ARCADIA

Transformative climate resilience by nature-based solutions in the continental bio-geographical region

Work Package 9
‘Governance, policy and finance’

D9.1– Principles for Just and Equitable Nature-based Solutions and Green-blue Infrastructure

Co-funded by the European Union

The transformative climate resilience by nature-based solutions in the continental bio-geographical region project has received funding from the European Union under the HORIZON-MISS-2022-CLIMA-01 call with Grant Agreement n. 101112737.

Work Package 9
Governance, policy and finance
DELIVERABLE 9.1

Principles for Just and Equitable
Nature-based Solutions and Green-blue Infrastructure

TASK 9.1 PRINCIPLES FOR JUST AND EQUITABLE NATURE-BASED INTERVENTIONS

TYPE: REPORT
LEVEL OF DISSEMINATION: PUBLIC
DUE at MONTH: 12

DATE of RELEASE:

RESPONSIBLE PARTNER: 5 SLU

Version: 1.0

CONTRIBUTORS: 7 WR 2 CMCC 8 CKIC 3 DEDA

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Co-funded by the European Union

Project acronym	ARCADIA
Project full title	TrAnsformative climate ResilienCe by nAture-baseD solutions in the contInentAl bio-geographical region
Call identifier	Horizon-MISS-CLIMA-01
Type of action	Horizon - IA
Start date	1° January 2024
End date	
Grant Agreement n.	101112737

TABLE OF CHANGES

Version	Date	Description	Reference person	Notes

GLOSSARY

Entry	Definition
Nature-based solutions	Nature-based solutions are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social, and economic benefits and help build resilience.
Green-blue infrastructure	Green-blue infrastructure are an interconnected network of waterways, wetlands, wildlife habitats, and other natural areas; greenways, parks, and other conservation lands; working farms, ranches, and forests; and wilderness and other open spaces that support species, maintain natural ecological processes, sustain air and water resources, and contribute to the health and quality of life.
Climate resilience	Climate resilience often refers to the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to a changing climate. It focuses on adaptation but with connections to ongoing mitigation efforts.
Biodiversity loss	Biodiversity loss commonly refers to the reduction of any aspect of biological diversity in a particular area through death (including extinction), destruction or manual removal. It can refer to many scales, from global extinctions to population extinctions.
Sustainability transitions	The field of sustainability transitions involves a mix of definitions but they are often considered processes of structural change towards sustainable societal and technical systems. They can include profound changes in ways of doing, thinking and organising, as well as in underlying institutions and values.
Sustainable development	Sustainable development is considered development that meets the needs of the present, without compromising the ability of future generations to meet their own needs.
Transformative change	There is a diversity of definitions for transformative change and what it entails. In this report, it refers to a fundamental, systemic reorganisation across technological, economic, cultural and social factors, including paradigms, goals and values.
Social justice	An outcome that people perceive as being fair due to adhering to agreed upon principles of recognitional, distributive and procedural justice. It differs from ‘legal’ justice, i.e. obeying formal laws and regulations, and disciplinary actions in case these are not obeyed. Social justice is about achieving equality. However, there are always multiple dimensions on which equality can be assessed. Consensus among all stakeholders and rightsholders (or their representatives) on which dimension(s) are considered how relevant in the given situation should be looked for (but may be hard to attain).
Restorative justice	Restorative justice seeks to repair the harm done to individuals, communities, and ecosystems during past developments or past transition processes. It acknowledges the historical injustices and systemic marginalization that have contributed to the unequal distribution of environmental burdens and benefits. This dimension emphasizes the importance of healing relationships and restoring trust, particularly in communities that have been disproportionately impacted by industrial activities or environmental degradation.
Intergenerational justice	Intergenerational justice focuses on safeguarding the rights of future generations and ensuring that the decisions made by current generations do not harm those who will inherit the planet. In the

	context of climate change, this dimension underscores the importance of designing policies and actions that avoid further environmental degradation and prevent the deepening of social inequalities.
Spatial justice	Spatial justice relates space to society. It can be argued that space matters in searching for a just society, and that geography and space play critical roles in social justice. Furthermore, the equitable distribution of services and resources is a vital human right and that everyone should gain from the development processes and benefits. Overall, spatial justice arises from integrated distributional, procedural, and recognitional justice.
Ecological justice	While social justice focuses on the distribution of benefits among humans, the term ecological justice is about the relationship between humans and the rest of the natural world. To operationalize ecological justice, it has to be clear that the concept is about the claim that all living beings can be holders of justice entitlements. Ecological justice focuses on how humans treat other species.
Multispecies justice	Like ecological justice, multispecies justice challenges the dominance of anthropocentrism in conventional (social) justice approaches and emphasizes the importance of including non-human species and their needs in justice considerations. It does differ from its ecological counterpart, however, as it includes social justice between (future generations of) humans and non-human beings.
Environmental justice	Environmental justice often refers to the conceptual connections and causal relationships between environmental issues and social justice. Furthermore, it aims to treat citizens equally and to also involve them in the development, implementation and enforcement of environmental laws, regulations and policies. Given these definitions, environmental justice may be considered a specific domain to which social justice considerations are applied.
Climate justice	Climate justice is a specific type of environmental justice that addresses the profound inequities related to climate change, emphasizing that those least responsible for its causes are often the most severely affected by its impacts . This ‘double inequality’ - low responsibility for climate change and highly vulnerable to its impacts - indicates the distributive injustices caused by climate change, while also hinting at insufficient acknowledgement and incorporation of the needs and interests of poorer countries.
Recognitional justice	Inclusiveness (related to NbS projects) in terms of who and what are acknowledged as stakeholders and rightsholders in the discussion on what constitutes distributive justice. This also includes which needs and values of these stakeholders and rightsholders are considered admissible to bring to the table in that discussion.
Distributional justice	The extent to which people consider the distribution of costs and benefits (here: related to the NbS under consideration) to be fair, i.e., justified based on principles that they agree with as respecting everyone’s (better: every entity’s) rights and entitlements as well as possible given the circumstances
Procedural justice	The extent to which people consider the process to determine what constitutes optimal recognitional justice and/or distributional justice in the situation at hand as fair. This includes the adherence

	to agreed upon procedures during that process. Note that the establishment of such procedures is subject to procedural justice considerations as well.

ACRONYMS

Abbreviated	Extended
NbS	Nature-based Solutions
GBI	Green-blue Infrastructure
EEA	European Environment Agency
EU	European Union
EC	European Commission
UN	United Nations
SDGs	Sustainable Development Goals
IPCC	Intergovernmental Panel on Climate Change

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Executive Summary

Nature-based solutions (NbS) can play a key role in shaping sustainable futures for cities and regions by contributing to green-blue infrastructure (GBI) and adapting to and mitigating climate change and reponding to biodiversity loss. At the same time, NbS aims to address various social, ecological and economic challenges simultaneously, often referred to as generating co-benefits.

While NbS offers a mix of co-benefits, they can also exacerbate existing inequalities and contribute to exclusion and gentrification, benefiting some privileged groups. Furthermore, human needs are interconnected with those of nature. Hence, nature-based transformations of environments need to safeguard life and aim to improve the living conditions for both nature and humans.

In the collective effort to achieve the Sustainable Development Goals (SDGs) established by the United Nations (UN), NbS can significantly contribute to a better future for all. The European Commission (EC) has incorporated NbS (and GBI) into its missions and key regulations to foster a greener, healthier, inclusive, and resilient Europe. However, the connection between NbS and the concept of justice is largely unknown. In this regard, and to leave no one behind, exploring and addressing the relationships between justice and nature-based transformations is crucial.

In the context of NbS, justice goes beyond mere equality that, typically, tends to standardize the needs of different groups and communities, focusing on the final product and providing an identical service. It also extends beyond merely ensuring the appropriateness of benefits, usually seen as equity. It focuses on the differences in needs and contexts to adapt the final service effectively and respectively. This report considers justice as a broader concept that refers to the fairness of nature-based transformations regarding the results and procedures and, in some cases, tries to tackle the roots of disparities.

Based on this starting point, justice is considered a process-oriented approach in this report that carries a long-term perspective, taking into account the local and regional contexts by recognizing the causes of inequity and imbalances in the governance, planning, design and implementation of NbS. Furthermore, transformative change is understood as fundamental, systemic reorganisation across technological, economic, cultural and social factors, including paradigms, goals and values.

In this report, we encourage a two-step perspective shift to effectively achieve justice through NbS. First, it is crucial to recognize that NbS cannot per se be considered just only due to its nature-based technical function. Second, NbS can only be considered a just approach if it contributes to a fair process and outcome for both human and non-human environments. This report elaborates on driving transformative change by ensuring that nature-based interventions go beyond being only technical solutions and directly address deeper socio-ecological imbalances.

This report investigates principles for just and equitable nature-based interventions, including how cities and regions can use principles or processes behind the development of principles to guide nature-based transformations. The report highlights the critical role of integrating the principles for just and equitable NbS into broader transformative change processes and elaborates on how justice can be more systematically addressed in processes to design, plan and implement NBS, and how this can foster climate resilience.

A starting point for this report involved mapping out the connections between NbS and justice and the overlaps within the ARCADIA project (including different tasks and work packages) as well as national and international projects, the European missions and key regulations, and the SDGs. This process provided a foundation for research activities within this task and a broader understanding of related initiatives.

This report is developed based on a scoping literature review that helped to gain an overview of how justice is defined in different disciplines and discourses in relation to the objective of the ARCADIA project, which is to galvanize climate resilience through NbS. The scoping literature review includes scientific peer-reviewed literature and grey literature such as reports and policy documents.

Since justice is a situational and contextual concept, acknowledging its variety and relativity is essential. Hence, in parallel with the literature review, a case study approach is employed to involve the regions in the ARCADIA project and facilitate a more detailed exploration of key questions to this work around just NbS. The case study approach allowed exploring the conceptuality of how justice relates to NbS and developing a more adaptive understanding of the inter-relations of the two concepts in different settings.

To obtain more detailed and context-based information, the authors of this report arranged focus group dialogues with each region aiming at problematizing, delivering, and improving justice via NbS. Through the focus group dialogues, with 30 representatives of governance and planning authorities from all regions, this report offers a more in-depth understanding of specific and multiple real-world situations of NbS.

This report characterizes justice as a relational, dynamic, and contextual concept with multiple facets that arise through various relationships within a system. The main features of justice, underlining its nature, are recognized as sociality, spatiality and temporality. The features highlight that justice influences and is influenced by individuals and groups in society, by geographical and physical context, and by time (which is mainly about the norms and needs in the past, present and future).

The report also explores the main dimensions of justice to underline its core and vital analytical mechanisms. The main dimensions are distributional justice (fair allocation of resources and benefits), recognitional justice (recognition of diversity in needs, identities and values), and procedural justice (fair participation and decision-making processes), focusing on how justice needs to be endorsed and experienced in every context. This report then refers to different types of justice related to NbS to highlight different justice domains.

This report concludes that there is a critical need for a perspective change on justice (in the regions and beyond), viewing it as a dynamic process rather than a by-product of NbS. Furthermore, this research highlights that to prevent any generation and reinforcement of inequalities, the existing structures are required to be challenged, and embedding justice into every stage of governance, planning, design and implementation is necessary.

To fully engage with how to shape nature-based transformations, this report identifies key drivers of injustice for NbS in the context of transformative change. This report outlines 12 overlapping and

interconnected categories of drivers for unjust NbS that were most often referred to in the focus group dialogues with the regions and identified in the literature review. The drivers for unjust NbS emphasize underlying justice matters, highlighting similarities and contextual differences (see Diagram 1).

Diagram 1: Presenting twelve drivers for unjust NbS

Ambiguity of NbS and justice	Lack of financing NbS and economic inequality	Historical physical, political and social context
Inconsistent planning processes (and design)	Ineffective governance systems and power dynamics	Insufficient assessing, monitoring and sharing knowledge
Incoherent legislation and regulation	Lack of NbS pilot projects and living labs	Lack of dialogue and insufficient communication approaches
Lack of community involvement and trust	Resistance to paradigm shifts toward human-nature harmony	Justice gaps in sustainability frameworks

Overall, this report presents a set of six key reflections – to guide decision-making and implementation processes for NbS in the context of justice.

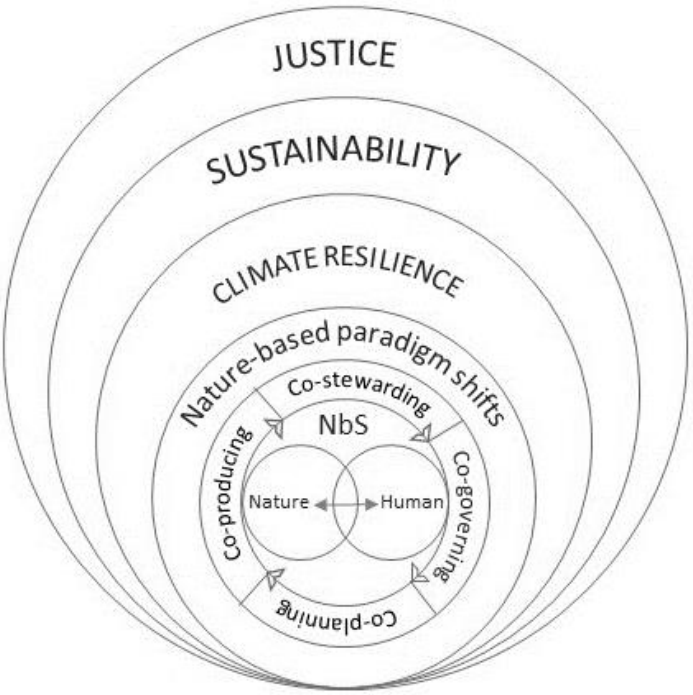
First, findings and lessons on navigating the complex relationship between justice and NbS, and the process to operationalise justice in NbS projects. This elaborates on integrating matters of justice into NbS processes and addressing distributional, procedural, and recognitional justice.

Second, presenting 12 drivers for unjust NbS. This underlines a need to systematically revise the positionality of justice in relation to NbS in governance, planning, design and implementation processes.

Third, providing tentative recommendations of principles to guide NbS. This highlights avoiding a mismatch of expectations among stakeholders. The suggested principles in this report reveal the contextuality and diversity of justice matters and are to be interpreted as guidance for regions rather than strict rules to follow and apply. It provides a tentative overview of how justice can be achieved in climate resilience via NbS depending on place-based meanings and domains.

Fourth, positioning NbS in the context of paradigm shifts. This presents a conceptual framework for applying the justice lens as a common view for creating consistency in sustainability, climate resilience and NbS (see Diagram 2). This, moreover, accentuates NbS to be decided, implemented and scaled up based on multispecies justice, considering humans and nature as interconnected, as well as restorative justice and intergenational justice. It also highlights the need for a significant nature-based paradigm shift that prioritizes collaboration in co-governance, co-planning (and design), co-production (of monitoring, validation and knowledge), and co-stewardship.

Diagrm 2: Situating NbS in the context of addressing paradigm shifts



Fifth, applying spatial justice thinking to NbS to facilitate transformative change. This emphasizes that spatial and physical planning, along with the design of NbS, plays a critical role in promoting and implementing justice.

And finally some remarks concerning nature, marginalized groups, and future generations in NbS. This indicates integrating NbS into transformative change requires recognizing their socio-spatial dimensions and justice-oriented foundations. A justice-centered approach to NbS involves rethinking decision-making processes to include under-represented stakeholders, including vulnerable human populations, non-human species, and future generations.

