, and extensive green and blue urban spaces and corridors for rainwater management, watercourse restoration, and renaturalization—to those that are more socially and economically oriented, including artistic installations, theatrical productions, and cultural and behavioral mapping [3,39]. To manage this variety, the IUCN has developed a global standard for NbS that, despite being a technocratic approach to structure the field, gives attention to contextual social and institutional factors for implementation and mainstreaming [4].

The IUCN positions NbS as "a way to operationalize the Ecosystem Approach" [37] (p. 1) (see also [40–43]), bringing a variety of benefits[1]. However, the benefits depend on the types of NbS applied and their interacting technical and environmental systems and communities. Applied to urban projects, NbS integrate the ecosystem approach into urban ecosystems and communities, taking ecological functions as a basis for urban development. Accordingly, the benefits of individual NbS projects are partial and incremental, although they are often designed to be replicable and scalable [1], leading to cumulative environmental and societal impacts.

Despite the claimed attention to social aspects, NbS are still dominated by normative goal setting and a technocratic approach to shift infrastructure from "gray" to "green". This often privileges technical expert knowledge and solutions [7,8,10,12,18], potentially reducing the model of NbS to one of technical feasibility and management rather than one of shared governance and participation. The "democratic and transformative potential" [6] (p. 1) of NbS may thereby go unharnessed. As a result, "key questions on the capacity of NbS to deliver on larger societal pledges remain wide open" [5] (p. 1). While the technical expertise of NbS continues to develop, the social aspects of implementation remain a hindrance to mainstreaming NbS in practice.

2.2. Reframing NbS Towards More Inclusive and Participatory Approaches

Drawing on experiences from the first NbS projects to be funded under the EU's participatory agenda [48], there is a need to focus on planning processes and the long-term sustainability of NbS rather than solely on technical solutions. This has prompted recent calls for a "critical reassessment of participation" [7] (p. 9) as a part of a wider reframing of NbS [34–36,49]. For this purpose, a critical stance must be adopted towards NbS, which

marks a shift from the overtly positive framing as an umbrella solution [5]. Faced with the increasing knowledge of challenges and barriers of implementation—as with other areas of sustainability transitions research [50,51]—the direction of progress shifts from technical solutions to the human factors supporting the democratic and transformative potential of NbS. Calls to reframe NbS imply a shift towards more inclusive and participatory approaches, moving away from the established focus on technical ecological centered knowledge and processes. The co-creative context of NbS is based on theories of stakeholder engagement in environmental management [52,53] and participatory planning [22,23,54]. Drawing from these theories, genuine participation is commonly characterized by three core principles: (1) inclusiveness, ensuring the involvement of all relevant stakeholders; (2) power balance, providing participants with equal voice and influence; and (3) consensus building, fostering agreement through deliberation and facilitation. The ideals of participation are centrally positioned in the co-creation approach adopted by European NbS projects [48,55]. By incorporating participatory approaches, NbS projects can build trust and goodwill for collaboration and develop shared narratives and learning opportunities for replication [8,56].

While these represent positive social aspects, critical views also highlight the downsides of participation, where the need to achieve a balance with environmental aspects is a challenge [13]. This has much to do with the tendency of NbS projects towards privilege engineering (i.e., material, technical) knowledge [12,18] and pragmatism in planning [20], on the one hand, in contrast with the empowering aspects of participation that can raise uncertainty around the NbS outcomes [13,57], on the other. To achieve the long-term sustainability aims of NbS, however, "uncertainties should not always be eliminated," and emphasis should be placed on "'culturing' rather than 'controlling' transformations" [7] (p. 3). Such culturing through participation requires resources and expertise for coordination as well as a commitment to lead participants towards a sustainable outcome [13]. By opening up the participatory processes beyond technical actors, it is thought that participatory NbS could achieve a stronger position in urban sustainability actions and become embedded in planning practices [13]. Hence, reframing NbS to be more participatory and open-ended can be a strategy for mainstreaming. After the first phase of technical experimentation [56], mainstreaming is considered to be a long-term social challenge of NbS [11,31,32].

2.3. Social and Participatory NbS: Co-Creation and Transformation

The EU's Horizon 2020 and Horizon Europe programs have been instrumental in forwarding the ideas of participatory NbS by funding the first cohort of projects and requiring co-creation in their implementation [48]. Similar to the principles of genuine participation, co-creation refers to the inclusion of diverse actors in all phases of the NbS project cycle including design, production, and governance [55,58]. The evolving EU ideals of co-creation are best represented in the New European Bauhaus Compass guide, emphasizing the participatory process, multi-level engagement, and transdisciplinarity as its core working principles [26]. However, when extending beyond the earlier mentioned technical scope of NbS, meeting the expectations of co-creation remains a challenge. Project leaders must deal with known participation issues from environmental management [53], including the complexity of the ecosystem approach [41], and from communicative planning [22,23], including a lack of environmental awareness amongst participants and balancing different forms of knowledge in decision making [59–62].

Additionally, NbS projects' reliance on external EU funding mechanisms imposes constraints on their capacity for co-creation, whereby the extensive work required is limited by the resources available in the fixed timelines of project cycle stages (e.g., the agenda-setting

project call phase, participatory phase, implementation, and project delivery). The constraints of such "projectification" of NbS exacerbate participation challenges, particularly the involvement of different groups including the hard-to-reach and keeping them engaged throughout the process. These difficulties stem from unbalanced trust and power relations, a lack of time to invest in relationships, and the complex facilitation of group dynamics and communication flows [63–66]. This, in turn, contributes to challenges of consensus building, including negotiating conflicting rationalities of stakeholders and difficulties in attaining consensus on controversial decisions [14–16,67].

These challenges point to additional tensions of participation in relation to their transformative potential and the limits of projectification. For the first, participation in NbS can be transformative in terms of actors' agency [68] and institutional capacities [69,70]. This influences the power balances amongst participants and the potential of NbS to stimulate cultural change towards sustainable practices, e.g., through increased human–nature interactions [30]. NbS can thus be viewed as a tool to address complex environmental and climate issues through specialized and co-produced knowledge [61,62,71]. As such, their implementation requires tangible time and knowledge resources that intensify already existing tensions between swift and slow planning processes [72].

