

BOOK OF ABSTRACTS

This Book of Abstracts provides a comprehensive overview of the session content and is structured into three main sections:

- I. **Session Description** – an introduction to each session, including its objectives and expected outputs
- II. **Session Program** – a detailed schedule for each session, including speakers and timing
- III. **List of Abstracts** – a complete compilation of all accepted abstracts

I. SESSION DESCRIPTION

ID: T20c

Co-creating with people and nature: inclusive NBS to promote justice and equity for building sustainable, resilient, and liveable cities

Hosts:

	Name	Organisation	E-mail
Host (s):	Diana Dushkova	Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany	diana.dushkova@ufz.de
Co-host(s):	Ina Sieber	Kassel University, Institute for Sustainability, Kassel, Germany	ina.sieber@uni-kassel.de
	Olga Ivlieva	Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany	olya.ivlieva@gmail.com

Abstract:

Nature-Based Solutions (NBS) are increasingly promoted as strategic and practical approaches to address societal challenges such as climate change, biodiversity loss, and human well-being. NBS directly enhance ecosystem services, including provisioning, regulating, and cultural services, while contributing to biodiversity conservation and climate adaptation. However, ensuring that NBS are inclusive, equitable, and empowering for communities remains a critical challenge. Inclusive NBS are essential for enabling just sustainability transitions, which achieve long-term ecological restoration while promoting social equity and participatory governance.

Recent research highlights key principles and practical frameworks for inclusive NBS: engaging all relevant stakeholders, ensuring equitable benefit distribution, and fostering empowerment through multi-level participatory and collaborative governance. These frameworks are structured around capacity building, stakeholder involvement, inclusive NBS design, and fair benefit distribution. By linking NBS implementation to ecosystem services and social justice, these approaches provide practical guidance for researchers, practitioners, and policymakers to ensure meaningful, locally-relevant, and socially equitable outcomes. However, gaps remain in understanding how these frameworks perform in real-world contexts, how they can be operationalized across different governance and cultural settings, and how trade-offs between ecological, social, and economic objectives are negotiated. Evidence on best practices for co-creating inclusive NBS that simultaneously enhance ecosystem services, social equity, and resilience is still fragmented, and guidance for practitioners to implement them effectively is limited.

Considering these gaps, the session will explore:

- Frameworks and approaches for realizing inclusive NBS that enhance ecosystem services and drive transformative sustainability transitions.
- Case studies demonstrating practical integration of ecosystem service (co-)benefits, social equity, and community empowerment.
- Governance mechanisms, stakeholder engagement strategies, and participatory tools that enable fair distribution of ecosystem service benefits.
- Methods for co-producing knowledge with diverse stakeholders to guide inclusive, ecosystem-service-informed NBS interventions.
- Opportunities and challenges in designing NBS that deliver both ecological outcomes and social co-benefits, aligned with nature- and people-positive objectives.

We invite scientists, practitioners, policymakers, and civil society representatives to share experiences, frameworks, conceptual and practical approaches, and social innovations. The session provides a collaborative space to explore inclusive NBS and identify actionable pathways for integrating social justice, ecosystem services, and transformative sustainability in Europe and beyond.

Goals and objectives of the session:

The session aims to:

- Examine how NBS can be designed to enhance ecosystem services while promoting inclusivity, equity, and empowerment.
- Showcase frameworks, strategies, and examples that integrate ecological and social co-benefits.
- Discuss inclusive governance, participation, and stakeholder engagement mechanisms that support just sustainability transitions.
- Provide actionable guidance, tools, and checklists for implementing inclusive, ecosystem-service-informed NBS.
- Facilitate knowledge exchange and dialogue on transformative NBS interventions that deliver ecological, social, and cultural benefits.

Planned output / Deliverables:

- Co-production of a discussion paper summarizing insights, recommendations, and lessons learned from the session.
- Practitioner-oriented guidance and recommendations for implementing inclusive NBS across multiple ecological and social contexts.

Session format:

We plan to open the session with an introductory note from the session chairs (10 min), followed by 1-2 time slots of 1,5-2 h each (depending on the number of contributors, with presentations of 10 min each), and conclude with a discussion (20 min). Thank you!

Related to ESP Working Group:

[TWG 20 - Equity in ES research](#)

II. SESSION PROGRAM

Room: C1

Date of session: Wednesday, 20 May 2026

Time of session: 9:00 – 16:30

Timetable speakers/session chairs: Diana Dushkova & Olya Ivlieva & Ina Sieber

Time	First name	Surname	Organization	Title of presentation
Round 1: Understanding Justice, Equity, & Inclusion in NBS (concepts, recognition & perspectives: setting the stage)				
9:00-10:40				
9:00-9:10	Diana Olya	Dushkova Ivlieva	Helmholtz Centre for Environmental Research – UFZ Leipzig, Germany;	Introductory note by session chairs