By embedding these considerations within transformative change, NbS can transcend being only considered technical solutions, and become tools for creating just and sustainable cities and regions. This systemic, justice-oriented integration can contribute to climate resilience that is not only facilitating transformative change but also inclusive, addressing the needs of the most vulnerable while fostering a future where human well-being and ecosystem health are deeply interconnected.

Chapter 1: INTRODUCTION

The ARCADIA project considers nature-based solutions (NbS) through the definition of the European Commission (EC) as inspired and supported by nature, which simultaneously can provide environmental, social and economic benefits, and they can help to build climate resilience (EEA, 2023). Green-blue infrastructure (GBI) is a broader term that refers to green and blue areas and infrastructure. It can be described as a network constituted by a set of core areas and corridors that connect landscapes and natural systems. The EC has the ambition to strengthen European natural systems in order to improve biodiversity and contribute to increased climate resilience and it is therefore providing significant policy and investment support for NbS.

In this report, we focus on how NbS can play a key role in shaping sustainable futures for cities and regions by adapting to and mitigating climate change and its environmental impacts as well as responding to biodeiversity loss. At the same time, NbS aims to also address various social, ecological and economic challenges simultaneously often referred to as generating co-benefits. While NbS offers a mix of co-benefits, they can also exacerbate existing social inequalities and contribute to exclusion and gentrification, benefiting some privileged groups (Sekulova et al., 2021). Therefore, the impacts and possible unintended negative effects of NbS - often referred to as maladaptation (Schipper, 2020) - need to be closely examined.

The Work Package 9 (WP9) in the ARCADIA project - on governance, policy and finance - is focused on how to stimulate inclusive and transparent governance, planning, and implementation processes; build up synergies and policy coherence across water, agriculture, urban, and land management adaptation sectors; and devise financial and business innovation strategies for scaling up impacts and stimulate adaptation of NbS. The activities of WP9 aim to support regional action teams (including participants from local and regional authorities, academia, business and community initiatives) with up-to-date knowledge and methods for policy and governance analysis, policy coherence for sustainable development, and financial and business innovation for the nature-based economy.

One of the many challenges for local and regional authorities is the need to apply governance and planning approaches that ensure NbS and justice go hand in hand, and that NbS simultaneously repair social, economic and ecological deficiencies within and beyond their physical implementation. As such, exploring and addressing the relationships between justice and nature-based transformations in regions is crucial.

Climate change and biodiversity loss are increasing at disturbing rates and they are being recognised as deeply interconnected challenges along with sustainable development. This calls for urgent and significant changes in governance and planning systems in countries and regions (IPBES and IPCC, 2021). However, humans and nature are often considered separate entities in governance and planning practices. But human needs, such as food and health, are interconnected with those of nature, such as habitat (Robinson et al., 2024). Therefore, nature-based transformations of environments need to aim to improve the quality of the environment and, hence, life for both nature and humans, while dealing with climate issues, and ensure not to exacerbate injustices for any humans or non-human species. This requires re-imagining the environment together with its potential and actual inhabitants in a climate-changed world (Castán Broto and Robin, 2021).

For example, when retrofitting urban areas with NbS, it is crucial to support vulnerable groups of people and prevent gentrification and displacement of local communities (Anguelovski and Corbera, 2023) and at the same time, provide support for vulnerable non-human species in the environment, including urban animals and ecologically fragile species (Mottaghi, 2023). Cousins (2024) elaborates on just NbS and argues for a shift of NbS approaches towards just approaches that utilize the power of nature and people together to transform the drivers of socio-spatial inequality into opportunities for socio-ecologically constructed communities. This paradigm shift in the relationship between people and nature reflects a broader evolution in conservation science, which has shifted from "*nature for itself*" to "*nature despite people*", "*nature for people*", and ultimately "*people and nature*" (Mace, 2014). These shifting frameworks in conservation echo the growing recognition in governance and planning that addressing socio-ecological challenges requires integrating human and non-human needs, fostering equitable and resilient communities. This involves re-visiting and considering all structural, systemic and enabling approaches through a lens of justice.

The Sixth Assessment Report (IPCC, 2022) of the Intergovernmental Panel on Climate Change (IPCC) highlights justice as one of the key elements of climate adaptation. Climate change is a justice issue for (at least) three key reasons. First, there are the causes of climate change, including social and environmental inequalities that drive overconsumption, a key source of unsustainable levels of emissions. Second, the impacts of climate change are felt unequally, and disparate impacts will continue to increase in future generations. Third, policies designed to manage climate change can have starkly unequal consequences, and the processes by which emissions and climate adaptation policies are decided tend to exclude the poor and the powerless (Harlan, 2015).

In 2024, the European Environment Agency (EEA) published a flagship document on delivering justice in sustainability transitions, going through EU policies for just transitions, and at the same time acknowledging that the policy framework for sustainability transitions influences regions and their populations differently and may, in some cases, even result in negative impacts. The document presents a conceptual framework for just transitions and highlights several crucial dimensions of justice to consider (EEA, 2024). The three main dimensions are listed as distributional justice (in terms of the benefits and costs), procedural justice (in terms of decision-making processes), and recognitional justice (in terms of diversity of needs and viewpoints) (EEA, 2024).

In addition, restorative justice (in terms of the connectedness of human-nonhuman species and ecosystems over time) is mentioned as an important extent of justice. The framework (see Figure 1) presents three crucial dimensions of justice and their interaction with a set of justice concepts. The five concepts considered are intersectionality (acknowledging diverse situations and circumstances), capabilities (evaluating the differences between groups and their abilities), epistemic injustice (including all forms of knowledge), spatiality (considering the geographic level and scope of policies), and temporality (identifying impacts of policies over time). The EEA (2024: 3) intends to apply this conceptual framework to "develop recommendations to support the design, implementation, and evaluation of just sustainability transition policies that leave no one behind."

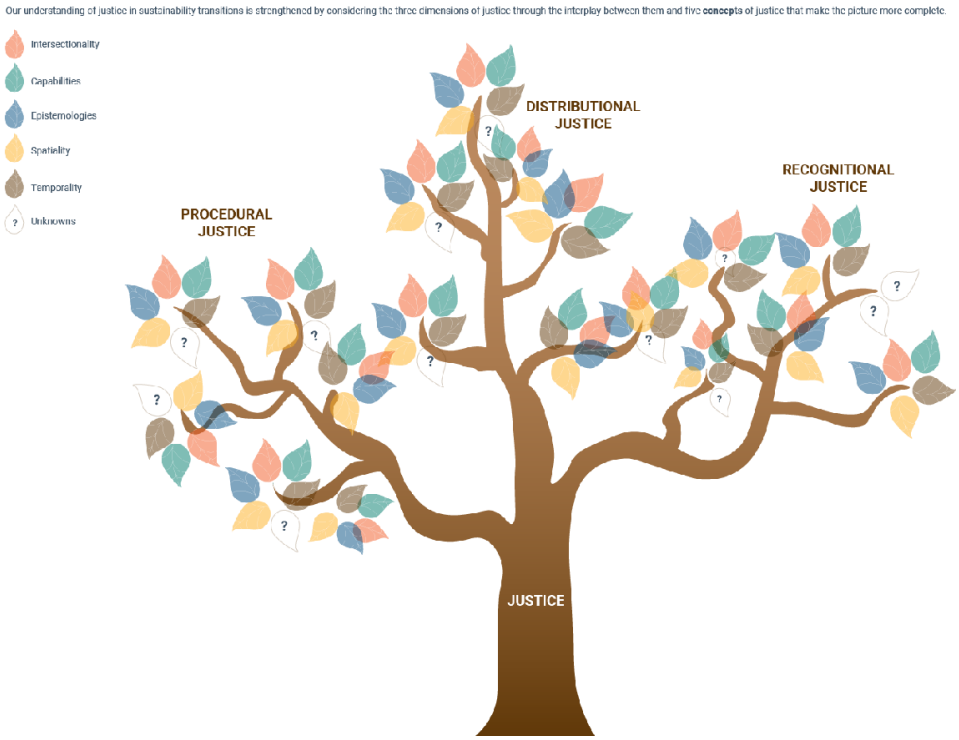


Figure 1: Understanding justice in sustainability transitions
Source: EEA, 2024

This report from the ARCADIA project focuses on investigating what constitutes principles for just and equitable nature-based interventions, including how regions can use principles or processes behind the development of principles to guide the design and implementation of NbS. The overarching goal is to foster inclusive and transparent governance, planning, and implementation processes around NbS. We use the EEA framework as our departure point (baseline) and expand upon it to explore how to understand principles for just and equitable NbS (and related GBI).

In this report, we encourage a two-step perspective shift to effectively achieve justice through NbS. First, it is crucial to recognize that NbS cannot per se be considered just only due to its nature-based technical function. Second, NbS can only be considered a just approach if it contributes to a fair transformation of both human and non-human environments. This report elaborates on driving transformative change by ensuring that nature-based interventions go beyond being mere technical solutions and directly address deeper socio-ecological imbalances.

By integrating these principles into broader frameworks on transitions (often in terms of sectoral changes) and transformations (often in terms of systemic changes), regional action teams can use NbS to promote inclusivity and fairness in both ecological restoration and community empowerment. This approach emphasizes the importance of justice at every stage of planning, decision-making, and implementation. Hence this report elaborates on how can justice be more systematically addressed in processes to design, plan, and implement NBS, and how can this foster regional climate resilience?

Unpacking the objectives of this report

This report elaborates on the link between justice and NbS to contribute to a deeper understanding of how to ensure that all members of society can benefit from NbS and so the scaling up of NbS prevents the creation or worsening of inequalities. In the context of NbS, justice goes beyond mere equality that, typically, tends to standardize the needs of different groups and communities, focusing on the final product and providing an identical service. It also extends beyond merely ensuring the appropriateness of benefits, which is usually seen as equity, and focuses on the differences in needs and contexts to adapt the final service effectively and respectively. We interpret justice as a broader concept that refers to the fairness of nature-based transformations regarding the results and procedures and, in some cases, tries to tackle the roots of disparities. Justice is a process-oriented approach that carries a long-term perspective, taking into account the local and regional contexts by recognizing the causes of inequity and imbalances in the governance, planning, design and implementation of NbS.

The ARCADIA project is exploring climate resilience and transformative change through NbS in general and more specifically in relation to five model regions (see Figure 2), and from a justice perspective to establish a shared understanding of how sustainability transitions can be just or unjust. Here, transformation is understood within the framework of sustainability as "a fundamental qualitative change that often involves a change in paradigm" and requires multiple shifts in meanings, norms, values, patterns, structures, and frameworks (IPCC 2012: 436). However, different interpretations of transformation can influence the decisions and actions that follow. According to Scoones et al. (2020), there are three interconnected approaches to transformation, covering a spectrum of shifts from large-scale changes to grassroots actions. These are structural, systemic and enabling approaches.

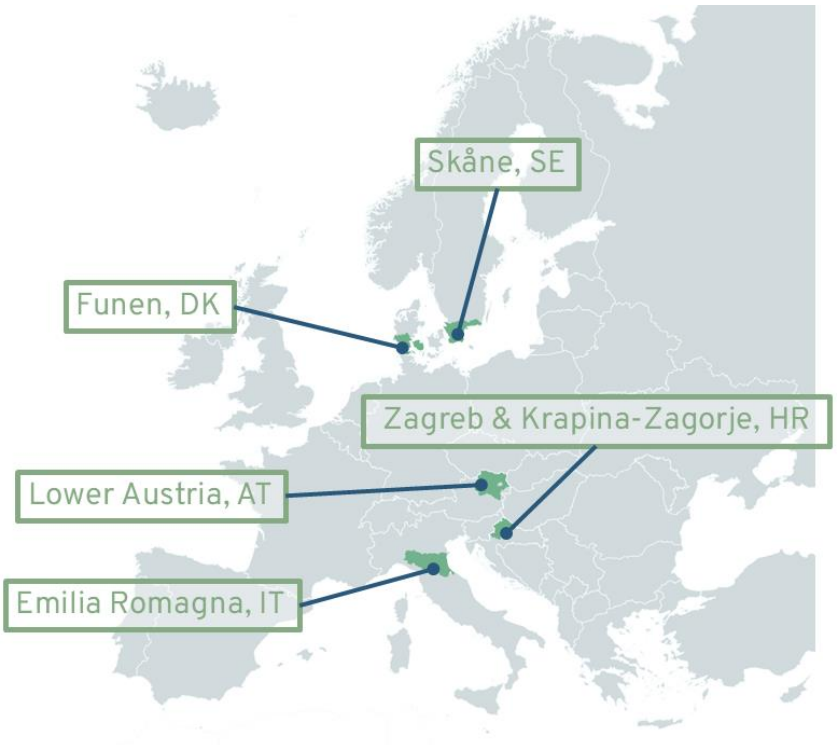


Figure 2: Five model regions in the ARCADIA project

Structural approaches that address fundamental changes in social systems, focusing on deep and systemic changes in economy, politics, and society to reshape social systems such as norms, regulations, and practices. *Systemic approaches* refer to intentional changes in specific parts of a system focusing on the connections and interactions between different features of a system such as elements, levels and drivers. *Enabling approaches* that bring capacity and agency changes, focusing on empowering communities and human actors to deal with uncertainties. Therefore, this report highlights the critical role of integrating the principles for just and equitable NbS into broader transformative change processes. These principles need to encourage NbS that not only address ecological concerns but also consider the socio-economic disparities that may accompany climate resilience efforts.

By embedding justice into every stage of governance, planning, and implementation, we can challenge existing power structures and prevent possible reinforcement of inequalities. This approach emphasizes the need for adaptive and inclusive strategies that recognize the diverse needs and vulnerabilities of different human (and nonhuman) members of the environments in the regions, ensuring that NbS contributes to a resilient and equitable future for all. This report therefore hope to contribute to making nature-based transformations just and effective and ensuring justice is operational. It recognizes and values existing knowledge and the gaps to facilitate justice in practice, making cities and regions responsive to climate change via NbS. This report explicitly focuses on justice as a place-based matter in which problems (types of relationships to be transformed via NbS), processes (production of NbS) , and progress (assessment) are interconnected (Cousins, 2024).

Situating the content of this report

Justice has been a focal point in the earliest definition of sustainable development. In 1987, in the report "Our Common Future" - the concept of sustainable development was introduced as an approach that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987: 16). Although attempts were made to ensure safeguarding justice and social equity aspects of measures applied to promote sustainability transitions, there often is a heavy focus on environmental and economic aspects and justice dimensions have generally received less attention in practice. This report tries to elaborate on the fairness of NbS within larger sustainability transitions and climate resilience frameworks.

Accordingly, this report is not considered a standalone task, but rather part of the ARCADIA project as well as broader frameworks, initiatives, projects and contexts. A starting point for this report involved mapping out the connections and overlaps within the ARCADIA project (including different tasks and work packages) as well as national and international projects, the European missions and key regulations, and the sustainable development goals (see Appendix 1). This process provided a foundation to research activities underpinning this report, and at the same time can help streamline efforts, minimize repetition, and enhance the impact of initiatives while promoting collaboration. It also highlights the potential for this report to contribute to multiple objectives both within and beyond the ARCADIA project.

Chapter 2: METHODOLOGY

This report is developed based on a scoping literature review and a case study approach through focus group dialogues. The literature review helped to gain an overview of how justice is defined from the angle of different disciplines in relation to the objective of the ARCADIA project, which is to galvanize climate resilience through NbS. The scoping literature review includes both scientific peer-reviewed literature as well as grey literature that is more applied and practical, such as reports and policy documents. The literature review helped explore the questions of what justice is as a concept, what are the key dimensions of justice, what is considered a "just transition", how adaptation by NbS can be just, and what constitutes just NbS.