This leads to the second point, i.e., the limits of projectification. The fact that NbS are often project-based and temporally limited to the project cycle has an impact on participatory ideals [18,31]: the incentives to participate are temporary and limited by external funding; the principles of inclusion risk not being sustained within existing power structures; and, without a guarantee of citizen empowerment, diverse sources of local knowledge risk not being cultivated and institutionalized over the long term [31,73].

In the next section, we draw on the abovementioned ideas to critically investigate how participatory NbS approaches have been implemented in the European context. Adopting a critical–pragmatic approach, inspired by [20], we emphasize what is realistically achievable in everyday NbS planning practice, rather than relying on normative or idealized visions on how participatory NbS ought to be. Accordingly, our analysis focuses on key tensions that emerged during the project-led implementation of participation in seven NbS projects across the Nordic–Baltic region and the strategies project organizers employed to address them.

3. Methods and Materials

3.1. Case Study Overview

This research follows a multi-sited, qualitative case study approach, drawing on original, primary empirical material—and, in some cases, secondary material for triangulation—to analyze and compare seven cases of participatory NbS project implementations in the Nordic–Baltic region. Mirroring the projectification of NbS, the analyzed cases were part of two EU-funded projects: the Central–Baltic Interreg project *Augmented Urbans* (2017–2021) and the H2020 Research and Innovation project *GoGreenRoutes* (2020–2024). Both EU projects utilized NbS as a central tool for socio-ecological transformation with diverse aims.

Augmented Urbans focused on urban renewal and ecological resilience, using biodiversity enhancement and green infrastructure development in five cases. *GoGreenRoutes* is represented by two cases with a focus on wellbeing enhancement via nature connectedness and active mobility. The NbS included foremost biodiversity—enhancing measures such as sponge gardens, health forests, urban meadows, pocket parks, green corridors, or the curation of biodiverse landscapes, as well as measures such as the retrofitting of existing buildings or light traffic enhancement according to ecological standards to foster sustainable city planning more widely[2]. The cases were situated in the countries of Sweden, Finland, Estonia, and Latvia. While facing similar environmental challenges and conditions for NbS, they differ in political, institutional, social, and economic contexts, e.g., in size and

development of urban settlement or legacies affecting planning and participation. Despite these differences, common tensions were experienced.

All cases were implemented with ambitious participatory agendas set at the EU-funded project level, blending digital with non-digital means and co-creation methods. The projects referred to the criteria of the International Association for Public Participation (IAP2) [75], based on Arnstein's famous ladder of participation [21], to select methods to enhance the flow of information, consultations, and collaboration with stakeholders, including art-based methods. Some also aimed towards empowerment by co-creating biodiversity, for example, in the form of window gardens or insect hotels.

As project organizers became aware of the transformatory aspect of NbS as social interventions [68,70,76], many engaged in actions to foster a transformative change. These included transformative knowledge building with biodiversity apps, site walks or nature marathons, and advocacy for gaining legitimacy for their projects, e.g., with image campaigns or active expectation management (for a more in-depth analysis; see [13]).

Table 1 gives an overview of the cases, including their NbS objectives, participatory goals, and the data used in the analysis.

Table 1. Overview of NbS project cases and used data.

Environmental Theme	NbS Synonym	NbS Area	NbS Project Objective	Participatory Goals	Quoted Respondents and Form of Data Collection
Augmented Urbans: ecological resilience and urban renewal	Case 1: *Courtyard Meadows*		Transform courtyards of existing housing estate by engaging people in creating more biodiversity and pollinator-friendly outdoor areas with focus on meadows as an alternative to lawns	Information and consultation–collaboration- and empowerment-enhancing transformative change	Project organizer Helle, in-depth interview (online)
	Case 2: *Street Axis*		Develop underutilized street axis located in the city center into a work and cultural center by deepening the commitment of existing stakeholders to a sustainable planning and retrofitting process	Information and consultation–collaboration-enhancing transformative change	Project organizer Lily, in-depth interview (in-person)
	Case 3: *Bee Corridor*		Transform gray into green infrastructure, following the concept of a bee corridor; this included the construction of a light traffic road, an active linear park as well as the curation of biodiverse landscapes	Information and consultation; collaboration and empowerment; enhancing transformative change	Project organizers Nele and Stiina, in-depth group interview (online) Local resident Marten, supported by input from student works (field visit)
	Case 4: *Main Street*		Develop human-scale and resilient planning solutions for the main street that would decrease commuting to the city center and enhance sustainable mobility options	Information and consultations; enhancing transformative change	Project organizer Robin, in-depth interview (online)
	Case 5: *Riverfront*		Develop a green corridor connecting the urban core with the riverfront by combining tourism and recreation with biodiversity-enhancement and landscapes preservation	Information and consultations; collaboration; enhancing transformative change	Project organizer Zaiga, in-depth interview (online)

Table 1. *Cont.*

Environmental Theme	NbS Synonym	NbS Area	NbS Project Objective	Participatory Goals	Quoted Respondents and Form of Data Collection
GoGreenRoutes: nature connectedness and nearby greenery	Case 6: *Active Mobility*		Develop a street corridor to encourage active, non-motorized mobility and foster the development of safe and inclusive urban spaces, including small pocket parks and green interventions	Information and consultation; collaboration; enhancing transformative change	Project organizer Bella, focus group discussions and in-depth interviews (online and in-person)
	Case 7: *Nearby Greenery*		Maintain biodiversity at the site while diversifying a residential green area through a renewal in accordance with site-specific needs and the intention to make it more accessible and pleasant	Information and consultation; collaboration and empowerment; enhancing transformative change	Project organizers Epp, Maie, and Madle, in-depth group interview (in person) Local residents Annela, Anu, Merike, Tiit, Tarmo, Peeter, Irma, Jaan, and Karmen from open comment survey section and I360, supported by input from student works

Source: Authors' analysis, categorizations based on [10,13,21,53,75]; case and respondents' names have been anonymized.