Time	First name	Surname	Organization	Title of presentation
	Ina	Sieber	Kassel University, Germany	
9:10-9:20	Diana	Dushkova	Helmholtz Centre for Environmental Research – UFZ Leipzig, Germany;	Integrating inclusivity, justice, and empowerment in NBS: a practitioner-oriented framework and guidelines
9:22-9:32	Matthew	Kirby	University of Dundee, UK	Inclusive citizen-centred nature-based cities: insights from Urban ReLeaf
9:34-9:44	Enrica	Garau	University of Almería, Spain	Informing inclusive NBS through residents' perceptions and human-nature connectedness in a semi-arid city.
9:46-9:56	Martina	Artmann	Weihenstephan-Triesdorf University of Applied Science, Germany	Listening to more-than-human voices: co-creating ecologically just cities through love letters to nature
09:58-10:08	Naomi	Blumlein	Trinity College Dublin, Ireland	A systematic review to examine the 'subjects' of justice-oriented NBS literature: An exercise in recognitional justice
10:10-10:20	Kirsty	Blackstock	James Hutton Institute, UK	Seeds for co-creating inclusive and just NBS: Insights from 19 European freshwater restoration projects
10:20-10:40	Discussion (1 st round)			
Round 2: Participatory Tools, Methods, and Co-Creation Approaches for NBS (methods and frameworks to enable inclusive NBS design) 11:00-12:40				
11:00-11:10	Syeda Khushnuma	Wasim	Eindhoven University of Technology, the Netherlands	Digital Tools for Co-Creating Urban NBS: A Systematic Review
11:12-11:22	Nicolas	Salliou	ETH Zürich/University, Switzerland	Co-Creating Just and Resilient Peri-Urban Futures: Inclusion and Legitimacy Challenges in Antananarivo, Madagascar
11:24-11:34	Gerd	Lupp	Technical University of Munich	Measuring What Matters: A Participatory Indicator Framework for Assessing the Socio-Political and Socio-Cultural Aspects of NBS
11:34-11:44	Gerd	Lupp	Technical University of Munich	Operationalising Ethics in NBS: A Reflexive Framework for Inclusive Practice from the TRANS-Lighthouses Project
11:46-11:56	Anda	Ruskule	Baltic Environmental Forum – Latvia, Latvia	Engagement of local communities in the development of urban NBS scenarios in three cities in Latvia

Time	First name	Surname	Organization	Title of presentation
11:58-12:08	Sebastian	Scheuer	Humboldt University Berlin, Germany	Co-Designing NBS for Urban Resilience: Lessons from Hué City, Vietnam
12:10-12:20	Viktoria	Khokhlova	HafenCity University Hamburg, Germany	From Vision to Accounting: Participatory Governance and Urban Agriculture as Inclusive Climate and Biodiversity Infrastructure in Hamburg-Öjendorf
12:20-12:40	Discussion (2 nd round)			
Round 3: Governance, Implementation, and Long-Term Stewardship of NBS (scaling, institutionalisation, and evaluation of inclusive NBS) 15:00-16:50				
15:00-15:10	Lidia	Poniży	Adam Mickiewicz University, Poland	Living Labs in Inclusive NBS Governance
15:12-15:22	Agata	Cieszewska	Warsaw University of Life Sciences, Poland	From Methodology to Practice: Implementing NBS in ProAdapt Urban Labs in Minsk Mazowiecki, Poland
15:24-15:34	Natasha	Pauli	University of Western Australia, Australia	Opportunities and challenges for greening urban streetscapes as an NBS for habitat provision, climate change adaptation, and human well-being
15:36-15:46	Raul	Marino	University of El Rosario, Colombia	Water Sensitive Cities in Colombia: Co-creating NBS for climate adaptation and ecosystem restoration in Cartagena, Colombia
15:48-15:58	Mieke	Siebers	Foundation for Sustainable Development, the Netherlands	Value of Nature: The Investment Case for NBS
16:00-16:10	Anna Särnblad	Hansson	Ronneby Municipality / Biosphere Reserve Blekinge Archipelago, Sweden	Supported by Nature – NBS Learning Sites for a Sustainable Baltic Sea
16:12-16:22	Raimund	Kemper	OST – Eastern Switzerland University of Applied Sciences, Switzerland	Collaborative Governance Mechanisms for Post-Implementation NBS Stewardship: Enabling Inclusive and Equitable Urban Transformation
16:24-16:50	Discussion (final round)			

III. LIST OF ABSTRACTS

The first author is the presenting author unless indicated otherwise

1. Integrating inclusivity, justice, and empowerment in nature-based solutions: a practitioner-oriented framework and guidelines

First author(s): Diana Dushkova

Other author(s): Olga Ivlieva, Ina Sieber, Rita Carasco, Jose Ponton Cevallos, Marie Vandewalle

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As societies confront climate change, biodiversity decline, and rising health and well-being challenges, nature-based Solutions (NBS) have increasingly emerged as both a practical tool and a strategic framework to address these issues. However, questions of inclusivity, equity, justice, and community empowerment in NBS decision-making remain insufficiently addressed. This study therefore aims to (1) critically analyse existing NBS frameworks and approaches with a particular focus on inclusivity, equity, justice, and empowerment; (2) explore the interlinkages among these dimensions and examine their contribution to sustainability transitions; and (3) develop a comprehensive, practitioner-oriented framework that integrates recommended actions, measurable outcomes, and adaptive implementation steps.

Using a targeted semi-systematic literature review combined with empirical insights, we identified existing approaches and mapped key knowledge gaps, including the tendency of current frameworks to be fragmented, limited in practical applicability, and insufficiently structured for practitioner use. In response, we propose a clear and practitioner-friendly set of guidelines for NBS researchers and practitioners, designed to ensure the systematic integration of inclusivity, equity, and justice throughout NBS processes.

The study situates inclusive NBS within the context of just sustainability transitions, understood as long-term, structural changes that restore ecosystems while advancing social equity. It identifies three overarching principles: engaging all relevant stakeholders, ensuring an equitable distribution of NBS benefits and burdens, and fostering community empowerment through inclusive, multi-level governance. The proposed framework is organized around four thematic areas of criteria: capacity building, stakeholder involvement, inclusive NBS design, and fair benefit and burden distribution. While acknowledging limitations such as data constraints and context-specific variability, the study provides actionable guidance, including practical actions, outcome-oriented monitoring, reflective considerations, and a checklist, to support the implementation of inclusive NBS as drivers of more equitable, resilient, and transformative sustainability transitions.