At the very beginning of the ARCADIA project, we realized even if justice as a notion indicates common aspirations particularly of fairness and equity, its dimensions, and implications are influenced by various placed-based parameters. Hence, it is a very situational and contextual concept, and acknowledging its variety and relativity is important. The case study approach allows us to explore the contextuality of how justice relates to NbS and develop a more adaptive understanding of the inter-relations of the two concepts in different settings. A case study approach also facilitates a more in-depth understanding of specific and multiple real-world situations (Creswell, 2013). Case studies provide opportunities for more detailed exploration around how and why questions. They allow investigations with both realistic focus ("assume the existence of a single reality that is independent of any observer") and relativist view ("multiple realities having multiple meanings") (Yin, 2014: 17).

In the ARCADIA project, our case studies are five regions in Europe where we are investigating how justice can be understood and operationalized via NbS (see Appendix 2). In cooperation with partners in the regions, we collected and reviewed existing documents and materials that the regions believe directly or indirectly elaborate on the link between justice and NbS. The regions were asked to respond to two key questions to obtain more information about national, regional or local legal documents and frameworks addressing justice matters. First, they were asked to list key documents, such as policies, guidelines, or regulations, that their municipality or region refers to when integrating justice with sustainable development. And second, they were asked to explain how these documents influence the planning and implementation of NbS projects in their municipality or region?

The documents and reflections the regions shared revealed a huge variety of views on how regions interpret justice in relation to NbS. This revealed the need for more context-based information from the regions and hence, we arranged focus group dialogues with each region. This approach helped understand whether and how people collectively interpret a phenomenon and develop meanings around certain matters (Bryman, 2008). We organised 2-hour dialogues in English (in one case ARCADIA members provided necessary translation), gathering several representatives from regions together and raising discussions through semi-structured questions around justice and its implementation via NbS. Through discussion with governance and planning authorities and in relation to their particular region and circumstances around NbS, we investigated barriers and obstacles to operationalizing justice via NbS. The open-ended questions were designed within three interconnected tracks to stimulate discussions (see Table 1).

Table 1: Key topics and key questions in the dialogues with regions

Key Topics	Key Questions
Problematizing justice (how to understand)	What is justice? How can it be related to NbS? What does just and equitable NbS mean in the context of climate resilience? What does it mean for your organization? And for your region? What are the problems (in relation to justice) that NbS can address or cause (can be at different levels such as local, municipal, regional and European)? When it comes to dealing with justice in nature-based transformations, what deficiencies do you recognize in the existing documents and how can they be addressed?
Delivering justice (how to address)	How can NbS deliver justice? What kinds of principles, strategies, and policies are required? Can you provide examples of NbS projects in your area where justice concerns were addressed or threatened? Please explain the parameters that influenced the results and elaborate on the specifications involved in the process.
Assessing justice (how to improve)	Do you have any experiences from your area regarding the assessment of the implication of justice in practice? What measures are needed to ensure justice considerations are central in nature-based transformations? How to evaluate the achievement of just and equitable NbS in practice?

The conversations were recorded with the consent of participants. First, the need to be recorded was communicated via initial notification in the invitation email, as well as assurance that the data would be processed anonymously. Before starting the dialogue, we also asked for verbal confirmation before starting recording. The talks then became transcribed and analysed for several rounds. The analysis aimed to reveal how the diversity and variety in justice concerns and approaches derived from different case studies can enhance our understanding of justice and its implications entangled with nature-based initiatives. This resulted in a range of focus areas covering a mixture of drivers, insights and principles.

Chapter 3: REVIEW OF THE LITERATURE

What is the state of the art on the concept of justice in NbS in the context of climate resilience? And what does it mean when the regions in the ARCADIA project aim to develop NbS? How can justice be more systematically addressed in processes to design, plan and implement NbS and how can this foster regional climate resilience? To enhance the understanding of justice within the ARCADIA project, this chapter explores key concepts often associated with justice, drawing on the understanding in the literature from various disciplines.

This chapter examines justice in relation to climate change, specifically regarding justice in both adaptation efforts and resilience-building, as well as justice concerning environmental quality and the importance of nature. Moreover, the chapter also considers justice in the broader sustainability context. The goal of this chapter is to identify common elements across justice-related concepts while also noting their differences. This can help regions involved in the ARCADIA project grasp the nuances of justice that are most relevant to their specific circumstances (see Table 2).

Table 2: Unpacking the foundations, features, dimensions and types of justice

Parts of justice	**Elements of justice**
Foundations of justice	Justice Equity Equality
Features of justice	Sociality Spatiality Temporality
Dimensions of justice	Distributional Procedural Recognitional
Types of justice (relevant to NbS)	Social justice Restorative justice Intergenerational justice Spatial justice Ecological justice Multispecies justice Environmental justice Climate justice

Foundations of justice

Justice is a concept frequently invoked by those seeking to address inequality or unjust situations. Terms such as equity, and equality are often used interchangeably, yet their meanings differ significantly (e.g., McCauley, 2018). Understanding these distinctions is essential. Inequality typically refers to a situation where certain groups of people have unequal access to opportunities, which increases their risk of being left behind. In contrast, equality refers to offering the same tools and support to all people, regardless

of their initial circumstances. This approach, however, might still leave some people without adequate support, as it overlooks differing needs and starting points.

Equity, on the other hand, involves providing customized tools and support to ensure that everyone can access the same opportunities. Justice, by contrast, seeks to transform the system itself, ensuring that everyone has equal access to opportunities (European Environment Agency, 2024). Given that these terms are often used together, it is crucial to define them clearly and apply them appropriately in each specific context. Doing so will help engaged stakeholders align their visions for a resilient future and clarify how policies and actions can contribute to a just transition towards climate resilience through NbS.

Features of justice

This report characterizes justice as a relational, dynamic, and contextual concept with multiple facets that arise through various relationships within a system. The main features of justice, underlining its nature, are recognized as sociality, spatiality, and temporality. The features highlight that justice influences and is influenced by individuals and groups in society, by geographical and physical context, and by time (which is mainly about the norms and needs in the past, present, and future). These features are fundamental building blocks for justice in relation to NbS.

Justice goes beyond these features, emphasizing the interdependence of actors, time and environments. The relationality of these features highlights how relationships shape meanings, identities, experiences, and opportunities, influencing the distribution of resources and power within societies. Relationality is particularly relevant to justice frameworks, as it draws attention to the ways in which different structures influence interactions and outcomes. In this context, understanding relationality provides a foundation for addressing systemic inequities and fostering inclusive justice processes.

Sociality of justice

Sociality of justice partially refers to the degree to which individuals interact and form social impacts and relationships. It encompasses behaviors, structures, and systems that support social interaction and cooperation. The social nature of justice shows that it involves not only providing and receiving benefits, but also fostering harmonious and equitable relationships within society. In the context of climate change it also illuminates how communities take part, engage with, and benefit from adaptation and mitigation interventions. In the context of climate change, the sociality of justice has a lot to do with intersectionality of justice.

Intersectionality refers to the way in which social groups are affected by climate change and its mitigation measures in multiple and overlapping ways. Key intersections include gender, class, ethnicity, age, race, and (dis)ability. For instance, individuals who belong to more than one marginalized group—such as low-income women or elderly people of color—are often more vulnerable to the impacts of climate change. The inequalities faced by these groups often reinforce one another, a phenomenon known as the Matthew Eeffect (DiPrete & Eirich, 2006; Gancheva et al., 2023), where those who are already disadvantaged experience greater cumulative disadvantages over time.

Spatiality of justice

The NbS approach leads to diverse environments, typically found in green or blue spaces such as parks, urban gardens, ponds and wetlands. Those (spatial and physical) environments are indeed socially produced and shaped by human activities. At the same time the interpretation of NbS is actively (re)shaped by its materiality and via economic, political, and cultural norms and forces. However, space does not emerge in isolation and with a neutral background to just embrace the events (Lefebvre, 1991). Lefebvre presents a conceptual triad of space to highlight the social dimensions of space and the fluidity of zero space and where power, concepts, norms, and meanings are intertwined. Perceived space (spatial practice) refers to the physical and material aspects of space in terms of how the space is perceived in everyday life.

This includes how space is used and organized by routines and norms and where daily activities and repetitions, such as working and commuting, take place. Conceived space (representations of space) refers to an abstract understanding of space and reflects dominant structures and ideologies. This dimension of space is more technical and conceptual, imagined and defined by professionals such as engineers, urban planners, and architects. Lived space (representational space) is beyond the two mentioned dimensions and allows individuals (and communities) to develop attachments and symbols to physical places. This dimension of space relates to the meanings and experiences (i.e., creating memories and feelings). Therefore, NbS can also be viewed as spaces that are socially shaped and produced by specific decisions and processes, which in turn influence their character, meanings and use.

Temporality of justice

The concept of justice is also a temporal concept. What is perceived as a just decision, intervention, or action now may be viewed as unjust in a different situation. Furthermore, justice often focuses on present generations of humans, while other more inclusive types of justice more often pertain to who (and what) should be taken into account beyond these present generations, like future generations (a specific type of intergenerational social justice) and past generations (a specific form of restorative social justice). When addressing justice, it is crucial to consider the temporal dimensions involved. This encompasses the distribution of impacts across generations and decisions related to safeguarding resources for future generations, often referred to as intergenerational justice. Additionally, it requires reflecting on the harm inflicted on previous generations and implementing processes to acknowledge and compensate for past injustices, which is known as restorative justice (Robinson and Carlson, 2021; McCauley and Heffron, 2018).

Dimensions of justice

Justice is often thought of as ultimately being about the distribution of outcomes. Principles regarding what constitutes a fair distribution are referred to as distributional (or distributive) justice. However, there are many different aspects on which the fairness of a distribution may be judged. Acknowledging those aspects requires broadening the understanding of justice. Justice goes beyond just the uneven distribution of environmental harms and benefits. It needs to include the fairness of procedures (which encompasses aspects such as regulation, inclusion in decision-making, and access to environmental information. Additionally, it examines the dynamics that reproduce various forms and experiences of injustice, emphasizing the importance of individual and social recognition (Schlosberg 2003; 2004; 2007).

This report refers to the main dimensions of justice to underline its core and vital analytical mechanisms. The main dimensions are distributional justice (fair allocation of resources and benefits), recognitional justice (recognition of diversity in needs, identities and values), and procedural justice (fair participation and decision-making processes), focusing on how justice needs to be endorsed and experienced in every context.

Which dimension(s) should be considered as being most relevant in a given situation is open to discussion. This discussion itself and the decisions to which it leads with regard to what constitutes a fair distribution should be considered fair as well (which is the realm of procedural justice principles). It also needs to be decided who and what should/can take part in it, directly or by way of representation. This also includes which of their needs and values are considered legitimate and therefore need to be acknowledged in the discussion. The inclusiveness aspect of the process is the realm of recognitional justice considerations. Note that the decisions on who are considered stakeholders and rightsholders and who not are subject to procedural justice considerations as well (as are the procedures themselves). However, these three dimensions of justice are not interchangeable but interconnected in a nonlinear system.

Distributional justice

Distributional justice deals with how the costs and benefits of transitions are divided among different groups. It aims to ensure that the benefits of transitions are distributed equitably, while ensuring that no one is left behind. This dimension is crucial in addressing the disparities that arise from unequal access to resources and opportunities during transition processes. Addressing such inequalities requires transitions to actively minimize societal costs while maximizing the benefits for all.

Distributional justice also involves ensuring that transitions do not exacerbate existing inequities and therefore connects to the concept of maladaptation. Maladaptation is about measures, like NbS, that may aggravate the situation for some or all social groups. A commonly cited example is green gentrification, which can occur when improvements to the environment via NbS result in increased property values and rents, pushing lower-income residents out of their houses (Haque, 2024).

When operationalizing distributive justice in transition processes for climate resilience, commonly used tools and methods often involve GIS-based social vulnerability indices that assess the locations of groups most affected by climate change. These GIS maps provide decision-makers with a clearer understanding of the populations at risk of bearing the greatest burden from climate impacts. By identifying vulnerable groups, these maps can inform the initiation of engagement processes to better understand their specific needs and challenges, particularly in relation to adaptation solutions like nature-based interventions.

Tools such as climate vulnerability and capacity analyses can offer deeper insights into existing capacity gaps, guiding the selection of effective and tailored solutions to ensure fair and equitable adaptation processes. Additionally, tools like distributional impact analysis can be used to assess, ex-ante, the potential effects of proposed policies and measures on different social groups. This information can enable policy-makers to prioritize actions that deliver the greatest benefits to the most vulnerable or deprived population segments, ensuring that climate resilience efforts are both effective and just.

Ideally, the tools for distributive justice should incorporate participatory planning and co-creation methods, leveraging the knowledge, perspectives and experience of all stakeholders to develop solutions that reflect diverse perspectives and meet their needs, which are the topics that procedural and recognitional justice, explained below, are about.

Procedural justice

A fair distribution is usually considered important, but what constitutes a fair distribution is open to discussion. Being able to participate (or adequately represented) in that discussion in a respectful way, including trusting that one's input is taken into account (to feel heard), may help to be convinced that the outcome of the discussion (and ensuing actions) results in the most fair distribution possible in that situation. Thus, distributive justice is important, but that a (fair) process helps to decide and reach consensus on what a just distribution looks like in the case at hand. If the process for deciding what constitutes a fair distribution is considered to be fair, the distribution that is decided upon is fair (or as fair as it gets), almost by definition.

Procedural justice focuses on the fair and inclusive engagement of all relevant stakeholders in the decision-making processes. It ensures that all needs and interests— particularly those of marginalized and vulnerable groups — are heard and considered when shaping policies and measures that affect their lives. This justice dimension stresses the need for transparent, inclusive, accessible and participatory processes that empower people to have a say in decisions that directly impact them. In the context of climate and environmental transitions, procedural justice ensures that decision-making processes are aligned with democratic principles, allowing for meaningful participation by all stakeholders.

An essential starting point in operationalizing procedural justice in climate resilience transitions is the thorough mapping and analysis of stakeholders likely to be affected by both climate change and the proposed NbS. This involves not only identifying relevant stakeholders but also analyzing their stakes, perceptions, values, roles, power and resources for action or influence in the decision-making, which is closely related to recognitional justice. Such an analysis is crucial for determining who should be actively involved in the decision-making processes and who should be consulted or informed. Understanding these dynamics helps ensure that key stakeholders, especially those who can be marginalized or vulnerable, are included in the planning and implementation phases of the NbS.

In addition to stakeholder mapping, participatory planning and co-creation methods are vital for ensuring inclusivity and fairness in the design of climate resilience strategies. These methods can enable the co-design of solutions by bringing diverse stakeholders together to share knowledge. A critical aspect of participatory planning is ensuring that all participants have access to the same information and data and that communication occurs in a form that is universally understood. This often includes the multi-use of tools like spoken and written wording, supported by visualizations such as drawings and maps, to facilitate clear and meaningful dialogue. Using accessible communication methods ensures that participants from different backgrounds, with varying levels of expertise, can engage effectively in the process.

For those not directly involved in the participatory planning process, other methods like citizen assemblies and forms of deliberative democracy can play a role in ensuring that a broader audience is kept informed and has opportunities to contribute. These platforms can help to balance power dynamics,

especially during critical decision-making stages, and ensure that a diverse set of voices are heard. In particular, they offer a way for these groups to influence outcomes, even if they are not directly engaged in the more hands-on aspects of planning.

One other helpful tool for decision-making in these processes is Multi-criteria Decision Analysis (MCDA), which can support the evaluation of different climate resilience options based on multiple criteria, including social, environmental, and economic factors. MCDA, when combined with stakeholder participation, encourages the integration of perspectives and priorities of various stakeholders during the evaluation of possible solutions. This method helps ensure that the final decisions are not only technically sound but also socially acceptable and inclusive.