3.2. Data and Empirics

This study builds on a qualitative research design utilizing in-depth interviews with project organizers of the local cases. From *Augmented Urbans* (15 interviews with six project organizers from five cases), the experiences of project organizers were studied with recurring in-depth interviews conducted in three rounds to allow room for reflection during NbS project implementation. From *GoGreenRoutes* (two interviews with four project organizers in two cases), in-depth interviews with project organizers were held towards the end of the project in 2024. All interviews lasted between 45 min and 1 h 45 min, were conducted in English, recorded with informed consent, and transcribed. To allow for more depth in the analysis, secondary data were available and used to complement the two *GoGreenRoutes* cases, giving insight into local perceptions of the projects. This additional data were collected by the researchers and researcher-supervised student groups (following the principle of research-based teaching [77]) and included fieldwork, in situ interviews with residents (analyzed as the so-called I360 interviews: [78]), and qualitative data from resident surveys (analyzed in more detail: [74]).

As the analysis focuses on the experiences of local project organizers, additional measures had to be taken to ensure the anonymity of interview partners. Pseudonyms are therefore assigned to both individual respondents and specific case locations. Table 1 gives, however, an overview of the central characteristics of the cases studied here.

3.3. Analytical Approach

While the studied projects have been analyzed in greater detail elsewhere [13,74], the qualitative interview data were re-examined with the aim to understand tensions evolving during the implementation of participatory NbS projects and how these projects were handled by the project organizers.

For the purpose of this paper, our use of tensions corresponds with the approach of qualitative content analysis, namely, representing emergent themes from the analysis. For us, tensions describe thematically where social conflicts arise that threaten the long-term sustainability outcomes of NbS. This aligns with prior uses investigating social sustainability aspects in planning, management, and transition fields, relating to similar terms such as ambiguities, contradictions, oxymorons, and paradoxes [79–82]. Of particular relevance

to us, tensions convey a "strained dialectical relationship" [83] (p. 844) that can be found in planning politics, discourses, and rhetorics. Tensions are therefore highly contextual, emerging at multiple scales and levels, between various social groups and in connection with specific issues. Therefore, they are suitably applied within an inductive approach that allows them to emerge from and to be compared across cases.

Qualitative content analysis [84] was conducted for the seven cases following the conventional method of (1) manually coding interview transcripts and, if applicable, secondary material used for triangulation and (2) combining the results into analytical categories summarizing these codes. On the highest level of analysis, (3) analytical categories are abstracted into themes. The themes are then formulated as major tensions surrounding the implementation of participatory NbS:

- Tension 1: between open-ended participatory objectives and closed-ended NbS objectives.
- Tension 2: between increasing time demands for participatory processes and limited time for NbS delivery.
- Tension 3: between expert and lay knowledge and their role in participatory NbS.

The findings for each tension are structured around three main content–analytical categories. The first two categories are used to describe each of the three tensions in detail, while the third category discusses the tensions in relation to the dominant projectification of NbS. Altogether, they convey the subjective experiences of project organizers in these seven study cases. Table 2 gives an overview of the analysis, summing up categories and codes for the three tensions.

Table 2. Overview of analytical results.

Theme	Category	Codes
Tension 1: Between open-ended participatory and closed-ended NbS objectives	NbS objectives as too green	• Counteracting nature esthetics and human-centered planning norms. • Increasing risk of green gentrification. • Green objective vs. other pressing local issues and priorities.
	NbS objectives as not green enough	• Questioning the sincerity of green objectives and local government. • Embedded in general skepticism of government-led green transition. • Based on differing definitions of "green".
	Influence of NbS projectification on agenda setting	• Tension between expectations raised by participatory process vs. early-fixed and normative green focus of NbS project, leading to the following: ○ Delimiting participatory openness. ○ Balancing participatory openness with closed-endedness of NbS objectives. ○ Transformative planning measures to nudge acceptance of NbS objectives.
Tension 2: Between increasing time demands for participatory processes and limited time for NbS delivery	Visible time-consuming challenges of participatory NbS process	• Ambitious and exhausting participatory agendas. • Common participatory challenges: motivation, inclusion, and processing output.
	Invisible time-consuming challenges of implementing NbS project results	• Lengthy procurement processes. • Ensuring support for the transformative nature of NbS, including the following: ○ Securing green NbS land use against stakeholder interests with and beyond the government. ○ Securing co-funding.
	Influence of NbS projectification on time resource management	• Tension between time resources due to transformative nature of NbS vs. fixed timelines for NbS projects, leading to the following: ○ Lowering NbS ambitions in terms of implementation. ○ Lowering NbS ambitions in terms of alignment with participatory input.
Tension 3: Between expert and lay knowledge and their role in participatory NbS	Theoretical rationale to support lay knowledge	• Missing experience with new forms of knowledge production. • Need for negotiation of missing or conflicting knowledge.
	Practical drivers to support expert knowledge	• Complexity of NbS. • Need for transformative knowledge production. • Need for evidence-based advocacy.
	Influence of NbS projectification on knowledge production and use	• Tension between theoretical rationale to support lay knowledge and practical drivers to support expert knowledge, leading to the following: ○ Reliance on expert knowledge in decisive phases of the project cycle. ○ Reliance on expert knowledge to negotiate complexities of NbS as a tool and as a transformative project in need of local support.

Source: authors' illustration, based on inductive content analysis.

4. Results

4.1. Tension 1. Between Open-Ended Participatory Objectives and Closed-Ended NbS Objectives

Tension 1 is concerned with the mismatch between the open-ended ideals of participatory processes, in which participants are meant to be able to strongly influence the project, with the foundational nature-orientation of NbS [11,39–42], prescribing ecological outcomes that may not fully align with the priorities or expectations of participants. All of the analyzed NbS projects have a common focus on "green" solutions to foster urban sustainability [38]. While participatory NbS are used to enhance adoption and social acceptance [8,10,34], the project organizers experienced tensions evolving around the question of how green NbS ought to be, as well as critiques of whether the NbS objectives really are as green as claimed, and whether the objectives can be openly set within the limits of the project model. Core to this tension is the "negotiability" of green objectives of NbS.