Keywords: nature-based solutions, inclusivity, equity, justice, empowerment, sustainable transition

2. Inclusive citizen centred nature-based cities: insights from Urban ReLeaf


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Nature-based solutions (NbS) mitigate contemporary and interconnected urban challenges, including heat stress, air pollution, and a lack of high-quality greenspace, by supplying ecosystem services in built environments. Yet, traditional top-down approaches often fail to integrate local knowledge and citizen lived experiences, limiting the legitimacy of NbS policies, plans and interventions. Using an innovative transdisciplinary approach, Urban ReLeaf, a four-year Horizon Europe project is exploring how citizens, researchers, and municipalities collaborate to collect and apply environmental data to create more equitable, greener, and resilient cities. Campaigns were spearheaded by six pilot cities: Athens, Cascais, Dundee, Mannheim, Riga, and Utrecht, developed to respond to the unique environmental urban challenges being experienced by the cities and their citizens. Focusing on two of these cities (Cascais, Portugal and Dundee, UK) this paper presents how Urban ReLeaf's citizen science approach to



participatory data collection and uptake has been used to inform NbS planning and governance. In Dundee a greenspace perceptions app has been developed to better understand how citizens value and use the city's greenspace. These insights directly inform the city's greenspace and open space strategy and implementation of future NbS. In Cascais novel wearable temperature and humidity sensors and participatory mapping have been used to understand bioclimatic comfort of their greenspaces and the design of NbS in adapting to urban heat stress. In both examples the cities have actively sought engagement with vulnerable communities, including elderly residents and young people in Cascais and highly deprived communities in Dundee. Drawing from these two cases the paper provides transferable methodological, practical and conceptual insights for researchers, practitioners and policymakers showing how inclusive citizen science data can support equitable distribution and supply of ecosystem services. We position citizen science as a key pillar in the transition toward more equitable, greener, and resilient cities.

Keywords: Citizen Science; Vulnerable Communities; Horizon Europe; Participatory research; Transdisciplinary Research

3. Informing inclusive Nature-Based Solutions through residents' perceptions and human–nature connectedness in a semi-arid city

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Nature-Based Solutions (NBS) are increasingly promoted to address climate adaptation, biodiversity loss, and human well-being in cities. However, NBS design often relies on generalized assumptions about urban nature and its benefits to people, paying limited attention to how people perceive, emotionally relate to, and value different forms of nature and its benefits. This oversight may undermine inclusivity, equity, and social legitimacy, particularly in semi-arid urban contexts where ecological constraints challenge dominant "green" imaginaries.

This study provides empirical evidence on residents' perceptions of urban nature in the semi-arid Mediterranean city of Almería, Spain. Using a mixed-methods approach, we identify three dominant narratives of urban nature: (i) an aesthetic–ornamental perspective privileging greenery and visual appeal; (ii) an ecological–functional perspective emphasizing environmental regulation and health-related benefits; and (iii) a desert–arid perspective that values locally adapted dryland ecosystems. While ecological benefits are widely recognized across social groups, the desert–arid narrative, closely aligned with local environmental conditions and identities, remains marginal in prevailing urban planning discourses.

To deepen understanding of NBS social inclusion and engagement, these findings are complemented with analyses of human–nature connectedness and emotions associated with different urban nature spaces, understood as distinct types of urban NBS. Emotional and relational dimensions emerge as critical factors shaping residents' attachment, acceptance, and willingness to engage with nature-based interventions.

By demonstrating how social perceptions, plural values, and emotional connections influence the perceived legitimacy of urban nature interventions, this study highlights risks of exclusion in NBS design. The findings provide actionable insights for participatory and equitable NBS co-creation processes that align ecosystem-related benefits with cultural recognition, empowerment, and climate-adapted urban sustainability in semi-arid cities and beyond.

Keywords: Dryland urban nature, Social values, Narratives, Nature Connectedness, Sustainable urban planning

4. Listening to more-than-human voices: co-creating ecologically just cities through love letters to nature

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Strengthening human-nature relationships is increasingly recognized as a key pathway to more just, liveable, and resilient cities. Yet, dominant anthropocentric worldviews continue to marginalize the agency, voice, and needs of more-than-human urban co-inhabitants. Building on the concepts of human-nature partnerships and resonance, this study explores how creative and relational methods can support more inclusive forms of capturing the various relationships urban residents hold towards urban nature. We conducted a citizen-engagement experiment in Dresden (Germany), inviting urban residents to write love letters to urban nature. From these 121 love letters, we performed a qualitative content analysis to assess two capacities essential for human-nature partnerships: (1) humans' self-efficacy in listening to more-than-human voices and (2) non-human nature's self-efficacy in speaking with its own voice.

First results show that affective, relational, and sensorially grounded descriptions frequently demonstrate a pronounced human capacity to listen to more-than-human voices - expressed through qualities such as openness, slowness, and compassion. At the same time, many letters convey a strong perception of non-human nature speaking with its own voice, for example, by acknowledgments of autonomy, agency, vitality, and sacredness. These two forms of self-efficacy often co-occur in moments described as atmospherically "magical," where participants perceive themselves as addressed by nature while simultaneously recognizing their own ability to attune and respond. Overall, the findings suggest that affective resonance moments can strengthen both listening and speaking capacities within human-nature partnerships, while also coexisting with more familiar restorative effects such as calmness, relaxation, and recovery.

Our findings highlight that affective, imaginative, and relational practices, such as letter-writing to nature, offer a promising avenue to co-create cities that are liveable and just for both human and non-human inhabitants. Such practices amplify nature's voice and strengthen citizens' relational capacities to listen and respond to it.

Keywords: human-nature relationships, more-than-human voices, ecological justice, urban sustainability transformation, relational methods

5. A systematic review to examine the 'subjects' of justice-orientated nature-based solution (NbS) literature: An exercise in recognitional justice

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NbS have observed a significant surge in popularity for their diverse, multi-functional capacities in recent years. This rise, however, has not been without calls for caution. One such call articulates concerns regarding environmental justice. While the ability for NbS to deliver co-benefits across environmental, ecological, social, and economic spheres remains strong, ensuring the outcomes of these co-benefits reach their full and equitable potential is crucial. Without comprehensive justice considerations and mechanisms in policy and governance processes, NbS are vulnerable to the perpetuation and reinforcement of existing inequities.