To ensure that gender and social inclusion are addressed, Gender and Social Inclusion (GESI) frameworks are often integrated into participatory processes. These frameworks ensure that gender considerations and other social factors, such as age, ethnicity, and economic status, are explicitly considered throughout the design, planning, and implementation phases of climate resilience projects. GESI frameworks can help to promote inclusivity, making sure that women and marginalized groups have meaningful opportunities to participate in decision-making.

It is common for tensions to arise during participatory processes, especially when value conflicts between stakeholders surface. In such cases, consensus-building and conflict resolution methods become crucial. These tools provide structured approaches to resolving conflicts and building consensus among stakeholders with differing or conflicting interests. Consensus-building can ensure that decisions are reached through fair and inclusive dialogue rather than being imposed by the most powerful actors in the process. Conflict resolution methods can help to ensure that procedural justice is maintained, even when difficult decisions are needed, fostering trust and long-term cooperation among stakeholders.

Recognitional justice

Recognitional justice should be the starting point of any transition, as it involves identifying individuals and groups and respecting not only the legal rights, but also the values and needs of these individuals and groups affected by transition processes. This dimension stresses the importance of acknowledging the socio-political and cultural contexts of all groups and in particular marginalized communities, which are often underrepresented in decision-making processes. It requires the recognition of both direct and indirect climate change impacts on these groups and their ways of life as well as the recognition that these groups can have different needs and requests with regards to NbS.

Marginalized groups, such as indigenous populations, low-income communities or migrants are frequently overlooked in transition planning. As a result, they can bear disproportionate costs of change without reaping the benefits. Recognitional justice demands not only awareness of these groups but also respect for their cultural differences and differing social contexts. It aims to ensure that decision-makers and policy-makers understand and mitigate the structural reasons for their underrepresentation and their vulnerability.

The development of tools and methods for recognitional justice is quite advanced with regards to the inclusion of indigenous people in resilience processes. In the ARCADIA project, we can learn from these approaches and apply them in regional climate resilience processes on NbS. One commonly used

method is cultural mapping, where the landscape and surrounding ecosystems are mapped in terms of their significance for the social groups. Another approach is ethnographic research and participatory appraisal to better understand the perceptions, values and knowledge systems of such marginalized groups.

Regognitional justice can tackled via a care-based approach, which focuses on relationships between people and shows how relationships between people have changed over time. Ethics of care is recognized as a practical approach to addressing recognitional justice, drawing attention to the overlooked areas of justice, and avoiding misrecognition (i.e. Preston and Carr, 2018). The ethics of care has been entered into the field of research as a feminist approach defined which Joan Tronto in her work with Fischer defines as "a species activity that includes everything we do to maintain, continue and repair our "world" so that we can live in it as well as possible. That world includes our bodies, ourselves, and our environment, all of which we seek to interweave in a complex, life-sustaining web" (Fischer et al., 1990: 34) . Puig de la Bellacasa (2017: 5) explained care as understanding tensions and relations concealed in contextual situations and material conditions. Scholars in sustainability governance, planning, and design have recently broadly referred to care as a lens to question the dominant concepts, standards, and assumptions.

Research not only highlights a worldwide need for multi-species care and support for life but also the importance of local and contextual relations of care (e.g., Mottaghi, 2023; Power and Williams, 2020; Jacobs and Wiens, 2024). Moriggi et al. (2020a and 2020b) refer to a care lens to emphasize practitioners' moral agency and argue for a care-based approach to reconsidering sustainability frameworks, which excessively focus on technological aspects and reframe them with more social and ecological accentuations. Williams (2016: 830) approaches justice and care through a relational social ontology, and by introducing the term care-full justice, she tries to capture the potential care-justice relationships in practice. "With care considered alongside justice, we are able to acknowledge the role of practices such as nurturing, listening and support in repairing worlds, which are often undervalued and we are able to make visible the "implicit activisms" and everyday practices that contribute to care/carelessness and justice/injustice. Understanding care and justice as interdependent ethics enhances our ability to critique and explore how the urban is brought into being as caring or just at particular moments".

Kotsila et al. (2020: 12) argue that NbS (urban gardens in their case) can be transformed into initiatives focused on solidarity, sustainability, and justice through relationships that are put into action and supported by both "tangible and intangible materialities of care". The care-based approach is focused on integrating the different cultures, values and situations of the people engaged. It also acknowledges that some people depend on other groups and are interacting with each other, jointly affecting their capabilities, as for instance children who depend on their parents (Mottaghi et al., 2020). Understanding NbS with help of the care-based approach can be about looking into the changing relationships between people and with the environments, to assess if these relationships become more nurturing and enabling, or more dependent and limiting.

The three dimensions of justice mentioned above are commonly used, as have been introduced by Schlosberg with his trivalent approach to justice (Walker et al., 2024; Law et al., 2018; McDermott et al., 2013). These three dimensions have been integrated into major climate frameworks. However, while

frequently cited in literature, these dimensions are rarely examined in relation to one another (Walker et al., 2024; Swanson, 2021). Mohtat and Khirfan (2021) argue that injustices often emerge when one or more of these dimensions is absent in adaptation efforts.

Different types of justice

This report refers to different types of justice to highlight different justice domains. Different types of justice arise from specific needs of particular contexts and focus on contextual applications of the justice features and dimensions. Based on how justice features and its dimensions are prioritized, interacted with, or emphasized as well as in which context, multiple concepts of justice have emerged and they have been so far discussed in the scientific literature particularly in relation to climate change.

Social justice

Social justice is about what people perceive as being fair. It differs from legal justice, as laid down in laws and regulations, and its associated procedures (Sadurski, 2011). In some cases, people may consider the legal justice system to be fair, whereas in other cases they may perceive it as being unfair, e.g., because it is seen as favoring those in power and/or the already wealthy. Social justice itself is predominantly about equality, in whatever shape or form (Sen, 1980). There are many dimensions on which equality may be considered (Heyen, 2021). Inequalities on one dimension can be considered acceptable if they can be justified, usually by pointing out that they promote equality on another dimension that is considered to be morally more relevant. However, not all inequalities that are voluntarily accepted, are considered to be fair. Likewise, fair outcome distributions may not be accepted by all parties involved, usually because the outcome is considered (fair but) highly unfavorable by one of the parties. However, if the distribution of outcomes is considered fair by all parties involved, this increases the probability that it will be accepted, and no conflict will arise over it (Tyler, 2000). In this way, respecting social justice principles contributes to the sustainability of societies. Hereafter, we use the term justice as short for social justice, unless otherwise stated.

Sociality of justice is closely tied to the concept of social justice, as the way people interact with one another can significantly impact equity and fairness within a society social justice is often considered to refers to the equal distribution of wealth, opportunities, and privileges among groups of people, with privileges being defined as special rights, advantages, or immunities granted or available to a particular person or group. In other words, social justice is closely related to the distributive dimension of justice. Social justice is about ensuring entitlements are respected for everyone. This brings the question what a person is entitled to, or considers him-/herself to be entitled to from their perspective. The literature indicates that it is often referred to basic human rights are often referred to as the bottom line. Other approaches, like Nussbaum's capability approach to social justice go beyond human rights and identify central capabilities (see Nussbaum, 2007) or focus on realized outcomes (see Robeyns, 2017). However, usually even in such capability approaches there is allowance for inequalities in realized outcomes, for example because of individual differences in what is thought of as having a good life.

There are also approaches related to social justice that are about deservingness depending on voluntary behavioral choices affecting one's contribution in producing valued outcomes, and thereby a matter of proportional equality, i.e., a distribution of outcomes in proportion to one's contribution (Heyen, 2021).[2] In such deservingness approaches differences in one's capacities to contribute can be taken into account or not. Finally, Tyler (2000) concludes that "outcomes are less central to the feelings and

actions of the individuals who receive those outcomes than is supposed by theories of distributive justice". In other words, it is not only about the outcomes, it is also about the process. What is fair in a given situation usually is not obvious, given who (and what) should be involved/represented (stakeholders- and rightsholders), whether and to what extent pre-existing inequalities and asymmetries should be taken into account and which rules should subsequently be applied.

Spatial justice

Spatial justice relates space (which, according to Lefebvre, has social content) and society. In the book Seeking Spatial Justice, Edward Soja (2010) claims that space matters in searching for a just society. He argues that geography and space play critical roles in social justice and highlights that the equitable distribution of services and resources is a vital human right and that everyone should gain from the development processes and benefits. Ali Madanipour et al. (2022) employ the concept of spatial justice to explore the territorial cohesion policy in the EU concerning regional disparities and inequalities within the EU. They differentiate it from social justice, emphasizing, "Seeking spatial justice takes nothing away from the search for social justice. It adds to it" (Soja, 2011: 262). They argue that territorial cohesion needs to consider the spatial aspects of justice (which involves integrating distributive and procedural justice and avoiding their separation) and addressing inclusion (which requires a relational understanding of social and spatial inequalities within and across the regions).

Pries (2022) explores how planning practices can promote justice. He argues that standards can effectively translate and implement spatial justice into planning processes, facilitating some complex and multi-scalar decision-making. However, he highlights the limitations and significant challenges posed by the technocratic nature of these standards such as difficulties in addressing more complex and less tangible needs and preventing less technically skilled groups from effectively influencing the planning process. Yazar and York (2023) underscore the importance of NbS in promoting collective actions and enhancing spatial justice. They conclude that NbS creates engagement opportunities for marginalized groups to gain recognition and socio-political agency and resist dominant economic and political models. Overall, spatial justice arises from integrated distributive, procedural, and recognitional justice.

Restorative justice (past time dimension)

Restorative justice seeks to repair the harm done to individuals, communities, and ecosystems during past developments or past transition processes. It acknowledges the historical injustices and systemic marginalization that have contributed to the unequal distribution of environmental burdens and benefits. This dimension emphasizes the importance of healing relationships and restoring trust, particularly in communities that have been disproportionately impacted by industrial activities or environmental degradation.

Restorative justice often takes the form of compensation for past harms, whether through financial payments, job retraining programs, or the restoration of degraded environments. However, restorative justice can go beyond mere compensation. It also aims to rebuild relationships and foster collaboration among all affected parties, creating opportunities for mutual learning and shared understanding of the harm caused. This relational approach to justice is particularly important in fostering long-term cooperation and ensuring that past mistakes are not repeated.

Intergenerational justice (future time dimension)

Intergenerational justice focuses on safeguarding the rights of future generations and ensuring that the decisions made by current generations do not harm those who will inherit the planet. In the context of climate change and NbS, this dimension underscores the importance of designing policies and actions that avoid further environmental degradation and prevent the deepening of social inequalities. Nature-based interventions, in particular, must be developed with a forward-looking perspective, ensuring that they meet the needs of future generations. NbS. These solutions should therefore either be adaptable to future challenges or designed to address long-term sustainability.

Intergenerational justice is closely intertwined with all other justice dimensions, as it requires that distributional, procedural, and restorative measures not only be fair to current populations but also take into account their long-term implications, ensuring lasting equity and environmental resilience. Intergenerational justice can, therefore, be considered as a specific focus within recognitional justice. It is about recognizing the rights of the future generations to a livable planet and the preservation of resources. This intergenerational aspect is a key ethical concern in justice in climate change, highlighting the duty to preserve the environment for those who come after us.

Ecological justice

While social justice focuses on the distribution of benefits among humans, the term ecological justice is about the relationship between humans and the rest of the natural world (Low & Gleeson, 1998; Wienhues (2020). To operationalize ecological justice, it has to be clear that the concept is about the claim that all living beings can be holders of justice entitlements including the broad spectrum of life such as sharks, pine trees, seahorses or foxgloves. Ecological justice focuses on how humans treat other species. Specific for ecological justice is that, like future generations of humans, other living beings cannot represent themselves. In processes determining what is just, their entitlements have to be defended by human advocates. Wienhues (2020: 5) considers ecological justice to be informed by discussions on the intrinsic value of nature. This often includes a moral value to nature's right to exist (see also IPBES, 2022).

Multispecies justice

Like ecological justice, multispecies justice challenges the dominance of anthropocentrism in conventional (social) justice approaches and emphasizes the importance of including non-human species and their needs in justice considerations. It does differ from its ecological counterpart, however, as it includes social justice between (future generations of) humans and non-human beings (Treves et al, 2019).

In light of this, multi-species justice challenges the traditional division between humans and ecosystems, the so-called "extractive approach" to nature (Ojeda et al., 2022), a dichotomy deeply embedded in Western thought over the past centuries (Descola, 2006). This perspective, which naturalizes the view of nature as a resource for exploitation (Rees & Doyon, 2023), is also reflected in the concept of the Anthropocene, highlighting humanity's capacity to drive geological changes (Crutzen & Stoermer, 2021).

In recent decades, numerous studies have contested this assumption, questioning the idea of modernity as grounded in a strict dualistic opposition: humans as active subjects versus non-human beings as

objects of human action (Latour, 1993). These critiques advocate for a "more-than-human" relational framework, which takes into account multispecies entanglements in sociality networks (Tsing et al., 2017) as recognized in centuries of traditional ecological knowledge (Berkes, 2017) aiming to the acknowledgment of agency beyond humanity (Tsing, 2014).

In this context, Ingold's (2000) innovative concept of "relational thinking" reconceptualized human, society, and environment as interconnected entities that exist within a continuous network of relations, paving the way to a critic of the concept of Anthropocene itself (Haraway et al., 2015; Moore, 2016). Non-humans, rather than being passive objects, are instead seen as active participants in shaping the world alongside humans: they co-create phenomena like climate change, which blur the boundaries between human actions and environmental processes (Latour, 1993). This shift from an anthropocentric viewpoint acknowledges the agency of non-humans in environmental, social, and economic processes, viewing climate change as a complex, multispecies geo-ecological process (Haraway et al., 2015).

This relational perspective redefines ecosystems not as a passive backgrounds or resources for human exploitation but as an active, co-developing force in shaping planetary futures (Latour, 2018). It also underscores the importance of fostering human-environment reconnection (Cooke et al., 2016) and advancing multispecies justice, where nature claims its role in the discourse of justice.

Human societies do not exist in a vacuum; they are always “embedded within larger communities of life that entangle an innumerable diversity of beings (e.g. humans, animals, plants, ecosystems) in shared networks of living, dying, and the (re)making of worlds” (Houart et al, 2024: 10). This interweaving of human and other-than-human beings, significantly shaped by power relations and dynamics, has two significant implications for justice thinking.

First, it puts forward a social-ecological reality in which humans constitute only a small (yet impactful) part. Multispecies justice, therefore, recognizes animals, plants, ecosystems, bodies of water, and microbiomes as subjects of justice (Winter & Schlosberg, 2023). Second, it signifies the relationality of the concept, with justice not only pertaining to subjects who co-inhabit the multispecies world, but also to relationships that bind them together. Relationships that endanger particular beings could thus be regarded unjust, whereas just relationships might enhance their sustainability and resilience (Houart et al, 2024; Winter, 2022).

While one goal of multispecies justice is to challenge the idea humans are superior and more important than other species, Celermajer and colleagues (2020) warn this approach might unintentionally distract from pressing basic needs such as affordable housing, education and healthcare that still demand attention. Fitz-Henry (2021) reiterates caution is warranted to prevent multispecies justice becoming yet another tool that perpetuates the exclusion of marginalized groups that have been deeply impacted by power imbalances and the global economic order.

Multispecies justice should therefore not simply focus on stepping away from human-centered thinking, but on questioning and changing the ideas that put humans above other living beings and ignore the relationships between all species (Houart et al, 2024, Van Dooren & Chrulew, 2022). Participatory governance frameworks that incorporate the interests of non-human species, legal reforms, and

inclusion of diverse knowledge systems like indigenous or traditional ecological knowledge can facilitate the operationalization of this approach (Celermajer et al, 2022; Houart et al, 2024).