4.1.1. NbS Objectives as "Too Green"

Particularly in the projects focused on biodiversity, residents critically challenged the NbS objectives as being "too green" and contrary to competing priorities. For many, such as in the *Courtyard Meadows* project, "nice and tidy" lawns still represent cultural norms of "strict and clean environments" (project organizer Helle). The idea of more natural lawns was perceived rather as elitist environmentalism or "laziness" and non-care of the local government [85]. In the *Bee corridor* case, a new management plan for the NbS area that foresaw reduced mowing elicited a series of complaints claiming the site looked unattended. These included "a lively discussion" in social media about "what is going on" (project organizer Nele). As NbS projects widen the implicit human-centered focus of city planning [43,86], they were critically assessed by residents as caring more "about the wellbeing of beetles" than of people who might have other priorities than biodiversity enhancement (resident Marten). Changes in mowing regimes were seen as "something scary, almost" with people "afraid of snakes, ticks and the like" (project organizer Helle). Residents also expressed concerns about socio-economic impacts that such greening could have in the areas surrounding the NbS. This dynamic is discussed more widely, urging for critical NbS impact assessments [11,87]. The highly marketed *Bee Corridor* NbS project was, for instance, seen as a green gentrification threat involving a change in land use that would limit the access of a particular local subculture to nature.

In cases where the green NbS focus was not resisted—or was even supported to "plan urban space with more connection to nature" or "keep as much wilderness as possible" (residents Tiit and Anu)—residents were concerned whether being "green" was really needed the most. This question has been raised by [88] who analyzed whether the green focus of NbS correctly interprets the needs of and benefits to participants. In the *Nearby Greenery* case, these were expressed as feelings of whether important local issues, such as heritage preservation or safety, were being sufficiently addressed in relation to the green objectives: "Unfortunately, the area is still very trashy, I have even seen syringes on the ground. The only good time to go there is in the morning when [. . .] there are no old drunkards drinking between the trees" (resident Tarmo). The feeling of safety concerns being overlooked was also relevant elsewhere (project organizer Bella), as well as "green" in relation to other priorities such as tourism development, infrastructural planning, or real-estate development (project organizers Zaiga, Stiina and Nele, Robin). All of this illustrates how participatory processes can challenge and potentially undermine NbS' green objectives, forcing project organizers to restrict participants' influence in decision making. This contradicts the open-ended ideals of participatory NbS.

4.1.2. NbS Objectives as "Not Green Enough"

Additionally, the sincerity of green NbS objectives was questioned in relation to greenwashing, as shown by residents' doubts, skepticism, and lack of trust in project owners. In the *Nearby Greenery* case, participating residents asked whether the NbS focus was driven by a desire to gain more votes in the upcoming local elections, with one resident remarking, "This is why they are trying so hard" (Karmen). They were also critical of EU project funding schemes shifting the focus away from "old-fashioned" large-scale parks and green space solutions to small-scale NbS such as green walls or roofs (resident Peeter). Former research [56] has pointed out that "NbS experiments require [. . .] trust between the city and its citizens both for the aim of the experiment and for the experimenting process itself" (p. 106). In this light, the doubts in the sincerity of green objectives seem to be embedded in the general political skepticism and lack of trust towards the city government. Similarly, residents' doubts about the "actual greenness" of the NbS projects were also shaped by connections they made between the initiatives and broader green transition agendas—and their skepticism towards the latter: "I think [climate change] does not even affect [us] very much, hence we need to treat it more soberly" (resident Epp), or: "it's just there to spend money. . ." (resident Jaan).

A part of this skepticism is embedded in different views of what type of "green" solutions should be prioritized in urban projects. As critically discussed in the *Street Axis* case, "green" can point towards different solutions, such as housing energy efficiency, green mobility, or urban ecology—all of them necessitating different priority settings or contradictory measures (e.g., cutting down trees for more sustainable infrastructures). Altogether, these critical voices question how "green" in NbS projects is normatively framed in terms of ecological solutions and whether these are sufficient for reaching broader sustainability goals [34].

4.1.3. Influence of NbS Projectification on Agenda Setting

The projectification of NbS tends to exacerbate the tensions around green objectives due to the requirement for fixed, early agenda setting in the funding application [6]. Only few NbS projects have sought to circumvent this by formulating the project objectives iteratively [12]. Discussions on actual greenness become particularly relevant in a context where the green focus is set as a cornerstone early in the project plan, even before the participatory process is designed or initiated. This was reported in the *Nearby Greenery* case, where project organizer Epp confirmed that the ecological NbS focus was fixed already in the application because it was a condition of EU funding and seemed "tangible to implement". To follow the open-ended idea of participatory processes, project organizers nevertheless asked people, "what do you like?", which generated expectations of including local foci such as safety and historical heritage into the project plan (project organizers Epp and Madle).

The pre-given ecological focus of the NbS created a feeling of non-recognition of residential interests. Some told how they had advocated before to build a heritage memorial, which was declined because "the city has no resources" (resident Annela). Once the resource problem seemed to be solved with new funding, it remained unclear to them why heritage preservation could not have been included as a project objective from the outset. Such a feeling of non-recognition of local needs by an overly green focus could lead to disengagement and lower acceptance of final solutions. At the same time, fully opening the participatory process risks a focus shift away from the green objectives, as conveyed in the critical attitudes towards NbS being "too green" or being green but not necessarily what was needed in the area.

The final NbS plan for the *Nearby Greenery* and *Active Mobility* cases had a focus on local heritage, improved safety, and nature connectedness, conveying that it is possible to go beyond such "either-or" perceptions. However, beyond actively keeping the (discursive) room open for a combination of NbS with local objectives, project organizers also drew boundaries for the NbS projects and the participatory process. This included the clarification of NbS purposes, such as in *GoGreenRoutes*, where iterative loops and diverse communication channels were used to manage expectations during the co-creation process [74]. Moreover, a realignment of the participatory input with NbS objectives was necessary. Convinced that it is "important to make people understand what their input is used for, what can really be done and, more importantly, what cannot," the project organizers of the *Street Axis* case actively communicated that the participatory process is "neither a vote nor a wish list" (Lily). This was also relevant in other cases, where project organizers constantly negotiated local objectives with the NbS focus set by the project plan: "We had to balance. So, if people say that the historical orchard is very valuable, but to preserve it, we need to take down more trees, which is again not really a green solution. Which part to prioritize?" (Maie).

Finally, project organizers also engaged in transformative planning attempts by nudging residents towards NbS objectives. This included mini-window garden workshops and the initiation of a community garden in the *Courtyard Meadows* and *Bee Corridor* cases, with the idea to involve residents early on and create a visible biodiversity-enhancing ecosystem. Developing transformative agency has been recognized as central to NbS implementation [13,57], even though projects often face challenges due to insufficient public resources or a lack of capacity to engage in these transformative attempts [18].