Recently, research examining the environmental justice aspects of NbS has grown significantly; but who is at the centre of these investigations and discussions is a matter of some debate. A gap in the literature emerges in this regard for which a systematic review was deemed appropriate to explore further. This paper asks who the research 'subjects' of justice are in the context of policy-orientated NbS literature, and perhaps more importantly, who has been left out? To answer this question, subjects of justice are identified and categorised.



Particular attention is paid to the various dimensions of justice i.e., distributional, procedural, recognition, and restorative. Trends in this regard are assessed against NbS typology, subject categories, and policy mechanisms to determine the ways in which justice-orientated NbS research has manifested and where consistencies, disparities, and gaps exist.

In the context of debates regarding the shift towards more nature-positive models, this research provides an important basis for understanding how efforts might most effectively be concentrated to ensure just and equitable outcomes both for humans and nature. It is intended that this research contribute to the ongoing discourse in this area by providing a deepened insight into how justice is considered in planning, designing and implementing NbS in addition to highlighting areas in which future research is required.

Keywords: Nature-based solutions, environmental justice, equity, vulnerability, inclusion

6. Seeds for co-creating inclusive and just nature-based solutions: Insights from 19 European freshwater restoration projects

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Nature-based solutions (NbS) are increasingly promoted as pathways to deliver ecosystem services while supporting just and inclusive societal transformations. Co-creation, that is engaging diverse stakeholders to jointly shape planning and implementation of NbS interventions, is central to these ambitions. However, empirical insights on how co-creation unfolds and under what conditions remain scarce and fragmented.

This study addresses this gap by undertaking a comparative analysis of stakeholder engagement in 19 European freshwater NbS interventions under the MERLIN project against three core dimensions of just transformations – representation, procedural and distribution. Treating stakeholder engagement as the main co-creation mechanism, the study drew on a variety of data sources, including local survey and inclusivity tracker.

The findings show that there was multi-level stakeholder engagement, with some interventions progressing towards more active forms of engagement. While diverse stakeholders were represented, public authorities consistently held influential roles, while community groups were involved at less influential levels. Procedurally, interactive pathways such as workshops and case study boards were widely used. Distributional analysis revealed strong recognition of benefits like flood regulation, water quality, cultural values, but limited understanding of costs and trade-offs, particularly among local stakeholders.

Further analysis highlights a just transformations approach is not straightforward and tensions can emerge. For instance, non-participation and opposition by aggrieved stakeholders emerged as strategies to contest perceived losses, while stakeholders attach differing importance to benefits. Moreover, the process was constrained by policy gaps and resource limitation.

The study recommends eleven key enabling conditions as seeds for aligning co-creation with just transformations, including shared leadership, capacity building and transparency. These should be designed from the outset, tailoring engagement to specific context, while paying attention to interactions between representation, procedure, and distribution. Methodologically, integrating multiple, diverse datasets from NbS interventions implemented at different scales help clarify how contextual factors shape just transformation outcomes.

Keywords: Social justice, just transformations, mainstreaming nature-based solutions, inclusive governance, co-creation

7. Digital Tools for Co-Creating Urban Nature-based Solutions: A Systematic Review

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Urban areas across Europe face growing socio-ecological challenges such as climate change, flooding, biodiversity loss, and public health risk. Nature-based Solutions (NbS) are increasingly recognized as promising approaches to address these challenges while generating multiple co-benefits for people and nature. NbS are interdisciplinary solutions that their successful implementation requires co-creation through inclusive planning processes. Digital tools, ranging from participatory mapping platforms and gamified simulations to immersive virtual reality applications, are emerging as critical enablers of such co-creation. However, their actual roles, limitations, and effectiveness in empowering people to engage in NbS co-creation process remain fragmented and underexplored. This study addresses this gap by exploring the application of digital tools in NBS co-creation through systematically reviewing 44 academic studies. The review applies a comprehensive analytical framework to map how digital tools support different NbS planning phases, communicate plural values of nature, enable varying levels of citizen empowerment, engage different stakeholder groups, and operationalize participation instruments. The findings show that most digital tools are concentrated in the 'create visions and scenarios' and 'assess potential impacts' phases of NbS planning. In terms of empowerment, tools predominantly facilitate 'power-to' dynamics, where citizens act mainly as assessors or contributors to design options, but rarely as decision-makers who shape final outcomes. Despite these limitations, nearly all reviewed tools adopt a participatory co-design mindset that emphasizes inclusivity and dialogue. The findings highlight that the effectiveness of digital tools is highly contingent on facilitation quality, inclusivity, and how nature's role and agency are represented. Additional challenges, including digital literacy barriers, transient engagement, and an overreliance on visualization technologies, underscore the need for careful design and facilitation. The study concludes by outlining concrete directions for strengthening digital NbS tools, including extending their use across planning phases, enhancing citizen decision-making power, and better integrating plural values of nature through appropriate facilitation.

Keywords: Nature-based Solutions, Digital tools, Co-creation, Citizen empowerment, Urban planning

8. Co-Creating Just and Resilient Peri-Urban Futures: Inclusion and Legitimacy Challenges in Antananarivo, Madagascar

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Antananarivo, the capital of Madagascar, is highly exposed to climate risks, notably recurrent floods and increasing droughts. These risks are particularly acute in peri-urban floodplains, where vulnerable populations face compounded social and environmental pressures. Addressing such challenges requires approaches that integrate ecological resilience with social equity and inclusive governance. This study presents an interdisciplinary participatory process aimed at co-creating resilient peri-urban landscapes in a flood-prone area of Antananarivo, combining expertise from geography, agronomy, hydrology, and—originally—landscape architecture.