Environmental justice

According to Figueroa and Mills (2001: 427), "environmental justice refers to the conceptual connections and causal relationships between environmental issues and social justice." Heffron and McCauley (2018) define it somewhat differently: "Environmental justice aims to treat all citizens equally and to involve them in the development, implementation and enforcement of environmental laws, regulations and policies". Given these definitions, environmental justice may be considered a specific domain to which social justice considerations are applied. Each content domain has its peculiarities.

In the case of environmental justice (and in relation to spatial justice), the location of the environment is fixed and one's (residential) location tends to be taken as a given as well: relocation is often costly, economically and/or otherwise. The basic question then becomes: who is confronted with which environmental goods and bads, and can this distribution be considered fair? When only looking at the effects of the transition itself, the question focuses on how changes in environmental goods and bads due to the transition are distributed over people living in the affected environment(s), and to what extent this may be considered a fair distribution.

Climate justice

Climate justice is a specific type of environmental justice that addresses the profound inequities related to climate change, emphasizing that those least responsible for its causes are often the most severely affected by its impacts (Parsons et al, 2024). This "double inequality" - low responsibility for climate change and highly vulnerable to its impacts - indicates the distributive injustices caused by climate change, while also hinting at insufficient acknowledgement and incorporation of the needs and interests of poorer countries. Worryingly, these inequalities are frequently exacerbated by factors related to pre-existing health conditions, reliance on (subsistence) agriculture, limited access to resources and services, weak infrastructure and fragile governance arrangements, resulting in "triple injustices" (Barret, 2013; Füssel, 2010; Lindley et al, 2011; Miranda et al, 2011, Newell et al, 2021).

The connections between "various climate-related forces and how they collectively redefine experiences of this world as a space shared in common" (Skillington, 2023, p. 155) are central to climate justice. This perspective shifts the understanding of climate change from being just an environmental issue to one that is deeply intertwined with social, economic, and political inequalities (Roberts & Parks, 2007; Parsons et al., 2024). As a result, climate justice is a fight for human dignity, emphasizing the right to life, health, and a sustainable livelihood (Robinson, 2018). This framing hints at the moral and transnational dimensions of climate change. Shue (2014) operationalizes climate justice by emphasizing the ethical responsibilities of wealthy nations to reduce emissions and support adaptation efforts in poorer countries, emphasizing the importance of fair and inclusive policies and restorative efforts to provide redress for past wrongdoings.

Parsons et al. (2024), discuss how recent scholarship demonstrates that climate injustices are spatially and historically produced and tied to colonialism, racism, and globalization. The injustices have been found to be disproportionately impacting women and gender minorities, racialized communities and

nation-states in the Global South and marginalized communities in the Global North, with gender hegemony intersecting with power dynamics to make groups more or less vulnerable to climate risks. Furthermore, dominant groups are overrepresented within the climate justice literature itself which can lead to the misrepresentation or undervaluing of the experiences of marginalized populations, perpetuating existing power dynamics.

Klein (2014) stresses the need to challenge current economic systems and power structures that perpetuate inequalities and environmental degradation. It is argued that dismantling political-economic systems and their systematic drivers, considered to be the root causes of climate injustices, requires institutional change and, therefore, transformative climate action (Newell et al, 2021, Sultana, 2022) To this end, it is essential to map what (future) stakeholders are involved, what their needs and interests are, and allow for these different voices and perspectives to be included in policy-making and implementation processes. Sultana, 2022 states that applying a climate justice approach is an intentional process that involves carefully analyzing who is excluded or marginalized by climate change processes as well as any adaptation or mitigation interventions pursued. A climate justice approach focuses on who benefits, who loses out, in what ways, where, and why.

Justice and NbS in sustainability transitions and transformative change

The literature and field of sustainability transitions and transformative change is growing significantly, and this report is not able to capture its breadth or depth. However, it is important to acknowledge justice in this context. Just transitions refer to a process of transitioning systems/environments to more sustainable and equitable ones. Since NbS involves interactions between people, nature, and institutions they can facilitate just transitions and address systemic injustices (Raymond et al., 2023). In general, just transitions involve caring and support to find synergies and criteria for prioritizing the areas for transformation in relation to the scale of time and space. A just transition does not imply simply shifting focus from climate change to a greener, healthier, and multispecies perspective.

Rather, it necessitates integrating justice into this broader vision, ensuring that the benefits and responsibilities of transformative change are distributed equitably across all societal and ecological stakeholders. This does not mean shifting the main focus from climate change to a greener, healthier, and multispecies perspective. NbS, as a concept, can help us shift the focus of transformative change from resilience to responsivity based on creating synergy between the responses the environment gives to multiple needs. NbS needs to be understood as an approach for both humans and nature and as a collective commitment among all stakeholders (including the community). Commitments towards all risks and concerns for human-nonhuman species. Animals and plants can also be viewed as vital stakeholders who operate within mechanisms and establish and reinforce the natural environment to support nature as a whole.

Justice needs to be at the core of transformative change — not solely as an outcome, but as a guiding process embedded within all dimensions of decision-making and action. This encompasses environmental justice, social justice and other forms of justice, as previously discussed. These interconnected dimensions demand a systemic perspective that acknowledges the complexity and interdependence of human and natural systems. Transformative change involves not only advancing climate resilience, responding to biodiversity loss, and undertaking sustainability transitions but also challenging and reshaping the systems of governance and power structures that have historically

marginalized certain communities that are often disproportionately affected by climate change. The principles of distributional, procedural, recognitional, and restorative justice are therefore essential to ensuring that NbS (and GBI) contribute to a transformation that is socially equitable, ecologically resilient, and economically sustainable (Anguelovski et al., 2020).

As these interventions scale up, the link between just NbS and transformative change needs to be continuously re-assessed to prevent unintended consequences and avoid perpetuating existing inequalities, ensuring that the processes remain adaptive, inclusive, and fair. Vulnerable groups—such as marginalized communities, indigenous populations, and economically disadvantaged individuals—must receive particular attention, as they are often disproportionately affected by environmental degradation and social inequities. NbS however needs to go beyond addressing human priorities. They must recognize all elements of ecosystems as integral stakeholders whose roles in ecological systems are essential for maintaining the balance and health of natural environments. Their needs must be considered alongside those of social systems, as failing to address these interconnected dependencies can undermine both ecological integrity and human well-being.

By functioning as a critical part of the transformative change puzzle, NbS can help bridge the gap between immediate, localized actions and the broader systemic shifts needed to achieve long-term sustainability. A justice-centered approach to NbS ensures that systemic interconnections—between humans, non-human species, and broader ecosystems—are acknowledged and nurtured. This perspective emphasizes that safeguarding biodiversity and ecosystem health is inseparable from addressing the needs of vulnerable groups and communities. It requires us to approach transformative change holistically, ensuring that NbS foster an inclusive and equitable transition toward resilience and responsivity for all.

Injustice in the context of climate change and NbS

To integrate justice into the development of NbS, it is essential to understand the injustices associated with climate change and NbS implementation (Breil et al., 2018). The intersection of three main dimensions of justice—distributional, procedural, and recognitional—typically determines whether a situation is just or unjust (i.e., Mohtat and Khirfan, 2021). Recognition serves as the starting point for a just transition. Failures in proper recognition result in unfair procedures, leading to an unfair distribution of costs, resources, and benefits.

Scientific literature provides abundant evidence that certain social groups bear an uneven burden of climate change impacts. This inequity often results from a lack of resources, capacities, or skills to cope with or recover from the consequences of climate change. Climate change exacerbates existing inequalities, disproportionately affecting vulnerable groups and exposing deep-seated socio-economic, cultural, and institutional vulnerabilities. Among those most at risk are low-income households, single mothers, children, the elderly, and migrants. These groups face unique challenges stemming from limited adaptive capacities, restricted access to resources, and systemic exclusion from decision-making processes.

Low-income communities, for example, frequently lack the financial means to invest in protective measures or recover from climate-related disasters. Single mothers encounter compounded vulnerabilities due to their caregiving responsibilities, often bearing the brunt of extreme events.

Children and the elderly are particularly susceptible to heat-related illnesses and face longer recovery periods due to both physiological fragilities and socio-economic constraints. Migrants, meanwhile, may experience heightened vulnerability due to language barriers, limited access to information, and a lack of robust social networks. These groups endure not only the physical impacts of climate change but also the societal inequities embedded in climate adaptation and mitigation efforts.

Policies and interventions often fail to adequately consider their needs and perspectives, perpetuating cycles of exclusion and vulnerability. Addressing these injustices highlights the urgent need for just and equitable adaptation strategies, particularly in the development of NbS. Although NbS are often intended to be good, they may come along with risk of injustice, as for instance unequal access to benefits, or gentrification which exacerbate the existing socio-economic inequalities, or uneven burden due to maintenance.

Responses need to be tailored to address the specific vulnerabilities of these groups while ensuring their active and meaningful participation in planning and decision-making processes. Integrating justice into NbS development is crucial to fostering resilience, empowering marginalized communities, and advancing climate justice for all. This integration must also address the protection of and embracing nature and the rights of non-human species, promoting multispecies justice. Unjust NbS can also arise from external factors or drivers that are rooted in injustice (Kotsila et al., 202). Those parameters are particularly important to be identified and addressed in relation to recognitional, procedural and distributional justice.

Chapter 4: INSIGHTS FROM THE REGIONS

This chapter presents insights and perspectives from the regions based on the dialogues conducted with 30 people as well as the guiding documents collected from the regions related to justice (see Appendix 3). As explained, the dialogues gathered several representatives from specific regions together and raised discussions through semi-structured questions around justice and its implementation via NbS. Through discussion with governance and planning authorities and in relation to their particular region and circumstances around NbS, we investigated barriers and obstacles to operationalising justice via NbS. The content here tries to capture the essence of the conversations to provide a direct connection with the dialogues.

Region Emilia-Romagna

The number of participants was ten including six representatives from the Emilia-Romagna Region (different departments) and four participants from Art-er and CMCC sometimes helped with the translation. Below are key insights and reflections brought up in the dialogue with the participants.

NbS as a concept for Emilia-Romagna

It seems NbS are understood mainly as technical solutions with nature-based technical design. In fact, NbS with social equity and justice in focus are not yet considered in any depth.

Justice as a concept for Emilia-Romagna

There is ambiguity around the justice concept, and they believe it is not clear what it is or how it is connected to NbS, even at the EU level. They wish to increase their knowledge of this concept via ARCADIA. For the participants, justice is understood as the social impact of the projects and as something that comes as the consequence of the projects and makes the outcome fair (at last). They see justice as a by-product of NbS. For the participants, NbS is not viewed as a tool through which it would be possible to target social amenities. NbS is believed to always have social impacts. Those impacts need to be known, and indicators need to be found to measure those effects. One participant differentiates between mitigation and adaptation when discussing justice in the context of climate change. The speaker refers to a law on mitigation of climate change focusing on energy efficiency and reducing energy poverty and states when it comes to adaptation, more skills and criteria are needed.

Barriers, gaps, and opportunities to achieve just NbS in Emilia-Romagna

There is a lack of NbS and pilot projects. Many stakeholders are unaware of the impact of NbS and how to improve it. Therefore, more research, analysis, and studies need to be conducted. In Italy, decision-makers and civil society learn through various projects. These experiences enable them to develop knowledge and update their strategies. The region sees great potential in their contribution to ARCADIA for similar project-based learning to gain knowledge on how to make the NbS just.

The lack of justice concerns in sustainability frameworks is also introduced as a barrier to operational justice. Strengthening the connection between NbS and justice requires revisiting and rereading the sustainability concept. They believe in having a good base for meeting social equity in their region due to the history and political will for it, but the problem is that social equity is not well connected with sustainable policies yet.

The main issue in achieving justice is the lack of financial resources and systems. Systemic financial support and placing justice at the core of financing different types of transformations is important. In a country like Italy, a large share of NbS finances comes from the national level, and projects are carried out with the assistance of EU funding. Positioning justice in financial frameworks can be a key driver. Financing NbS should follow justice criteria at higher levels, first ensuring basic social welfare for all and then not making NbS implementations fully dependent on individuals and locals. One reason, the participants refer to is that the main challenge constantly shifts: once it is about energy efficiency, once one flooding mitigation, and so on and so forth. So, the financial system should allow adaptation and safeguard what already works.

Conflicting interests across governance levels (and legislation systems) is an obstacle to achieving just NbS. Sometimes, national interests are laid in some regions, and heavy loads come to the regions (e.g., harvesting wood). The national plans are sometimes made without considering the impacts on the local community and influencing their lives and businesses. For instance, national regulations have had a huge impact on this region during the last 10 years. However, occasionally, national interests collide with regional interests, and the regulations made affect the region, for instance, in forest and mountain territories, and cause biodiversity issues, resulting in struggling to restore the ecosystem and biodiversity. These issues can end in significant conflicts when challenges are dealt with in silos and with short-term perspectives.

Power distribution dominant structures can play a role in resistance against justice. This can be tackled through efficient intergovernmental cooperation. In Italy, regions are responsible for strategies and plans such as territorial plans (they probably mean land use of larger territories to coordinate local plans, including land use plans, so it is maybe more spatial planning and zoning, land use plans might be more on municipal levels), energy plans, etc. All are for implementing national plans. The participants mentioned that all municipalities in Italy have two regional and national associations, but the municipalities do not have any important role in making legislation. Legislations to some extent stop at the regional level. Municipalities are required to implement the regional plan via their local plans and sometimes interfering laws and overlapped planning systems is a challenge. Top-down governance structures can work efficiently in some aspects; however, not questioning centralized systems can hinder a fair distribution of power and, hence, equity. It seems they see their traditional cooperation at different levels as very strong and not at all problematic. Criticizing the existing can help enhance the governance systems and increase trans-scale collaboration. However, even though the existing frameworks seem strong, it is important to ask key questions as new concepts, such as NbS, always need revisions, so they need to leave more room to restructure the conventional systems.

Lack of trust hinders the involvement of citizens in NbS processes. Citizens need to believe in NbS and the decision-makers. Efficient approaches need to be utilized to involve people. A top-down view over bottom-up participatory approaches and referring to community involvement as a tool to facilitate implementations that are already decided is not efficient in promoting justice.

There is a lack of monitoring and assessing social impacts (justice). Quantifying social dimensions and turning them into numbers is important. The challenge is to provide justice criteria and a common platform for municipalities with the same indicators to measure the impact and efficiency of NbS policies. One way to promote justice is to map the vulnerable socio-economic-ecological-environmental

areas and translate NbS in relation to those vulnerabilities. The impacts of NbS on the quality of life of citizens should be assessed and used to improve their daily lives i.e., by improving microclimate and health.

Region Lower Austria

The number of participants was three including representatives from Lower Austrian regional government, Energy, and environmental agency in lower Austria, Ecological Gardening Association (Natur im Garten). Below are key insights and reflections brought up in the dialogue with the participants.

NbS as a concept for Lower Austria

NBS has not yet been recognized as a planning tool and as a specific area for governance in Lower Austria. Acknowledging NbS in urban transition and regeneration projects is important. Additionally, the term is not well-established, and there is no consensus on its meaning.