4.2. Tension 2: Between Increasing Time Demands for Participatory Processes and Limited Time for NbS Delivery

Tension 2 lies in the mismatch between the extended timeframes required for meaningful participatory processes to achieve the potential social and ecological benefits of NbS, and the often rigid, short-term deadlines imposed by funding requirements. This disparity reflects a broader tension of "swift" and "slow" planning [72], wherein the demand for efficient decision making and fast implementation comes into conflict with inherently time-intensive participatory processes. The pressure for efficiency in planning has increased with neoliberal and market-oriented planning agendas [6,8]. While time-consuming participatory processes are seen as a major obstacle to increasing time efficiency [72], planners are urged to include different forms of knowledge to address the complexity of emerging challenges [61,66] and to deepen the democracy and social acceptance of planning processes [89].

The case analysis shows that the timeframe tension of NbS projects derives from a combination of highly visible demands for allocating sufficient time to achieve participatory ideals with often less visible governance processes slowing down their implementation. Within the scope of projectification, the pressure for time efficiency creates situations where NbS are only partially implemented or stay at a planning document level. For residents, attempts to reconcile diverging time horizons may result in unmet expectations impeding the same adoption and social acceptance that participatory NbS seek to generate.

4.2.1. Visible Time-Consuming Challenges of Participatory NbS Process

All projects were implemented with ambitious participatory agendas planned at the application stage and steered on a project level: "Actually, for the engagement we had a specific format from the project, so we did not decide when [. . .] and how we do [it]." (project organizer Maie). The time dedicated to participatory activities led to positive experiences, as participants expressed being "thankful that this green area is finally dealt

with" and "approving of the diverse events" (residents Anu and Merike). Moreover, new EU standards such as co-creation or the "leave-no-one-behind" principle helped to empower and monitor inclusion. This was the case in *Nearby Greenery*, where a multi-stakeholder and bilingual approach was used: "I do not feel that we are lacking anyone" (project organizer Maie). However, prolonged participatory processes also resulted in fatigue amongst organizers and participants: "This engagement process was so long. It was too long. . .".

Such ambitious participatory processes are undoubtedly time-consuming, as they account for the design of participatory activities, for the creation of engagement opportunities for diverse stakeholder groups, and for translation in multilingual meetings and contexts (project organizers Maie and Epp). The need for time resources increased even more when those organizers that wished to engage showed limited interest in the project. In the *Riverfront* case, the tourism sector was central but took little interest in the NbS project that sought to balance biodiversity with touristic development. Mainly, tourism stakeholders did not see biodiversity as attractive enough to create "revenue opportunities sometime in the future" (project organizer Zaiga). Others also had to dedicate extra time motivating participants. In the *Courtyard Meadows* case, project organizers addressed this with initially unplanned activities, nudging residents towards NbS objectives with pollinator-friendly window gardens. On top of that, the analysis of participatory input is time-intensive (project organizer Helle). This is not only true for technicalities and feasibility, but also regarding the communication and justification of decisions to include or exclude inputs from the final NbS solution.

4.2.2. Invisible Time-Consuming Challenges of Implementing NbS Project Results

While participatory processes need visible time-consuming efforts, significant time resources are also required for governance processes underlying NbS implementation [89]. These often remain invisible to participants who expect swift decision making and implementation, which raises the risk of participation fatigue: "I understand them because you have been engaged like a hundred times, but nothing is ready" (project organizer Madle). Among the less visible challenges are time-intensive procurement procedures, depending on local capacities and resources [18], as well as the need to gain political goodwill by negotiating stakeholder interests with and beyond the government. Lengthy procurement processes not only consume time but are also often difficult to communicate and to fit into the project logic, which tends to lack frameworks for the actual implementation of NbS plans [8,10]: "We work for the city government, and [the EU project organizers who wrote the application] have no clue how the city works. It's not like we're engaging people and then going to construct something. No, there's a lot of [. . .] papers to fill and licenses to gain, making those public procurements" (project organizer Madle).

Next to lengthy procurement processes, the transformative nature of NbS projects entails the need to ensure support for their actual implementation and long-term management. These include securing the green NbS land use against other stakeholder interests and securing co-funding—activities often invisible to the residents and partially unexpected for project organizers [13]. NbS projects in urban areas take place in the context of competing land use interests within a limited space. In cases where NbS were used as means for urban renewal, this contestation was particularly pronounced. In the *Main Street* case, situated in a suburb area, the threat of real estate development to green spaces has been documented over the last decades. During the participatory process, project organizers highlighted that "there seemed to be a strong bias towards the developers" (Robin) who have more resources to make their voices heard in the local council. For the project organizers, this meant using tangible time negotiating stakeholder interests "behind the scenes": "This is a

tough nut to crack: how to communicate with real estate developers, how to make them understand?"

Other projects' green land uses were contested by infrastructural developments, such as when the transport department wanted to use the *Bee Corridor* area for a motor highway: "When the land ownership was finally transferred from the state to the municipality, which freed space [for the NbS], the transport department put the plans for a motorway road back on the table" (project organizer Stiina). When funding only covers part of the NbS, there is the need to secure extra local funds including political negotiations that come with it: "But that is the point. None of the small parts would mean anything there. And really you cannot do anything with [that sum of money] that people were saying that they want, such as accessibility. You cannot do accessibility with [that sum of money]. Sorry, you just cannot!" (project organizer Maie). As the extra money comes from local funds, it raises questions of "priority-setting inside the city" in a context where the project site might "not be a priority place in the city."

4.2.3. Influence of NbS Projectification on Time Resource Management

Projectification tends to exacerbate this tension due to relatively fixed timeframes and deadlines of NbS project plans, even when flexible and tangible time resources are needed for the participatory process and to govern the NbS development itself. How visible and less-visible time-consuming tasks are accounted for also plays a role, as project plans tend to focus more on the visible time resources required for participatory activities, while neglecting less visible processes, with frameworks, capacities, or resources oftentimes missing [8,10,18]. Moreover, the fact that the transformative nature of NbS is not sufficiently acknowledged in project plans [13] leads to a lack of time resources for activities to gain legitimacy for the NbS project within the local governance system, such as to secure land use. In the *Bee Corridor* case, an image campaign to "create a pool of supporters in and outside the government" was developed to tackle the land use conflict with the transport department (project organizer Stiina). In the *Street Axis* case, private owners and developers were convinced to build in accordance with environmental governing principles using a "give and take" approach that offered shorter procurement periods for environmentally oriented retrofitting projects (project organizer Lily). In other cases, such as *Nearby Greenery*, it was not possible to prevent competing land uses, leading to a time-intensive relocation of the project site. These invisible stakeholder negotiations are particularly time-intensive amongst changing government coalitions, where goodwill needs to be repeatedly ensured: "People are changing in the city government. You have to get somebody on board–I do not know, twice or so–explaining why you are doing things" (project organizer Madle).