We implemented a participatory science–design loop that enabled continuous engagement of both local stakeholders and decision-makers throughout multiple stages of the process. Participation tools included household surveys, participatory mapping, visioning workshops, serious gaming sessions, and information meetings. This paper focuses on the analysis of serious game workshops conducted separately with local stakeholders and decision-makers. We carried out a qualitative analysis of game interactions and debriefing discussions to examine how different actor groups perceive risks, responsibilities, and future pathways for peri-urban development.



Results reveal a pronounced legitimacy mismatch embedded in Madagascar's weak state structure. While decision-makers possess formal and legal legitimacy, they exhibit limited democratic and operational legitimacy, resulting in risk-averse behaviour and reluctance to depart from the status quo. In contrast, local stakeholders hold little formal legitimacy but demonstrate strong operational legitimacy rooted in place-based knowledge, everyday practices, and adaptive capacities. Their perspectives align closely with the objectives of the co-design process, emphasizing inclusive, flexible, and resilience-oriented futures.

This case highlights the challenges of navigating inclusion and legitimacy in participatory NBS and landscape co-creation processes in contexts of fragile governance. While decision-makers remain unavoidable due to their institutional power, meaningful engagement with local stakeholders emerges as critical for advancing just and resilient peri-urban futures.

Keywords: Participatory co-design, Nature-based solutions, Legitimacy and governance, Peri-urban resilience, Serious games

9. Measuring What Matters: A Participatory Indicator Framework for Assessing the Socio-Political and Socio-Cultural Aspects of Nature-Based Solutions

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Nature-Based Solutions (NBS) are increasingly integrated into urban and landscape planning as multifunctional strategies to address climate adaptation, biodiversity loss, and social well-being. However, their evaluation remains dominated by biophysical or expert-driven indicators that insufficiently capture social processes, governance dynamics, and place-specific outcomes. We therefore elaborated a participatory indicator framework developed within the TRANS-lighthouses project to support the assessment of co-created NBS in urban, rural, coastal and forest contexts.

To address these gaps, we adopted a participatory, multi-phase methodological approach that embeds indicator development within local realities. The process combined reviews of indicator catalogues with collaborative workshops, webinars, and in-person exchanges involving interdisciplinary researchers, practitioners, and pilot case representatives. Indicators were iteratively identified, filtered, operationalised, and negotiated, ensuring relevance across diverse socio-ecological contexts while maintaining cross-case comparability. The resulting set of indicators followed the five interrelated dimensions of the overall TRANS-lighthouses guiding framework – participatory governance, social, nature, economic, and cultural aspects reflecting the “more-than-green” ambition of TRANS-lighthouses. Rather than biophysical or expert-driven metrics, the framework puts relational, procedural, and experiential aspects of NBS in the foreground, such as inclusivity, learning, stewardship, and reciprocal human–nature relations. A structured combination of mandatory and context-specific indicators enables cross-case comparability while allowing sensitivity to local needs and interests, governance arrangements, and priorities of local communities.

By co-producing indicators with stakeholders, this framework contributes to advancing transdisciplinary evaluation practices for NBS. It demonstrates how participatory indicator development can enhance legitimacy, usability, and transformative potential, offering a transferable approach for monitoring inclusive, just, and context-responsive NBS across diverse governance settings.

Keywords: NBS, Co-Creation, Socio-Political, Socio-Cultural, Indicators

10. Operationalising Ethics in Nature-Based Solutions: A Reflexive Framework for Inclusive Practice from the TRANS-Lighthouses Project

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Nature-Based Solutions (NBS) are increasingly promoted as integrative responses to socio-environmental challenges; however, critical ethical questions regarding human-nature relations, environmental justice, and sustainability governance arise. This contribution explores how NBS can meaningfully give voice to nature, foster care for ecosystems, and support a shift in human-nature relations by integrating diverse ethical worldviews and knowledges.

Grounded in participatory action research and co-production epistemologies, we believe that conceptualizing ethics is not a static normative checklist, but a continuously evolving process embedded within research-in-action practices. The normative core of TRANS-lighthouses is structured around the project's four conceptual dimensions: participatory governance, social, human-nature, and economic dimensions. For each dimension, across the consortium, we co-formulated key ethical questions, challenges, and corresponding principles with recommended strategies.

For the human-nature dimension, we conceptualise ethics as being relational, context-dependent, and inherently political. Rather than treating nature as a resource for delivering ecosystem services, the framework for this dimension centres intrinsic value of ecosystems and advocates for regenerative, care-oriented human-nature relation. Key ethical issues include the risk of reinforcing anthropocentric and extractivist paradigms, the commodification of nature through market-oriented NBS, and the potential for unintended ecological harm or social exclusion under the guise of sustainability interventions.

To address these concerns, the framework articulates a set of ethical principles and strategies centred on ecological integrity, intergenerational justice, and the recognition of nature as a co-constitutive actor in socio-ecological systems. It emphasises the ethical obligation to align NBS with strong sustainability principles, acknowledge ecological limits, and critically interrogate growth-oriented development logics. The framework further integrates the EU "Do No Significant Harm" principle.

The work developed emphasises the importance of shifting human-nature relations by strengthening relational and intrinsic values to support more balanced, ethical, and resilient NBS co-creation processes that reconnect people with nature and reinforce environmental citizenship.

Keywords: NBS, Co-Creation, Ethics, Human-Nature Relations

11. Engagement of local communities in the development of urban NBS scenarios in three cities in Latvia

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Urban ecosystems are complex and adaptable socio-ecological systems that are formed through continuous interaction between nature and people. The societal challenges that cities are facing today due to urbanization, climate change, and environmental degradation require investing in nature-based solutions (NBS). Engagement of local communities in co-creation of NBS is crucial to ensure the well-being of citizens, as well as their understanding and acceptance of the proposed measures.