Justice as a concept for Lower Austria

Justice means offering different groups different things to meet their different needs and times. This can mobilize fairness and justice and unlock them in other dimensions. Justice is a matter for NbS since they need to help people with lower incomes. It is important to map vulnerable areas and groups in the city. For example, those who cannot afford air conditioning during hot summer days can maybe get more use of the shade of a tree outside their window to help cool down the indoor temperature. One main challenge is the lack of justice criteria for NbS in terms of, i.e., where they are needed (in terms of the climatic benefits of greenery and trees to cool down the temperature) or who needs them more. Justice lenses are sometimes practical for dealing with shocks. For instance, to address farmers' concerns after the newly adopted nature restoration law by the EU. The view helps consider all beneficiaries together in relation to time and space. It helps with long-term views on justice and addresses how they collide with short-term benefits.

Barriers, gaps, and opportunities to achieve just NbS in Lower Austria

There is a gap between bottom-up initiatives and top-down strategies. This has a lot to do with the existing political and organizational frameworks; looking for cross-organizational frameworks and pathways is very important to gain shared objectives, governance, funding, data, etc., and balance power relations. A multi-level governance approach is needed to ensure justice approval at different levels and cover the gap first between rural and urban areas and then between municipalities and regions.

Another main issue is the noticeable gap between theory and practice, which affects not only the quality and adequacy of visions and policies but also how they are implemented on the ground. According to the participants, the existing documents contain many well-addressed recommendations, but they need to focus on improving the execution of those at the individual level. Besides, the existing conventional and top-down theories and implementation approaches need to be criticized. This shows how co-governance takes important roles and how we need to re-think its position.

Very fixed regulation systems are a big challenge and need us to elaborate to make them adaptive (as laws are set very specifically). Besides, NbS are introduced as multi-functional approaches, and hence, legal documents and strategies addressing multi-functionality need improvements.

Plans are important tools, and hence, justice can be reflected in planning systems. When dealing with NBS, re-planning and redesigning mobility, heat, and biodiversity should go hand in hand. Additionally, the implementation of plans by public authorities must first engage individuals to ensure that their efforts are not undermined and do not lead to harmful outcomes like deforestation. This aspect of the process is crucial and highlights the importance of prioritizing individual involvement. However, involving and engaging people is the biggest challenge in using NbS as a way to address justice. One key driver is positioning social aspects and bottom-up approaches at the very beginning of climate adaptation. Regarding citizen engagement, the discussion focused on public initiation and strategies to involve citizens (not really on grassroots initiatives).

Preparedness is important at all levels, and one way to increase it is by shifting mind-sets and seeing ourselves in a broader context. This is where education comes in handy. Educating all parts of the society including current and future actors can increase the chance for NbS to be supported by influential groups of people like community representatives who both sides (i.e., municipality and residents) trust. It can efficiently deal with the "not in my backyard" mentality which is currently a challenge for just nature-based transition. This also requires a clear understanding of NbS and justice and their relations to facilitate a just process and deal with all stakeholders' questions, doubts, and concerns with a common ground. The participants mostly talk about the role of organizations in raising awareness and positioning justice from their perspective. It was less about questioning justice in that organization and about looking for what is fairness.

Creating trust between parties is the most challenging part and enhancing communication is the key. Facilitating communication between different stakeholders can help to even out power relations (particularly between bigger and stronger bodies and smaller ones i.e., between different departments of a municipality, between big and small municipalities, between the region and citizens, etc.) and make them to learn from one another. Communication with the politicians is also an area needs to be improved. The role of political icons such as the mayor of a city in the transformation process is very critical, as they can be very efficient. Hence, it is important to communicate facts with those politicians, and the role of research models and data is important here. Since they need people's support, they will not go for projects not supported by data and facts in a democratic way (because then they will not be elected again).

The main barrier is the lack of funding and bringing justice to the big businesses that run the economy. To implement NbS, significant financial resources are essential, so addressing this issue should be the first priority. Moreover, due to the financing issues prioritization of some justice matters is unavoidable. This step also increases the project's overall budget. Lower Austria focuses heavily on implementing NbS based on public funding and making NbS part of public space and free for citizens to use. Hence, justice issues are more concerned when NbS are based on public funding, so it is very important to know whom the public money goes for. Financing is a tool for implementing justice; for instance, if justice criteria are requirements for NbS projects to be approved and granted public budgets or to make a piece of private land public by compensation for a better use of land for all.

The role of best practices in shifting the justice question is very critical. More NbS projects can shift the stakeholders' focus from not wanting it to wanting it. If people do not live with nature, nature will not be associated with meaning. Let them live with it to like them and want to have more. This allows

them to reconfigure the meanings of equality. Besides, there is a need not to always compare the best practices to the worst cases but to be critical in every project, assess the impact, and consider how to increase the benefits and make it more inclusive.

Region Zagreb & Krapina-Zagorje

The number of participants was seven including representatives from the Regional energy and climate agency (REGEA), city of Zagreb, Public institution for managing protective areas in Krapina-Zagorje county. Below are key insights and reflections brought up in the dialogue by the participants.

NbS as a concept for Zagreb & Krapina-Zagorje

NbS for the participants has been mostly understood as a technical approach. For some, it is just a technology and cannot be discussed in terms of being just or unjust. The separation between NbS and social values and the way people see them in dichotomy in responding to their needs is clear in the dialogue.

Justice as a concept for Zagreb & Krapina-Zagorje

Justice is interpreted differently. For instance, on the same project, therapeutic garden in Sesvete, we can see different readings of justice between the participants. One participant believes it addresses justice by including the disabled in the target group. In contrast, the other believes we cannot claim it is a just project since NbS was mainly implemented because of its technological functions, and yes, it might also be used by the disabled (and maybe not). This highlights clear ambiguity around the (justice) concept in form of subjective interpretations, ideological and philosophical disagreements etc.

Justice should be integrated systematically into the decision-making processes to reduce the risk of limiting it to specific areas such as NBS or energy. Embedding justice cannot only be a matter of climate adaptation and mitigation. It should be a matter of the overall governance within its system. It needs a broad and in-depth understanding of how justice is embedded in the systems and how the system can change to better address justice, which comes with many changes on different levels, from individuals to systems and mechanisms, etc. One believes that understanding NBS as only a technology leaves no room for asking for feelings and empathy (which again goes back to the identification of what is just and what is NBS and how they relate). Justice as a concept needs to involve addressing the needs of various groups through NbS. It is important to include diverse groups and their benefits, ensuring that everyone can gain from the outcomes and not create new problems that could affect other (particularly vulnerable) groups. Justice for the participants is strongly understood in the form of distributive justice and a bit of procedural justice.

Barriers, gaps, and opportunities to achieve just NbS in Zagreb & Krapina-Zagorje

The lack of dialogue affects the fairness of the measures. The regions (likewise other model regions) emphasize the impact of these dialogues in centralizing justice in their work on NbS. They believe that these dialogues are influential in promoting and integrating multi-level and inclusive approaches related to NbS. Hence, more NbS projects are needed to facilitate the dialogues and knowledge on the procedures and impacts. Moreover, partnerships in broader agreements and commitment can serve as motivation. For instance, signing the Paris Declaration by Croatia marked a significant turning point for the country.

Lack of relational understanding of NbS and justice should be seriously addressed. What possibly lead to just NbS in the region is first not to see NbS as a magic wand (leaving room to criticize) and second to ensure avoiding the silo effect and seeing NbS as standalone projects. These two need proper assessment on how nature-based interventions interact with other socio-economic, technological, and ecological interventions and tools. There is currently lack of data and monitoring capacities, including all kinds of data, physical, spatial, demographic, economic, financial, biological, etc. Based on the assessments we can develop baselines for justice and reach coherence in policies, strategies, principles, governance, planning, design, implementation, management, etc. There is a specific need for coherence in climate adaptation both at the EU and national levels and in relation to all SDGs.

Economic inequality and lack of financing are the most significant issues. Making a transition just can sometimes be paradoxical (in this case, on the national and local levels) when the area's economy is involved in that transition, such as in a county that relies on coal and oil refineries. There is a lot of diversity in NbS processes to address, such as diversity in history of the area as well as diversity in ownership, income, and financial resources among the citizens. Besides, socioeconomic inequalities make NbS considered a non-realistic concept. Socio-economic conditions influence engaging individuals in nature-based initiatives. After people reach a minimum standard for their living conditions, then they might start considering climate-neutral actions and NbS. Reducing poverty and evening out the quality of life is the foundation for bringing NbS to people's attention. At the moment there is a critical lack of policies on why and how NbS measures would be affordable and useful for the actors. Making NbS less costly for people is a challenge for which states and cities should take some responsibility. A systemic approach is needed to mobilize financial resources via collaborations at national, regional, and local levels (especially since the Tax is paid to the state except for small amounts such as for parking). Consideration of the next generations, and in general, caring about the environment can come as a priority, but after ensuring everyone has the minimum living standard because the future is luxuries when the basic needs of people are not met, and they are poor.

Plans are effective tools for improving consistency in decision-making. Croatia is a centralized country and has mostly a top-down governance system. Decisions are made on national levels, and cities and counties implement them. However, there is a clear problem with the cohesion of planning and strategic documents. The cohesion of planning and strategic documents needs improvement, and at the moment, they are working on it. For them, spatial planning is an efficient tool to bring justice to a center of transformation (however, it is not enough and needs to be combined with other tools). At the moment the region is using spatial planning as a central planning pillar and trying to (re)formulate all other documents and plans around spatial plans. However, there are some inconsistencies between planning documents horizontally and vertically to be addressed. There are many good policies and strategies but the main challenge lies in implementing the measures, as each plan exists in isolation and serves as a standalone plan supportive to other plans. They now aim to integrate national climate change adaptation and mitigation goals into all plans and the governance system. They think regeneration and mainstreaming should probably go through NbS. If they manage to position NbS in the center for climate resilience and use it as a tool to align policies, plans, designs, etc., they believe the possibility of success is high. Otherwise, just going for single NbS elements, like trees here and there, cannot be efficient and help adaptation and mitigation. As such, the systemic approach needed seems to involve spatial planning at its core. The regional energy and climate agency is now trying to integrate climate

considerations into spatial planning to ensure a practical foundation for all cities. For the city of Zagreb, they are piloting how to do that on the budgetary level (together with the national ministry of finance).

Coherent governance and revising power dynamics within the governance systems are essential. Their current centralized system can play a role in aligning objectives and policies. Such as encouraging and allowing tourism and making the country greener, more self-sufficient, and climate-resilient, which are not currently aligned, resulted in a mess at both local and regional levels. While the central governance system offers some advantages, the slow reaction time can be a barrier to justice and present hindrances. Therefore, finding a balance between centralized and decentralized decision-making is beneficial and for that, trans-level bodies are essential to be the integrator to glue and lead. In Croatia, there are counties, cities, and municipalities with misalignment between strategies. Regional bodies are unofficial and are not administrative or political units. In the dialogue, a holistic view has been presented as necessary at a regional level. Hence, regional bodies or units can play the role of facilitators for the governance coherence to connect national, local, and regional levels. On the other hand, it is clear that the participants recognize the importance of bottom-up and participatory approaches in promoting justice, such as public consultations and awareness campaigns. However, communicating effectively with diverse citizens is challenging, as different strategies are needed to be taken in advance to end to useful feedback. It is very useful to involve citizens and, more specifically, vulnerable groups and empower them in decision-making processes. For instance, they mention how the elderly always have something to say and are a valuable source of information for the planning processes. This co-creation, co-design, etc., brings co-benefits for both sides.

Effective communication on justice dimensions of NbS based on the everyday impact (to householders, politicians, etc.) can be helpful. NbS, justice, and the connection between them are not tangible concepts neither for citizens nor for politicians. There is a huge difference for individuals between NbS and energy refurbishment of buildings that everyone feels and knows the difference before and after in their budget. This shows how important it is to measure and quantify the impact of NbS in relation to common concerns and challenges such as individual health or the economy.

There is a need for a paradigm shift across all sectors to become more in harmony with nature. Incorporating ecological considerations into the management and maintenance of infrastructures is essential to foster greater sensitivity and care for the environment. For example the road maintenance at the moment relies on machines and techniques designed to be fast and efficient. However, these methods are used by prioritizing the budget and safety over environmental concerns. These methods can damage nature, such as tree roots, and contribute to environmental pollution through the use of chemicals and noise.

Region Skåne

The number of participants in the dialogue was seven representatives from Malmö Municipality, Lund Municipality, Helsingborg Municipality, Region Skåne and Sustainable Business Hub. Below are key insights and reflections brought up in the dialogue with the participants.

NbS as a concept for Skåne

All participants refer to NbS as physical green and blue solutions implemented in the outdoor environment mainly to address water and environmental challenges that have certain social consequences.

Justice as a concept for Skåne

All participants agree that justice is about fairness. They emphasize that justice involves not just providing everyone with the same opportunities, but also considering individual variabilities and vulnerabilities. However, there is no consensus in the views through which equality can be linked to and achieved by NbS. Moreover, everyone links NbS and justice based on their individual background and field of work. For instance, one participant emphasizes the importance of access to the landscape, while the other one refers to the importance of community access to public and social services. This highlights the spectrum of justice to be identified and integrated into NbS.

Barriers, gaps, and opportunities to achieve just NbS in Skåne

A non-integrated regulation system is one of the main challenges for operational justice. An example is a regional principle in Skåne region named 3-30-300. The principle states that each person should be able to see 3 trees from their home, each neighborhood should have a canopy cover of at least 30%, and everyone should be able to reach a green area within 300 meters of their home. However, to apply the 3-30-300 principle efficiently, there is a need to reduce the distance between infrastructural pipes and trees (for their roots), for which we already have the technical solutions. It just needs a minor change in regulations and, hence, a change in the governance structures that are more integrative (pipe, housing, and green are considered together), collaborative (between water utility, traffic, park, and environmental departments), and adaptive. The shift in the governance structures bridges institutional reorganizations, regulation and plans reforms (coherence of planning rules).

There is a need for spatial understanding of NbS and mapping. For instance, mapping tree canopy coverage in Malmo shows that, on average, 13% of the city is covered by trees. This percentage is much higher for neighborhoods with good socio-economic conditions and villa houses and much lower for the socio-economically vulnerable areas. This indicates the distribution of the trees in Malmö aligns with socio-economic disparities and, to some extent, also the built form of the city. However, this does not follow the same pattern in Lund and a similar study needs to be carried out there and in other cities. Efficient spatial understanding allows combining NbS and other layers of infrastructure, for instance, in relation to vulnerable groups, cooler down the living spaces, etc.

A coherent planning system is essential. NbS is not innocent and can sometimes work against justice. An efficient governance and planning system can address this, compensate for, and minimize the injustice. An example is when a public green space needs to change to a wetland (which is less accessible for recreational use) to protect the area from flooding. Implementing NbS on public land requires municipalities to make it accessible or at least ensure reinforcing the functionality and accessibility of other green spaces in the vicinity. However, facilitating pre-conditions for coherence between plans is a prerequisite for creating coherence between the plans, as there are numerous legal obstacles to this step. In Sweden, there are different plans: a regional plan (in Skåne region the plan was so far focused on health and public transport, and now the 3-30-300 plan is new), a comprehensive plan, area (limited) regulation (to safeguard the comprehensive plan), and a detailed development plan. There

is a clear gap between the comprehensive plan (not legally binding) and the detailed plans (building rights and rules) (legally binding, and any change is almost never or very slow, difficult, and costly through some processes that involve the court also). So if something is realised needed for the city (dealing with urban flooding), detailed plans cannot be easily adjusted based on this need. Accordingly revisiting the planning practices is needed. In addition, planning practices involve highly technical aspects and need to look for more soft values and knowledge and find ways to incorporate them.

Lack of interrelated understanding of justice dimensions can be another area to improve. For instance, a strength in the Swedish context is that justice is perceived as connected to NbS from a distributional point of view. This is a great start but lacks some other dimensions such as procedural justice.