The resulting lack of time can affect participatory processes, becoming less inclusive and influential at final project stages. Furthermore, it can lead to situations where ambitions for implementing NbS plans are either lowered (e.g., replaced by planning documents/architectural designs instead of building the actual NbS), or less ambitious NbS are implemented that meet the funder's demands but might be less aligned with the participatory input. This can conflict with the expectations raised during participatory processes.

An illustrative example is *Nearby Greenery*, which ran out of time due to several constraints, including the relocation of the site, lengthy procurements, and the need to secure additional local funds. Even though a landscape architectural solution was developed in close alignment with the participatory inputs, the final project output will only achieve an interim stage of the planned development, with the full implementation now pending on local follow-up funding: "Because our NbS will not be ready by the end of the project, we are having a small NbS before [in form of] a pollinator friendly sponge garden" (project organizer Madle). "[It] is not something that people asked for, but it is ticking all boxes. It's

NbS, inviting more pollinators, and the orchard is very well connected. . . It's something new that could be done anywhere in the city, not site specific" (project organizer Maie). In other cases, such as *Active Mobility* and *Bee Corridor*, the final NbS construction processes were delayed, causing pressures among project organizers on how to meet the set deadlines, and leading to applications for deadline prolongation and critical scrutiny among citizens (project organizers Bella, Nele, and Stiina).

4.3. Tension 3: Between Expert and Lay Knowledge and Their Role in Participatory NbS Processes

Tension 3 concerns the balancing of lay and expert knowledge in participatory NbS projects. While the inclusion of diverse, place-based, and tacit knowledge is widely acknowledged as a core component of participatory NbS [6,8,10,34], our findings reveal a persistent reliance on expert-oriented knowledge during implementation.

In the literature and policy documents, the essential role of lay knowledge for addressing complex ecological and climate challenges targeted in NbS is increasingly acknowledged, indicating a shift in traditional roles, where planners act as mediators between stakeholders and their knowledge rather than as decision makers [13,90,91]. This recognition underscores the need for collaborative, transdisciplinary learning between actors [61,62], with particular emphasis on tacit, place-based, and "wordless knowledge" [92] (p. 327) (see also [71]). Nevertheless, expert knowledge is required for NbS due to its technical and ecological complexity [57,93] and, moreover, to counteract populist movements and ill-informed or intentioned segments of the public [94]. Being faster to recruit than participatory lay knowledge, the inclusion of expert knowledge might be incentivized due to the time pressures in NbS projects [41,57]. The same dynamic is visible in the analyzed NbS cases. However, they also show that reliance on experts increases due to the need for transformative knowledge dissemination, where expert knowledge is strategically used to encourage residents' alignment with NbS objectives or facilitate evidence-based advocacy with stakeholders.

4.3.1. Theoretical Rationale to Include and Support Lay Knowledge

While there is a strong theoretical rationale to support lay knowledge, existing research points to the challenges of gaining access to lay knowledge due to a lack of skills in process design and facilitation methods [95,96] and practicalities of participatory processes, e.g., to align time schedules of experts and lay people, or to gain access to different knowledge at the right time [18,34]. Challenges in integrating diverse forms of knowledge also stem from the capacities of residents engaged in the participatory process, who might lack experience with "new" co-creative ways of inquiry. This happened in *GoGreenRoutes*, where the canvas method was used to "discuss, visualize, and write [. . .] opinions and wishes for the green spaces," which for some felt very unfamiliar: "at the beginning, the canvas was just a white sheet of paper [. . .] no one wanted to start" (project organizer Bella, [74] (p. 10)). "Just asking about the needs" without a concrete proposal to discuss yet was rather uncommon: "When we had those engagement meetings, people were always asking why you engaged us at that point, when you have your plans not finalized" (project organizers Epp and Madle).

Project organizers perceived a need to guide missing or conflicting lay knowledge with regard to NbS objectives in ways that would support the effective implementation of project results. This challenge was acknowledged in previous studies in urban ecology, where participatory processes aim to incorporate and transform lay knowledge, seeking to address disconnection from nature or limited environmental awareness [59,60]. Dealing with this involved monitoring the communication around the NbS project to provide input and information where misunderstandings could arise. In the *Nearby Greenery* case, major

discussions evolved in social media around maintenance tree cutting and the wetland in the area, which generated quick reactions via different channels, also involving local experts (project organizer Maie).

4.3.2. Practical Drivers to Include and Support Expert Knowledge

While there is a theoretical rationale to increasingly include lay knowledge in NbS processes, the cases conveyed the manifold practical drivers to draw on expert knowledge. Dorst et al. [18] observed the same tendency, pointing out that "the dominance of one type of expertise is likely not incidental but reflects power relations between actors" (p. 5). Our interviews convey that a part of the dominance of expert knowledge stems from the different functions for which knowledge is used in NbS projects. On the one hand, expert knowledge is drawn on as technical, academic, ecological input, in order to explain the complexity of the issues at stake (e.g., [6,18,59,60]). In the projects studied here, expert knowledge was used to increase the environmental awareness of residents, e.g., in forest management, dendrology, or local biodiversity and pollinator-friendliness (*Riverfront*, *Nearby Greenery*, and *Courtyard Meadows* cases).

On the other hand, expert knowledge fulfilled important functions for transformative knowledge production to induce behavioral change [13,57,70] and to develop a feeling of ownership of NbS [90]. Following a learning-by-doing approach to overcome the "knowing-doing gap" relevant for transforming socio-ecological systems [97], e.g., in the *Courtyard Meadows* case, an app was initiated for residents and green space managers who could "walk on site with the app open, point to a flower bed and get information on the type of plant they are looking at, as well as the reason behind planting them [there], their characteristics, when they flower, what benefits they give to the ecosystems and what type of conditions they need" (project organizer Helle).