The co-creation approach to planning of NBS was applied in three Latvian cities – Riga, Cēsis, and Valmiera - to provide an input for development of Urban Greening Plans. Stakeholder engagement was organised as an iterative process, involving a series of workshops, expert meetings, and online participatory GIS surveys to identify green areas in the city that are important to residents and locations



where environmental problems have been observed. An essential part of the co-creation was the participatory scenario-building workshops to identify potential NBS in the selected problem areas in each city, involving residents, schoolchildren, and entrepreneurs from these areas, as well as local government representatives and other experts. All three workshops applied a similar methodology, including site visit and group work, starting with vision development, followed by selection of NBS suitable for the specific site and cost calculations. In addition, participants were asked to complete a short survey before and after the workshop, revealing how their knowledge and understanding of the NBS had changed.

The study was implemented with the support of the LIFE21-CCA-EE-LIFE LATESTadapt project (#101074438) on “Developing and demonstrating portfolio of nature based and smart solutions for improving urban climate resilience in Latvia and Estonia”.

Keywords: co-creation, urban, nature-based solutions, scenario building

12. Co-Designing Nature-Based Solutions for Urban Resilience: Lessons from Huế City, Vietnam

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Climate change-exacerbated natural hazards and extreme weather events are increasingly affecting urban areas worldwide, and pose a significant risk to ecosystems, human health, and livelihoods. Vietnam is considered particularly vulnerable to these trends, experiencing heavy rainfall, storms, flooding, the amplification and chronification of heat stress, and pressure on water resources, urging governance to act to boost urban resilience.

As systemic interventions drawing from social-ecological-technological systems thinking to harness ecosystem services, nature-based solutions (NbS) play a crucial role in sustainably tackling often interconnected societal, environmental and economic resilience challenges. However, the governance of NbS is complex and requires enabling legislation, suitable financing frameworks, and tapping into diverse bodies of knowledge. Co-creation, i.e., the participatory, iterative, reflective, cross-sectoral, inter- and transdisciplinary collaboration and decision-making involving a broad range of actors is often considered best practice in NbS governance. Through the integration of diverse perspectives into NbS planning and design, and by promoting tailored advocacy, facilitating mutual learning, and fostering environmental stewardship, co-design approaches are seen as vital to create inclusive, context-specific, sustainable, just and thus effective and accepted solutions.

Here, based on the case of Huế city, Vietnam, we present experiences drawn from the practical implementation of a process for co-designing NbS at selected public spaces to realize ecosystem services co-benefits for enhancing urban resilience, building on intertwined “entry points” for NbS governance related to scientific evidence, challenge-orientation, and place-specificity. A key focus is on the empowerment of the local community through community engagement, and on local experimentation in the form of “showcases for NbS”. In so-doing, we explore the opportunities and challenges to integrate NbS co-design into the local decision-making fabric that is often still characterized by top-down approaches and limited participation. The presented approach may serve as a blueprint for mainstreaming NbS in other Vietnam cities.

Keywords: urban resilience, nature-based solutions, co-design, climate change adaptation, sustainable development

13. From Vision to Accounting: Participatory Governance and Urban Agriculture as Inclusive Climate and Biodiversity Infrastructure in Hamburg-Öjendorf

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Nature-Based Solutions (NBS) are increasingly promoted as integrative responses to climate adaptation, biodiversity loss, and urban liveability, yet their capacity to deliver socially just and inclusive outcomes depends strongly on how they are governed, designed, and co-produced. This contribution presents the Innovation Area Öjendorf in Hamburg as a practice-oriented case study of co-creating inclusive NBS through urban agriculture, multifunctional landscapes, and participatory planning processes.

Öjendorf is conceived as a large-scale, multifunctional agriculture park that integrates productive land use, biodiversity enhancement, climate regulation, and inclusive public space within a rapidly urbanising context. The project applies a co-creative, scenario-based planning process, bringing together farmers, planners, researchers, civil society, developers, and public authorities to jointly explore alternative development pathways. Rather than prescribing a single blueprint, the process foregrounds spatial flexibility, adaptive governance, and ecosystem service integrity, addressing questions of access, benefit distribution, long-term stewardship, and the balance between professional production and community participation.

Drawing on insights from transdisciplinary scenario workshops and stakeholder dialogues, the paper examines how inclusive governance arrangements enable diverse forms of knowledge, values, and lived experiences to inform NBS design. Particular attention is given to how social equity concerns - such as affordability, accessibility, cultural inclusion, and the recognition of different land-use needs - are negotiated alongside ecological goals like biodiversity enhancement, soil regeneration, and climate resilience. The case highlights both opportunities and tensions, including conflicts between openness and economic viability, and between long-term ecological ambitions and short-term development pressures.

The Innovation Area Öjendorf experience demonstrates that inclusive NBS require not only participatory tools, but also institutional flexibility, trust-building, and iterative learning. The contribution offers transferable insights for cities seeking to align spatial planning, ecosystem accounting, and inclusive urban transformation.

Keywords: Nature-Based Solutions (NBS), inclusive governance, urban agriculture, participatory planning, multifunctional landscapes, ecosystem services

14. Living Labs in Inclusive Nature-Based Solutions Governance

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Nature-Based Solutions (NBS) are increasingly promoted as responses to climate change, biodiversity loss, and declining human well-being through the delivery of ecosystem services. However, translating inclusive NBS frameworks into practice remains challenging, particularly with regard to equitable participation, governance, and benefit distribution. This contribution presents the Living Labs methodology as an empirically tested approach for implementing inclusive, ecosystem-service-informed NBS in diverse real-world contexts.

Living Labs are place-based, transdisciplinary innovation environments that enable sustained collaboration between citizens, researchers, public authorities, businesses, and civil society actors. Drawing on practical experiences and conceptual insights, this contribution demonstrates how Living Labs can bridge the gap between inclusive NBS frameworks and their real-world implementation. Evidence is drawn from three EU-funded projects that apply the Living Labs approach in complementary ways. In IntegrateNBS, Living Labs were utilised to integrate ecosystem services assessment into urban planning processes, supporting municipalities in incorporating NBS into formal governance and decision-making structures. GreenEsteem focused on Living Labs to enhance and translate best practices, experiences and lessons learned from participatory NBS planning and quadruple helix collaboration and create the



conditions for them to be adopted and replicated across different disciplines, sectors, regional and societal contexts

In contrast, NatureScape applied Living Labs at the neighbourhood scale to co-design and test multifunctional NBS, explicitly addressing trade-offs between ecological performance, social needs, and spatial constraints.