Addressing the political disparities related to power and influence is essential to making the implementation of NbS more fair in the municipalities and the region. As an example, we see that the 3-30-300 principle proposed at the regional level got into the comprehensive plan of Malmö but has not yet become a political target in Lund. A city in which the main political focus is not on proximity to green but on compact and dense cities and protecting the soil around the city. Hence, more creative and efficient approaches i.e., via developing and communication through equity index for green space (that Region Rkåne is currently working on) or social vulnerability index for heat are needed to engage the politicians making them to prioritise NbS as a response to the existing inequalities.

Economic deficiency is the primary problem. This intersects with political disparities, as investing public money in one area means taking it from another. How fair the government can invest public money is complex and requires lots of research and further knowledge on what, why, where, when, whom, and how to prioritize, basically due to a lack of financial resources. For instance, the current Swedish coastal protection law asks property owners to protect themselves from flooding. There are many questions about whether it would be fair to them to be responsible here and whether it would be fair to other taxpayers if the municipality takes charge. Some participants highlight that in Sweden, municipalities somehow hold a planning monopoly and can make independent decisions. More regional investments are therefore needed to even out the fairness of decisions at the regional level. On the other hand, this is challenging due to the tax system since, in Sweden, taxes are mostly paid to the municipality and then to the state (and it seems regions are partially financed by the municipal tax). This is particularly relevant in terms of water management.

Governance structures and the power dynamics tied to them play crucial roles in the planning and execution of NbS. An adaptive and adjustable governance system is essential for balancing power to achieve equitable outcomes. For instance, when the national economy is stronger, benefits should be fairly shared, and the state can take away some burdens from municipalities. The insufficient budgets leave municipalities no choice but to prioritize their investments (and, in many cases, make unjust decisions at local levels) to achieve bigger climate resilience goals at larger scales. Regional organizations can enhance governance coherence. For example, as some municipalities are now considering heatwaves, these organizations can help raise this issue to a national level and present it as a requirement to increase health by providing a good environment for current and future generations.

Understanding that operating justice is a relative concept based on context and conditions is essential. What matters is moving beyond inaction by realizing what exists and can be utilized rather than waiting for a perfect condition. As an example, when it comes to the 3-30-300 principle and implementation, Malmö decided to adopt it despite knowing it cannot be fully achieved. Instead, they plan follow-up tasks and a never-ending process to identify feasible areas and work towards whatever progress allows them to get closer to the target. Sometimes due to insufficient data, resources and knowledge we need to draw indicators and develop criteria for a just implementation through learning by doing (i.e., pilot projects).

Underestimating the role of design in promoting justice is something to address. NbS are physical elements, and design matters not as a product but also as a process, It is a tool to promote co-governance and bottom-up decisions, welcoming everyone to take part in the design. The final design is something more than the physical environment, and it emits signals from the environment to people on how to use it.

Facilitating paradigm shifts and reducing resistance to the change is required. It is time to review and redefine the norms and paradigms (i.e., densification and car-centric) to ensure there is enough space for nature. Paradigms should evolve around justice to look at the (re)development influences through time and scale and avoid creating opportunities at the cost of limiting other groups and lives. For instance, in Sweden, there are many residential complexes from the 1960s (million programs) with large green spaces. Due to housing shortages, new densification plans arise despite the area's already high population density, and these areas are now targeted for reducing the green space for more housing units. There is often a misalignment between social and ecological decision-making (based on trends and agendas) in sustainable development processes which also calls for paradigm shifts. Besides, the participants highlight social values are usually seen as easier to embed in ecological values, but not the other way around. It is now the time to learn from previous experiences, knowing that shifting the decision-making direction, which has been constructed from a single perspective, is challenging. This calls for questioning our understanding of society and nature, avoiding seeing them in isolation, and making sure pushing one aspect does not diminish another aspect. Regional strategies and plans can efficiently address socio-ecological and multi-species disparities.

Effective communication with the politicians is crucial. Political will is crucial for addressing justice issues, and it is often challenging to prioritize them for politicians. Effective communication is key to emphasizing the importance of these issues. Researchers have a responsibility to translate and simplify academic findings to inform and guide public authorities and politicians. Strong, fact-based narratives are needed in this regard. Relying on familiar stories from decades ago when climate change issues were warned about, and until 15 years ago, no one paid attention, but now all those are happening in our lifetime. Formulating the narrative around justice is important to make justice central to the dialogue with politicians. This is important, as it is partially what they would be judged based on by the voters and probably might be taken into consideration.

Community involvement can play a critical role in the success of NbS. Enhancing climate resilience by NbS should involve more bottom-up to activate the locals and bring their issues up. Due to the differences between countries and areas place-based initiatives are required to encourage people to take part in the transition processes. One way is to acknowledge people's interests and what they like to have

through NbS. For instance, urban farming and community gardens are a growing trend now (there are many good examples that I can try to mention). This promotes certain caring behaviour among the general public but also makes the citizens influence and take place in public space via everyday activities.

Region Funen

Three individuals participated in the dialogue session, specifically representatives from Vandcenter (a water utility), Odense Municipality, and a researcher from the University of Southern Denmark that closely collaborates with the municipality. Below are key insights and reflections brought up in the dialogue with the participants.

NbS as a concept for Funen

The term needs clarification since, at the moment, each stakeholder (and generally all individuals) understands it differently. An important step is providing a common understanding of what is referred to as nature in this concept; the EU, for instance, uses a definition for NBS that includes all processes rooted in natural dynamics, whereas the IUCN defines the concept in terms of nature restoration. According to one participant, the NbS concept should really advocate for nature. It is dangerous to misuse nature and, under the cover of NbS, implement measures that do not really serve nature. Hence, repositioning the word nature in the NbS concept is recommended, and this requires a more comprehensive governance approach that looks for NbS in harmony with nature and as artifacts that meet human-nature benefits fairly.

Justice as a concept for Funen

All participants believe justice deserves to be included in the definition of NbS and all agree that NbS should be just and benefit all actors, including nature, vulnerable groups, etc. One suggests that defining NbS should come first, while another participant argues that determining justice should precede the definition of NbS, and that the concept of justice needs to be clarified before discussing NbS to ensure justice for both humans and nature. It is essential and efficient for regions to enhance dialogues about justice, specifying for whom it applies and how. This dialogue should continue both within and across sectors.

Barriers, gaps, and opportunities to achieve just NbS in Funen

There is a lack of resources, and the economic situation makes it necessary to prioritize and do things wisely. Prioritization is needed to determine to take the steps feasible. There is a need to better engage the community and involve them in a just transition. In this regard, improving our knowledge and methods of co-creation is necessary which requires time and resources. By integrating these efforts into our economy, municipalities can promote fairness, enhance ownership, and encourage participation in climate adaptation, ultimately saving time and money in the long term.

The complexity of the historical context makes it challenging for municipalities and regions to implement NbS that deal with multiple issues, such as climate change, biodiversity, and mental health crises at the same time. This history makes the prioritization processes even more difficult on who should use the land, what is more important, who should decide etc. One issue is the history of land ownership and land use. In Odense (and generally in Denmark), 60% of the land is agriculture (owned by a few owners), 14% are urban areas, some percentage to the forest, and very little to nature. At the

same time, they need space for producing green energy. This is a real issue for implementing justice when a certain group owns a large share of the country. Moreover, Odense is a city that is historically developed in the delta with a lot of streams and lakes and wetlands that expanded into a large city and made a large share of the watercourses be covered in the tubes under the ground. So one question here is, considering the large loss of nature in history, should we apply NbS to restore nature (and bring back open watercourses to the city) or allow city development or both? Furthermore, Funen only relates to NbS in relation to their history of water-related issues, and for them, NbS is a solution that revolves around those challenges. Hence, dealing with other challenges is seen as a consequence of tackling water issues.

Lack of acknowledging and positioning NbS in the planning systems. Not only national plans and strategies related to NbS are lacking but also generally, in Denmark, regions are not strong and do not have roles in spatial planning. An efficient national climate adaptation plan with a clear focus on NbS has a critical role in addressing justice and synchronizing regions and municipalities. The first climate adaptation plan was for 2012 and focused more on water issues. Since then, all municipalities have had their own climate adaptation plans. The first real national adaptation plan, with a wider spectrum of focuses, came in 2023. It has a dominant focus on coastal protection but also mentions the importance of cooperation between different municipalities. However, it is very general, short, and leaves lots of questions for municipalities. This means that all climate adaptation strategies and action plans are on municipalities, and they do not have any clear national and overall strategies for climate adaptation, which creates gaps (and possibly injustice). On the other hand, it becomes problematic when climate resilience and adaptation plans are developed from a single perspective, as it may hinder their adaptability to other issues in the future. In Denmark, climate adaptation is primarily focused on coastal protection, which is the country's main concern. Overall, water-related challenges have heavily shaped these documents of plans, strategies, and policies.

The participants believe they are missing regional plans (also national plans), especially around water. They have only a small development plan and a plan for raw materials (sand and clay mainly). Currently, water is managed within the municipalities' borders, but the responsibility of dealing with issues such as urban flooding is not on the municipality but mostly on the landowners and citizens (according to the law), and the municipality only facilitates dialogues on climate change.

Lack of coherence in governance systems in general and, in particular, positioning of NbS in governance systems makes implementing justice difficult due to the ambiguity of who does what and when. There is a clear need for co-governance to bridge the existing gaps, particularly because citizens in Funen have numerous responsibilities. These responsibilities are expected to become even more complicated in the future, leading to potential conflicts over who should handle various tasks and how. In Odense, the water utility manages rainwater only for events expected to occur once every ten years. For more severe rain events, citizens are responsible but they are not obligated to take action unless they are building new structures, where they must manage water levels expected from a 100-year rain event. Overall, there is no plan to protect low-lying cities from flooding. When it comes to sharing the costs and strategies for coastal protection between two farmers, it is often easier to negotiate and agree on a common solution, such as building a dike. However, in urban settings, the same principles apply, but the situation is far more complex and needs close collaboration between public, private, and societal

stakeholders, and this should be addressed by a multi-level governance system in order to make climate change resilience just and fair.

There is a gap in collecting and sharing existing knowledge and information, and this is a justice-related matter in many senses. For a long time, municipalities have been focusing on adaptation to climate change, which has had social and justice impacts (it was noticeable that all the shared documents by the region are at the municipal level). They are now doing less due to the economic situation. However, they have many experiences to share with one another, which need to be collected and scaled up. This can also result in covering other aspects of climate adaptation, such as dealing with temperature and drought and doing it faster on a larger scale. The role of the state is important here to connect the municipalities. Moreover, citizen science approach can help reducing the gap between municipality and community sharing what important data, problems and possible solutions exist out there. Citizens can be involved in different ways. Like in Citizen Science. From when citizens help collect data to when they co-create.

Fixed and inconsistent regulation system is a big challenge. There is a need for a collective legislation system that goes beyond municipal borders (also working across different departments), but the change is slow and cannot reach the changes in reality. As an example at the moment, there are different laws on water, one for water streams, one for coastal protection, etc., but they don not have a collective water law and system that they think is needed. The legislation system is very old, operates in silos, and cannot compensate for the needs emerging from climate change so rapidly. Even if the NbS meets all justice criteria for implementation, many restrictions hinder a proper implementation.

Other kinds of deficiency include a lack of clarity and unity in the political wills and temporality of the leadership, which can lead to the instability of NbS governance in achieving justice. That is why strengthening the justice framework, positioning it in the regulation systems, and then looking at NbS through a justice framework can reduce the risk of operational justice being vulnerable and temporal only based on who is elected with what kinds of interests.

There is a need for more project- and context-based learning. Pilot projects, such as living labs within ARCADIA, and creating chances for open and interactive dialogues offer excellent opportunities for exploring and mapping the landscape of justice. Additionally, more room for community involvement should be provided at project levels, which enhance specific and place-based knowledge and experiences in addressing justice. Therefore, more pilot projects should receive support from both the state and the EU to create dialogues, collaborative actions, and involvement of politicians (to engage with the community and do things with and for them, which is not common at all). There is a critical need to make decision-making processes transparent, rather than skipping the transparency to avoid more conflicts and adding to the complexity. The participants mentioned that some examples in Odense showed, when you give the right information to the citizens and communicate in the right way, they would be able to make very different decisions. This means we should not underestimate the community's capacities. By not discussing matters openly, we are actually delaying the process of discussion. Through pilot projects, we can provide such opportunities, get prepared, and go for dealing with the consequences of honest dialogues with citizens. It also indicates that we need to gain knowledge and methods for doing so, with the support of all stakeholders, to make the process efficient.

Advocating for nature requires a specific, place-based approach that leverages existing potentials and opportunities. Hence acknowledging existing frameworks and possibilities is crucial. In the city strategy 2023, the vision for Odense is to become the country's greenest city by prioritizing water, climate, and green space over urban development and construction. They believe this approach is a way to integrate consideration for nature into their plans, and through that, they might be able to boost safeguarding other species. Additionally, the city's unique historical context, shaped by its delta geography and water challenges, seems to foster multi-sectoral discussions and awareness of the importance of nature to be reinforced.

Lack of assessment and measurement skills and providing resources for this is another issue. To centralize justice, we first need to investigate the existing NbS and explore justice-related issues to establish evaluation criteria. Reviewing NbS projects will provide insights into their effectiveness and shortcomings, allowing us to measure their socio-ecological impacts comprehensively. Particularly regarding justice for nature, it is also important to apply and develop advanced technologies for monitoring. For instance, we need to determine whether species decline is due to cumulative effects or isolated incidents. Technologies such as sensors are vital for measuring oxygen levels and other environmental factors, or biosensors for accurate biodiversity assessments.

Chapter 5: DRIVERS FOR UNJUST NbS

This chapter critically analyzes and discusses the findings, mainly insights gained from the case studies, with the help of the scoping literature review. Inspired from the book ***Injustice in Urban Sustainability: Ten Core Drivers*** written by Kotsila et al. (2023) this report outlines twelve overlapping and interconnected categories of drivers for unjust NbS that were most often referred to in the focus group dialogues with the five model regions. This chapter synthesizes the findings from the case studies and summarizes the key themes of the underlying matters of justice around NbS, highlighting both commonalities and contextual variations (see Table 3).