Other project organizers used in situ workshops with local experts, like nature observation marathons (*Bee Corridor* and *Riverfront* cases). This was seen as particularly beneficial to lower objections and raise ownership of NbS objectives. Project organizer Zaiga in the *Riverfront* case remembers participants saying, "'Ooh, I cannot see the river from here,' or, 'Why is this forest so messy?' and then the biologist could explain why it's important to not clean it out." In situ workshops were also intended to mediate the complexity and conflictuality of NbS measures by using experts as knowledge brokers: "We were the most concerned about the fact that we, at the end, are going to take down about 100 trees, [. . .] and we did a walking tour together with the dendrologist who explained that on the spot, so that people could understand that this is not a light decision" (project organizer Maie).

Beyond that, expert knowledge was strategically relied on for evidence-based advocacy towards other stakeholders, such as among other city departments, to gain legitimacy for the NbS project. In all cases, scientific research on landscape and biodiversity or pollinator mobility, as well as design solutions, was prepared. These functioned as inputs to planning processes but were also referred to in land use interest conflicts: "We needed less salesmanship for our vision after it had been approved by experts" (project organizer Robin); the research findings "worked as a strong argument during institutional discussions" (project organizer Stiina).

4.3.3. Influence of NbS Projectification on Knowledge Production and Use

Regarding knowledge production and use in participatory NbS processes, the projectification trend tends to have a twofold effect. On the one hand, the inclusion of different forms of knowledge is fostered by ambitious participatory designs, which are part of funders' requirements. Among these are the "leave-no-one-behind" principle central to the 2030 Agenda for Sustainable Development and the European Green Deal [24,98]. Such en-

hanced efforts on inclusion have the potential to leave participants with novel but positive experiences, e.g., as in *GoGreenRoutes* [74]. On the other hand, the project cycle and complexity of NbS written into project applications influences how expert and lay knowledge are balanced against each other [6,18].

Although the prevalence of expert input is common in the project call-creation and application stage, experiences of project organizers show that this is also true for other decisive phases, such as project delivery, where final decisions on NbS are often made under deadline pressures (Tension 2). In *Nearby Greenery*, "clear and repeating statements from residents" on the use of the area and their preferences for development informed the NbS design principles. Nevertheless, the approval of the final solution strongly depended on input from dendrologists, landscape architects, designers, and city departments whose weighing role was explained by the complex needs of the NbS model: "Of course, if we talk about the wetland, I imagine that some specialists would say that the best way would be to channelize it somehow" (project organizers Madle and Maie).

Across projects, it became clear that there is a high incentive to include expert knowledge due to the technical and ecological complexities of NbS as a tool and due to the transformative nature of NbS projects. The latter indicates the need for gaining local support among residents and other stakeholders, which is difficult since NbS have often proved to be a contested concept (Tension 1). Expert knowledge was heavily drawn upon to build legitimacy with the help of expert-mediated transformative knowledge production and evidence-based advocacy. This indicates that the question of balancing lay and expert knowledge is not only one of inclusion and social acceptance, but also one of addressing the complexities of NbS as a tool and as a contested concept, where the latter sets strong incentives for the actual prevalence of expert knowledge.

Figure 1 sums up the dynamics between the tensions with regard to the green objectives, process, and knowledge inclusion of participatory NbS and the projectification of its implementation.

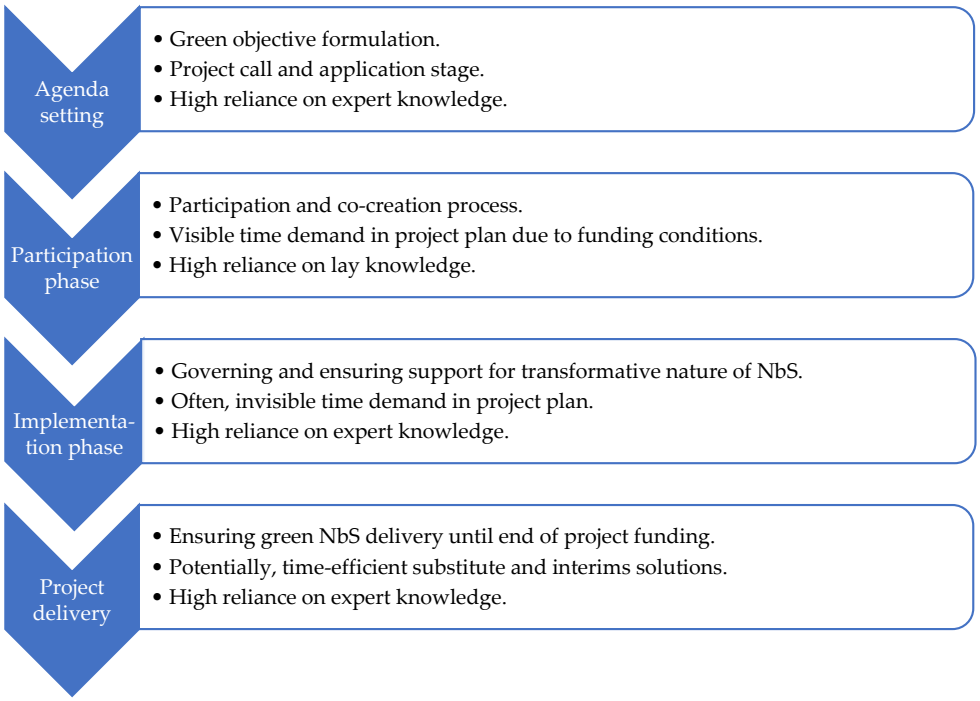

Figure 1. Experienced tensions of participatory NbS application under projectification conditions. Source: authors' illustration, based on stages of NbS project cycle and authors' analysis.

5. Discussion

The findings presented in this paper contribute to ongoing efforts to reframe NbS, going beyond the dominant technical and expert-based focus towards more participatory approaches [6,7,12,38,43]. Moreover, they offer a distinct and complementary critical–pragmatic perspective [20] by exploring tensions that can hinder the achievement of such reframing. In this sense, rather than promoting a normative or idealized vision of how participation in NbS ought to occur, our findings foreground what can be realistically achievable in everyday planning practice, laden with complexities, constraints, and conflicts.