Across all three projects, Living Labs enabled early and continuous stakeholder engagement, capacity building, and shared ownership of NBS processes. By using ecosystem services as a common language for dialogue, Living Labs made benefits, risks, and trade-offs transparent and negotiable, supporting fairer distribution of outcomes. The contribution highlights the value of Living Labs for adaptive governance, empowerment, and transformative sustainability transitions. It offers actionable guidance for researchers, practitioners, and policymakers seeking to co-create NBS that are both nature-positive and people-centred.

Keywords: Living Labs, Nature-Based Solutions (NBS), Ecosystem Services, Social Equity and Inclusion, Participatory Governance

15. From Methodology to Practice: Implementing Nature-based Solutions in ProAdapt Urban Labs in Minsk Mazowiecki, Poland

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The Integrate NbS project, implemented within the Driving Urban Transitions programme, aims to develop a methodology for an innovative approach to implementing Nature-based Solutions in cities. The project is based on four case studies that address diverse environmental and social challenges faced by urban areas and explore NbS as potential responses. These include: conflicts between stakeholder groups related to municipal development (Norway); social challenges accompanied by the marginalization of environmental issues (Spain); sector-specific environmental challenges resulting from water scarcity (Sweden); and limited local community engagement in urban transformation processes (Poland).

Across case studies, the urban living lab approach was applied, engaging a broad range of local stakeholders, including representatives of local authorities, businesses influencing spatial development (developers), and active residents. This participatory method aimed to foster collaboration, shared understanding, and co-creation of NbS tailored to local contexts.

The Polish case focuses on city of Mińsk Mazowiecki. Environmental challenges related to ongoing urbanization include stormwater management and air pollution. The living lab process involved a series of participatory meetings designed to increase understanding of NbS and their role in creating a healthy and resilient urban environment, while also strengthening cooperation among stakeholders. To date, five meetings have been held, covering selection of key areas for intervention, and co-design of NbS solutions. Participants planned the co-implementation of these solutions in public spaces as a city square, a school, as well as in a semi-private residential area. The next stages include implementation, evaluation of effectiveness using citizen science approaches, and the development of a roadmap for climate resilience. At the project's midpoint, city authorities have emerged as the most active stakeholder group, viewing broader citizen engagement as crucial for successful NbS implementation. While early benefits of participation are already visible, the long-term sustainability of this urban living lab experiment remains an open question.

Keywords: NbS, local ecosystem services, adaptation to the climate change

16. Opportunities and challenges for greening urban streetscapes as a nature-based solution for habitat provision, climate change adaptation, and human well-being

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Nature strips are underutilised roadside spaces that offer significant potential to enhance urban ecosystem services through nature-based solutions. By transforming these linear corridors into a network of vegetated streetscapes, cities can improve shade provision, wildlife habitat, social amenity, and water infiltration. This presentation synthesises recent socio-ecological research on the conversion of nature strips to native gardens in Perth, Australia, including recommendations for urban policy and planning.

Until ~2010, planting nature strips with anything other than grass was largely prohibited in Perth. Recent policy reversals now allow and encourage greening with native plants. This shift is significant given Perth's location within a global biodiversity hotspot and its exposure to climate change, including a sustained decline in rainfall since the 1970s. As a result, previously neglected nature strips (known locally as 'verges') have become sites of public-private collaboration and co-creation of urban greening, with residents increasingly replacing turf with native plants better adapted to Perth's hot, dry summers. In some suburbs, up to 10% of households have adopted verge greening.

While this trend offers clear ecosystem service benefits, verges remain contested spaces that must accommodate multiple urban functions. Our research provides a comprehensive assessment of the opportunities and challenges associated with citizen-led verge greening. Methods included interviews with key stakeholders and residents, mapping of verge gardens, an online survey of over 400 residents, and social network analysis of verge-greening practitioners.

There is broad agreement among stakeholders on the importance of roadsides for increasing tree canopy cover, reducing urban heat, and fostering social connection and walkability. However, areas of contestation remain, particularly regarding visual amenity, safety, and ongoing maintenance responsibilities. Drawing on these findings, we offer insights into how policy frameworks can better support equitable and accessible ecosystem service provision through nature strip greening in cities experiencing rapid climatic and social change.

Keywords: Nature strips, streetscapes, nature-based solutions, social-ecological systems, urban ecosystem services

17. Water Sensitive Cities in Colombia: Co-creating NBS for climate change adaptation and ecosystem restoration in Cartagena, Colombia

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Coastal cities in the Global South face increasing climate pressures that intensify socio-environmental vulnerabilities, particularly in informal and low-income neighborhoods. Cartagena, Colombia, is emblematic of this challenge: rapid urban expansion, ecosystem degradation, and recurrent flooding threaten both urban resilience and community well-being. This research presents a Water Sensitive Cities (WSC) framework adapted to the Colombian Caribbean context, emphasizing the co-creation of Nature-Based Solutions (NBS) with local communities, institutions, and technical actors. The study focuses on the Policarpa neighborhood, a high-risk settlement affected by inadequate drainage, mangrove loss, and tidal flooding.

The research combines spatial analysis, hydrological mapping, participatory workshops, and scenario-based design processes to assess public space potential for climate adaptation. Using community-driven



diagnostics, we identified critical water-related challenges and collaboratively developed NBS interventions such as mangrove restoration corridors, multifunctional floodable parks, constructed wetlands, and green–blue public space networks. These NBS typologies were evaluated for their capacity to reduce flood exposure, enhance ecosystem services, and strengthen social resilience.