In addition to distinct strategies used by project organizers to navigate tensions, the critical–pragmatic approach offers more general insights for advancing participatory NbS and enhancing its suitability for integration into mainstream planning practice.

First, there is an urgent need to move beyond the projectification of participatory NbS initiatives, which in the European context is characterized by a one-off, research-driven nature and dependence on international funding mechanisms. While our cases show that such projectification has been instrumental in proliferating the ecological orientation of NbS in planning and urban design contexts where such focus was previously absent, they also reveal significant limitations of this model for participatory NbS. Most notably, the impact of participatory NbS often remains confined within the temporal and institutional boundaries of individual projects, with limited continuity or institutionalization beyond their conclusion. Ideally, participatory NbS should be embedded into local planning frameworks and routines, rather than treated as standalone efforts. Admittedly, this remains a significant challenge, and NbS projectification may still be necessary in many contexts to continue advancing the development and mainstreaming of participatory NbS knowledge and practice. Hence, we suggest the need to set more open-ended objectives in project plans, which could be revised iteratively, as well as to provide more time and guidelines for "invisible" tasks associated with participatory NbS (see also [8,10,12]). We also suggest that funding mechanisms should better support the development of lasting partnerships with municipalities, invest in capacity building of planning practitioners, and foster the securing of local co-funding to ensure beyond project lifecycles.

Second, and more specifically in relation to the development of participatory ideas and practices within the NbS field, our findings point to two potential pathways. These alternatives concern trade-offs between the two foundational pillars of participatory NbS: (i) the democratic, social orientation of participation and (ii) the ecological focus at the core of NbS initiatives.

The first pathway involves fully embracing the reframing of NbS through democratic and participatory principles like inclusiveness, power balance, and consensus. While this alternative can help address many of the challenges associated with the technical dominance of NbS, particularly by improving social acceptance and enhancing long-term sustainability of project outcomes, it often requires compromises on ecological ambitions. These compromises reflect our findings, where participants in some projects challenged the projects' green solutions, often based on legitimate reasons regarding local values and more pressing issues. Pursuing this path would require NbS projects to invest greater effort in accommodating and integrating values, knowledge, and ultimately solutions that may not be fully aligned with ecological goals, potentially undermining the environmental focus central to NbS. Projects also need to recognize that, although not impossible, achieving the ideals of participation is very much conditioned by local contexts [16].

The second path involves rethinking participatory NbS in a way that more directly aligns with and actively supports the ecological goals and ecosystem approaches that set NbS projects apart from other urban interventions; goals that form their core contribution to today's pressing environmental challenges [7,34–36,49]. This path implies tempering

ambitions around participatory ideals by setting clearer boundaries around the scope and purpose of participation. Rather than open-ended processes where participants have the possibility to directly influence decisions, this path emphasizes processes with more explicitly defined limits on what issues or solutions are open to input. It also requires process organizers and experts to develop and exercise their role in setting agendas and making final decisions (see [13]). While this implies granting more power to these actors, which participatory NbS approaches often seek to challenge, this does not need to be viewed as inherently problematic. Instead, it reflects evolving thinking in participatory planning, which acknowledges the inevitable and at times necessary "art of exclusion" [14] and the legitimate exercise of authority and power in guiding complex planning processes [17]. Our study suggests that this does not need to imply a return to fully expert-driven processes. Instead, the exercise of authority and power could be close to the knowledge breaker role identified earlier, in which project organizers and experts focus on guiding and nudging the participants towards transformative knowledge that supports ecological goals.

6. Conclusions

In this paper, we drew on the cross-case analyses of seven urban NbS projects in Northern Europe, to critically examine and advance ideas and practices of participation within the NbS field. Rather than promoting normative and idealistic views of participatory NbS, we adopted a critical approach to unpack three key social tensions. In addition to deepening the understanding of tensions, our findings also showed distinct strategies used by project organizers to navigate them. In our view, understanding these tensions is essential for advancing the mainstreaming of participatory NbS and strengthening their role in addressing current environmental, social, and climate-related challenges.

Despite our critical approach, the cases reinforce the view that participation can play a significant role in fostering urban sustainability, particularly by promoting social acceptance of NbS project outcomes [8,10,34]. However, this contribution was neither straightforward nor consistently aligned with the expectations of project organizers or the way that participatory activities had been initially conceived in the funding proposals. Most projects had to diverge from original participatory intentions, whether in terms of ambitions for broad inclusion or meaningful co-creation, planned timelines or the type of NbS that were ultimately implemented. In our view, such deviations were not necessarily a result of flaws in the ideals that participatory NbS seek to pursue, but rather reflect the broader challenges of adhering to normative and idealistic views of participation without critically engaging with their practical limitations and the complex, and at times conflict-laden, planning contexts in which they are embedded [13–17,54,72].

As a way forward, we suggested two pathways to address these inherent tensions. These two pathways do not need to be viewed as mutually exclusive or rigid alternatives. Rather, it is better to see them as two ends of a spectrum along which participatory NbS projects can position themselves, depending on their specific goals and local institutional constraints. NbS projects may also shift along this spectrum throughout different stages of their development, requiring greater openness and inclusion at certain points and more directive, goal-oriented approaches at others. Recognizing this fluidity allows for a more context-sensitive application of participatory NbS, one that can flexibly balance ecological ambitions with democratic ideals as projects and contexts evolve. Building on these, future research could explore how NbS projects navigate shifts along this spectrum over time, and what institutional, social, or environmental factors enable or constrain such movement. There is also a need for comparative studies that examine how different positioning along the spectrum affects both ecological outcomes and the quality of participation. Finally, further investigation into the evolving roles of project organizers and experts, as both

facilitators and knowledge brokers, can deepen the understanding of how authority and inclusion can co-exist in participatory NbS.

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Abbreviations

The following abbreviations are used in this manuscript:

EU	European Union
NbS	Nature-based Solutions

Notes

[1] The benefits of NbS have been well covered by the literature. For a variety of disciplinary aspects, see [27,38,44–47], as well as policy documents promoting the benefits of NbS [1,2].

[2] Details of the specific NbS interventions have previously been presented in [13,74].

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