Findings demonstrate that co-created NBS can significantly improve adaptive capacity by reconnecting degraded ecosystems, reducing runoff, and generating public spaces that support social cohesion. The study also reveals institutional challenges, such as fragmented governance and limited maintenance capacities, but shows that participatory methodologies—rooted in local knowledge and shared decision-making—enhance feasibility and long-term stewardship. The Cartagena case illustrates how WSC principles can be operationalized in vulnerable coastal environments to integrate climate adaptation, risk mitigation, and ecological restoration.

The research contributes to emerging debates on urban climate resilience in the Global South by offering a practical, community-centered framework for implementing NBS in high-risk coastal settlements. It highlights the transformative potential of integrating blue–green infrastructure, participatory planning, and ecosystem-based design within broader urban development strategies.

Keywords: NBS, informal settlements, co-design, participatory planning, ecosystem restoration, climate change

18. Value of Nature: The Investment Case for Nature-based Solutions

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With the 2030 Global Biodiversity Framework (GBF) targets approaching rapidly, accelerating action for nature has become critical. Achieving the necessary systemic shift requires new alliances across sectors, supported by a clear understanding of the value of ecosystem services and their role in enabling this transition. Taking an ecosystem services perspective can shed light on which actors deliver these values, who benefits, and how this knowledge can inform innovative financial collaborations for nature restoration through Nature-based Solutions. NbS offer a powerful means to conserve, restore, and sustainably manage ecosystems while reducing physical and transition risks and creating new investment opportunities. NbS can also function as abatement measures that prevent, reduce, or compensate for ecosystem degradation.

This report demonstrates how ecosystem services valuation, through the TEEB classification, can catalyze the scaling of NbS, and outlines practical pathways for public and private stakeholders to collaborate in accelerating progress toward the GBF 2030 targets. Through two case studies, it highlights how such valuations reveal the added value of NbS compared with business-as-usual alternatives. Rather than simply confirming that NbS are beneficial, ecosystem services valuation provides a foundation for structuring public–private partnerships around tangible, place-based value creation. It clarifies the financial architecture needed to support NbS—who contributes what, under which conditions, which values are acknowledged, and which institutional arrangements are required.

Keywords: Nature-based Solutions; ecosystem services valuation; public-private partnerships; investment case


19. Supported by Nature – Nature Based Solution Learning Sites for a Sustainable Baltic Sea

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Supported by Nature is a collaborative project within the international network of UNESCO Biosphere Reserves around the Baltic Sea – Biosphere for Baltic. The project aims to increase understanding of nature-based solutions (NBS) and how they contribute to improved environmental conditions in the Baltic Sea. The long-term goal is that a better knowledge foundation will lead to more frequent and adequate use of NBS in planning processes, as well as land- and seascape management.

The project develops and pilots 17 NBS Learning Sites throughout the Baltic Sea region, focusing on multifunctional wetlands, coastal water habitats, and watercourse restoration. These sites are established through collaborative, multi-stakeholder approaches and function as arenas for 'learning by doing' and 'learning by experiencing', where methods for co-creation, demonstration, and knowledge generation are tested and refined.

At the learning sites, municipal practitioners, researchers, students, NGOs, interest groups, and local communities jointly engage in the design, implementation, and evaluation of NBS. Through a cross-sectoral and participatory approach, the project builds collective understanding of the built-in capacity of nature to mitigate societal challenges.

Key outcomes include increased understanding of NBS, strengthened local capacity for inclusive NBS implementation, and practical methods and good practices supporting more frequent and effective integration of NBS in land- and water-related planning.

Supported by Nature is a core project (2023 – 2026) funded by the EU through the Interreg Baltic Sea Region Programme. The project is led by Ronneby Municipality and implemented by a partnership of Biosphere Reserves, municipalities, universities, and education centres across the Baltic Sea region, including partners from Finland, Estonia, Poland, Germany, Denmark, and Sweden.

Keywords: Nature-based solutions, multi-stakeholder approach, ecosystem services, participatory governance, learning sites

20. Collaborative Governance Mechanisms for Post-Implementation NBS Stewardship: Enabling Inclusive and Equitable Urban Transformation

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This study presents insights from the EU Biodiversa+ NatureScape project (2025–2028). The project focuses on the post-implementation phase of urban nature-based solutions (NBS), examining whether their sustainable contributions to inclusive and equitable urban transformation can be realized.

Urban NBS are widely implemented in cities through development projects, including community gardens, rain gardens, green roofs, and other socio-ecological interventions, to address climate change adaptation and mitigation while delivering a range of ecosystem services to society. However, ensuring long-term justice, equity, and inclusive participation requires moving beyond implementation to examine the critical post-implementation phase. Growing evidence suggests that long-term NBS success fundamentally depends on collaborative governance mechanisms and stewardship approaches during the post-implementation phase. The NatureScape project addresses this critical transition and its challenges, which remain insufficiently explored in both research and practice.

Seven European Transformation Labs (Oslo, Dublin, Riga, Milan, Lisbon, Lublin, St. Gallen) test governance mechanisms designed to bridge critical knowledge gaps in post-implementation stewardship. The research team addresses two central questions: (1) What enablers and barriers shape the post-implementation stewardship of urban NBS? and (2) What governance mechanisms, strategies, and measures enable successful stewardship of urban NBS to realize their potential for inclusive and equitable urban transformation?



Initial findings demonstrate that achieving long-term justice and equity extends beyond co-maintenance. Instead, long-term NBS success requires transitioning from consultation to collaborative management, embedding NBS within institutional frameworks, securing financial sustainability, integrating local knowledge with formal institutions, and fostering dynamic community-led engagement that ensures meaningful participation. Together, these mechanisms position stewardship as a pivotal approach for equitable distribution of ecosystem service benefits and a just and inclusive biodiversity-positive transition.

Keywords: nature-based solutions, collaborative governance, stewardship, post-implementation, equity