Table 3: Twelve categories of drivers for unjust NbS

Drivers	Descriptions
Ambiguity of NbS and justice	There are often differences in how the terms NbS and justice are perceived and interpreted both in research and practice. The definition of NbS often does not clearly communicate justice aspects such as inclusion, participation, equitable distribution of benefits and resources, accountability, and transparency.
Lack of financing of NbS and economic inequality	Economic situations influence the fairness of NbS. A lack of financing undermines efforts on justice in NbS projects. In general, a systemic economic approach is needed to mobilize sustainable investments and funding mechanisms that are responsive at different national, regional, and local levels.
Historical physical, political and social context	Specific historical contexts result in different kinds of prioritization of justice concerns (and the role of NbS). The political history, ideologies, and structures often shape governmental organizations and, in general, citizen perceptions of justice and its application.
Inconsistent planning processes (and design)	Achieving justice in the context of climate resilience by NbS is complex and never fully achievable. However, planning processes are often inconsistent in terms of assessing risks, as well as costs and benefits, and balancing trade-offs in the context of justice.
Ineffective governance systems and power dynamics	Incoherence in governance and its system (interconnected mechanisms and structure of

	governance) is one of the most substantial obstacles for just NbS. Disparities across sectors and levels of governance, such as poor coordination, inconsistent policies, and contradictory objectives, deeply affect NbS projects.
Insufficient assessing, monitoring and knowledge	Just NbS needs analyzing and assessing the context as well as the existing NbS to identify justice-related issues and approaches. This helps establish evaluation criteria and indexes for just and equitable NbS. Monitoring NbS and their effects can provide insights into their effectiveness and shortcomings, allowing measuring socio-ecological impacts comprehensively.
Incoherent legislation and regulation	Legislation and regulations are closely related to political, governance, and planning systems, yet they are not the same. They indicate more directly and firmly what and how to focus on in relation to NbS. Often existing incoherent legislation and regulations negatively influence developing just NbS.
Lack of NbS pilot projects and living labs	There is a need for more pilot projects and investments in analyzing and, at the same time, researching the processes and outcomes of NbS. Such initiatives can help identify the undefined, unpredictable, and unintentional consequences of (existing) NbS and search for or embed justice in the process of (current and future) NbS.
Lack of dialogues and insufficient communication approaches	Lack of communication and dialogues between diverse stakeholders and decision-making on NbS remains a key challenge. Some research highlights that communication on NbS needs to be integrated into existing policies via joint and constant dialogues between policy-makers, society, and scientists.
Lack of community involvement and trust	Community involvement is crucial for the success of NbS projects and initiatives. Acknowledging and addressing diverse and

	collective interests is needed to promote general public support and in relation to different interests and, at the same time, allow people to develop attachments and connections to NbS projects.
Resistance to paradigm shifts toward human-nature harmony	Justice is mainly referred to as a by-product of NbS projects. It is often not considered in many NbS projects. Many policy frameworks are justice-ignored. Agreement on justice as a core value for NbS and viewing issues via a justice lens is needed. Paradigm shifts or mindsets on human-nature relations are key to balance nature and human-centered phenomena.
Justice gaps in sustainability frameworks	The lack of justice concerns in sustainability frameworks is identified as one of the barriers to operational justice for NbS. The dialogues strongly confirm the existence of important gaps in the relationship between concepts of justice and sustainability, both in the existing materials and in the perspectives of representatives.

Ambiguity of NbS and Justice

There are often differences in how the terms NbS and justice are perceived and interpreted both in research and practice (i.e., O'Leary et al., 2024; Wijsman and Berbes-blazquez, 2022). This variation stems not only from the lack of standardized definitions but also from the interdependence of the terms and the contextual influences that shape their meanings. This ambiguity around the terms can result in fragmented, inconsistent, and misaligned NbS goals and approaches, contributing to conflicts and disparities within society. The varying interpretations of these terms were also evident in the dialogues not only across different regions but also among individuals. However, Lazurko et al. (2024) argue that ambiguity in sustainability science (including NbS as a key component and justice as an integral part) is not per se a problem but a reflection of the complexity and diversity of perspectives in addressing sustainability. Ambiguity can possibly lead to more inclusive solutions if well acknowledged and tackled thoughtfully in relation to individual and organizational orientations, context-specific frames, and larger complex systems.

NbS as a concept

The representatives of the model regions consider NbS as nature-inspired spaces (mostly physical green and blue natural artefacts) with technical functions that respond to environmental issues (such as the local heat or flooding). They mainly see them as solutions in which social values are not yet considered as their main elements. The participants have diverging interpretations of the term NbS. One of the most unclear aspects is the interpretation of nature within this concept. The term NbS is not well-established in the regions, and there is no consensus on its connotation within and across the regions. The only shared viewpoint on NbS across the model regions was the spatial view, which reflects on NbS as a

form of space (often a green space). Furthermore, there appears to be a lack of critical reflection when it comes to NbS. It is often accepted as an innocent, neutral concept without any negative aspects.

Clarifying the definition of NbS and agreeing on its conceptualization can develop a common language for transferring knowledge and effective collaborations. This enhances the alignment of goals and approaches and fosters inclusive innovations, albeit by respecting differences (i.e., O'Leary et al., 2024; Castellar et al., 2021). Moreover, as mentioned above, the model regions mostly interpret NbS as elements with technical functions. There is also a noticeable division between the social values/impacts and the (nature-based) technical values of NbS. The separation highlights the need for more science and technology studies [or science, technology, and society] (STS) around NbS to provide critical reflections on the socio-technical dimensions of nature-based environments (Silvast et al., 2024; Bijker, 2012). This helps position NbS within the broader system of GBI, enhancing understanding of the effects of nature-based interventions on society and vice versa.

Justice as a concept

A sustainable future is only possible through a just transformation and if sustainable solutions embed justice as the core (i.e., Martin et al., 2020). To elevate the importance of justice and integrate it into the NbS framework first the common perception of justice as a concept must be examined. Furthermore, exploring the process of identifying and problematizing the inter-relationality of the aspects of climate adaptation via NbS with the justice lens and eventually operationalizing NbS to respond to the main identified (and possible following) issues is crucial and requires a long-term commitment. Justice-oriented approaches to NbS responses to socio-ecological vulnerabilities and reducing the tension between social and environmental dimensions of climate resilience and, in general, sustainability (Anguelovski and Corbera, 2023).

The majority of the participants agree that justice in their work involves addressing the needs of various groups. To them it is important to include diverse groups and their benefits, ensuring that everyone can gain from the outcomes of their work and that the results do not create new problems that could affect other (particularly vulnerable) groups which clearly links to social and environmental justice. Some participants emphasized that justice needs to be clarified prior to entering the discussion about NbS. The model regions believe they should foster discussions about justice, including whom to address and how NbS can bring fairness and equity since these are not in place yet. For the participants, justice is strongly understood in the form of distributive justice and a bit of procedural justice. Some participants believe justice needs to be integrated systematically into decision-making processes to reduce the risk of limiting it to specific areas such as NbS or energy. Embedding justice cannot only be a matter of climate adaptation and mitigation. Justice requires being a matter of the overall governance within its system. Justice lenses are also mentioned as practical for dealing with shocks. For instance, to address concerns of farmers after the newly adopted nature restoration law by the EU.

The dialogues underscore the significance of a just sustainability framework in the model regions. The European Environmental Agency recommends specific policies to address a just sustainability transition (EEA, 2024). The policies clarify the distribution of costs and benefits (distributional justice), who is involved in decision-making (procedural justice), what and whom are considered and the importance of respecting, engaging with, and fairly considering diverse cultures and perspectives (recognitional justice). In addition, restorative justice, which addresses historic and previous harms to

both human and non-human species and ecosystems, is also emphasized in the context of climate and environmental actions. A just sustainability transition considers all stakeholders and rightsholders together in relation to time and space. It helps with long-term views on certain values and addresses alignments with short-term benefits.

Overall, there is a clear ambiguity around the justice concept in the form of subjective interpretations, as well as ideological and philosophical disagreements. In general, there is no common understanding of justice neither in the regions not in the scientific literature. The interpretation of justice varies, depending on situations and experiences as well as historical, political, and cultural contexts. There is a lack of clear basic and theoretical understanding of justice around transformation projects. The notion of justice should not be taken for granted, assuming that everyone agrees on what it entails. Justice is rooted in ethical principles and can serve as a benchmark; hence, its core cannot be seen as flexible. If its foundation is understood differently, it can lead to critical conflicts and dilemmas.

A practical step could be reaching nuances and a beneficial-for-all understanding of justice in society as the foundation for how individuals position themselves in relation to themselves, others, and the environment to enhance living in harmony with nature (Lenzi et al., 2023). The involvement of authorities in any transformative project implementing justice requires a standard view and agreement on the justice aspect of their organization's work and a deeper, contextual, situational, and relational understanding of justice. Moreover, an inclusive approach is about involving both civil society actors and authorities with a comprehensive understanding of their local institutional strengths and weaknesses, the capabilities of civil societies, and the specific adaptation needs of the environments (Chu et al., 2016).

Furthermore, decision-makers need to be committed and equipped with holistic knowledge of justice and the tools to integrate discussions and decisions on it at different scales—national, regional, and local. However, justice should not only be embedded in the work of those who deal with decision-making, governance, and planning processes, but also in everyone’s everyday practices. In the book, Responsibility for Injustice, Young (2011) highlights the responsibilities that individuals and groups have in addressing and transforming unjust structures (such as those related to climate injustice and social inequality). She encourages everyone to see themselves as part of these structures and to promote shared responsibility and collective action. Justice is not merely a set of abstract principles. It is rooted in more significant concepts. For instance, justice is intertwined with the purpose of political cooperation and principles (Nussbaum, 2006). It is also partially rooted in the concept of solidarity, which involves fostering empathy and reducing inequality, or in the concept of democracy, which includes moral standards in decision-making and legislative systems. The principles of justice are not standalone. They are a blend of other principles, such as equality and fairness. Justice is a process in which questions, doubts, and concerns are addressed with respect (Tava, 2023; Varro, 2012).

The relationship between NbS and Justice

Just by looking into the definition of NbS in the ARCADIA project, borrowed from the European Research Executive Agency (2023), it is noticeable that the definition does not clearly communicate justice aspects such as inclusion, participation, equitable distribution of benefits and resources, accountability, and transparency. The definition is stated as “Nature-based solutions (NbS) are inspired and supported by nature, they are cost-effective, simultaneously provide environmental, social and

economic benefits and help build resilience; such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. NbS must benefit biodiversity and support the delivery of a range of ecosystem services" (EREA, 2023: 1). In other words, the position of justice in relation to NbS is not adequately addressed, leaving a gap in ensuring equitable environmental, social, and economic co-benefits. NbS often fails to adequately consider social and ecological justice, which limits its inclusivity and effectiveness (Grabowski et al., 2022). To enhance this, the definition of NbS can be restructured to better incorporate justice considerations. This would help ensure that justice goals are explicitly included in the understanding of NbS and in NbS-related policies.

The dialogue sessions confirm that there is a lack of clear justice-NbS relational understanding in all the model regions. Many of the representatives understand justice in relation to NbS only from the aspect of proximity and access to nature for humans, especially in urban areas, and to a lesser extent, in relation to certain vulnerable groups, identified as vulnerable mainly due to their specific socio-economic situations (and those being old). Moreover, the interviews did not really show recognition of NbS as a concept with the potential to address justice matters. They usually see justice as an outcome and discuss its relation to NbS in terms of how it would be better if the impacts of NbS were fairly distributed and for as many as possible. Justice is often viewed as a consequence of NbS. A by-product of NbS and a side consideration.

There is a critical need for a perspective shift and instead of seeing justice as a subset of NbS, one should look at NbS as one of the many tools in the broader framework of justice. This approach moves justice away from being a final step and embedded in the final product entangled with the implementation and outcomes of NbS. This perspective instead views justice as a driving force behind NbS, positioning NbS as one of the various strategies to achieve justice and address broader injustices. This calls for a more inclusive approach that reduces the risk of marginalizing justice. It can better address the systemic and fundamental causes of injustice and help integrate NbS with other justice policies (i.e., in relation to mobility and energy).

In addition, since the participants mainly view NbS as areas with technical functions, it is very important to redefine NbS as a space that promotes justice. Therefore, NbS must be viewed through the lens of spatial justice, ensuring it assists equitable and just environments. The concept of spatial justice focuses on the three key dimensions of distributional justice, procedural justice, and recognition justice.

Another issue that hinders operational justice via NbS lies in the gap between theoretical knowledge and practice. As the participants confirm, there are many "what-to-do" guides in the form of strategies and policies for just transformations, but a few "how-to-do" guides for implementation on the ground. There is a clear insight among the participants indicating that to improve synergistic justice, decision-making processes need to avoid the silo effect, seeing NbS as standalone projects and instead trying to understand how NbS interact with other socioeconomic, technological, and ecological interventions and tools.

Furthermore, there is a dominant human-centric perspective and pre-decisions on which humans are in focus and ecological or multispecies justice are not explicitly considered. This view can first hinder the representation of all voices and the recognition of those entities that have not yet been realized, defined,

or categorized. Second, this perspective heavily appreciates and considers NbS in the service of humans and overlooks the importance of NbS for and in nature. This results in overlooking social and ecological relationships. The lack of justice as recognition (and restorative justice) is what lead to consider humans as the main subjects of justice. Moreover, these approaches may fail to value human-nature relationships adequately and to recognize the potential in these links for leveraging these relationships to improve nature (via NbS). While ecological values can support social values, social values also have the potential to support and boost ecological and biodiversity values. For instance, a nature-based public space can develop new routines and lifestyles around appreciating nature (Mottaghi, 2023).

Evidence suggests that NbS should move beyond a human-centered perspective (Pineda-Pinto et al., 2022) by fully considering broader impacts and outcomes, to achieve a transition that is just for both humans and ecosystems, including biodiversity. The concept of multispecies justice has been increasingly taken into account also in NbS regulation and implementation: according to the IUCN Global Standard (2020), just and equitable NbS need to enhance adaptation and mitigation of natural and modified ecosystems to climate change in order to provide both human well-being and biodiversity benefits. Despite this strong assumption, recent literature reviews on NbS still underline an implicit anthropocentrism, which holds the separation of human and nature and the perception of nature as a resource to exploit in order to meet humans' needs (Rees & Doyon, 2023). By taking a multispecies framework into account, NbS design and planning can turn into a collaborative process involving both human and non-human actors: this approach can unlock the co-creative potential of ecosystems and humans to foster cooperation, resilience, and biodiversity conservation for the future in site-specific NbS implementation (Herman-Pillath et al., 2023).

Lack of financing NbS and economic inequality

According to the participants in the dialogues, economic situations influence the fairness of NbS. Based on their input the following aspects are identified as limiting investment in NbS. First, due to insufficient funding and limited resources, NbS cannot be implemented sufficiently. Decision-makers have no choice but to prioritize specific sorts of NbS in certain areas. This not only often results in distributive injustice but also forces short-term perspectives and less thorough processes, restricting opportunities such as multi-level and transdisciplinary approaches (that include a broad range of stakeholders, organizations, and institutes). The budgetary constraint also intersects with political disparities (regarding where funds are directed), as investing public money in one area means not investing it in another area.

Second, there is a multi-level economic interest in nature-based environments that often comes with conflicts of interest. For instance, if the national economy counts on tourism (the case in Croatia) or forestry wood (the case in Italy), this might heavily affect local resources and, hence, the living conditions of the residents of specific areas. Moreover, it is crucial for the existing or future NbS (such as a forest or a large green space influencing temperature, air quality, and flooding resilience of a certain area) to be safeguarded and considered important resources.

Third, socio-economic conditions influence engagement by individuals in nature-based initiatives. After people reach a minimum standard for their living conditions, they might start considering climate-neutral actions and NbS. Making NbS less costly for people is an underlying challenge for authorities and governments on national, regional and local levels.

According to some of the participants, justice needs to be first addressed at higher levels in a way that the state ensures the minimum standard for living conditions and basic social welfare for all. This can motivate the citizens and later increase community involvement in NbS processes and make them more just. The state could also ensure that NbS implementations are not fully dependent on individuals and locals. One reason is that the main challenge constantly shifts for the individuals, which is common in all of the model regions. Once the focus is on energy efficiency, another time, it can be on heat or flooding mitigation, and so on. The participants stressed that more regional economic plans are needed to even out the fairness of decisions and the implementation of NbS in the region.

In general, a systemic economic approach is needed to mobilize sustainable investments and funding mechanisms that are responsive at different national, regional, and local levels. Adopting equitable and collaborative financing systems can increase the effectiveness and success of NbS. Biasin et al. (2024) identify three key strategies to address financing challenges: knowledge and risk sharing, public-private co-financing, and alternative financing models. Economic diversification and better resource management strategies are required to align national objectives with local needs to support economic growth, environmental considerations and community resilience.

Financing is a powerful tool for implementing justice via NbS projects. Economic institutions can either support or hinder initiatives aimed at achieving sustainable justice. Combining economic considerations with social and environmental factors, emphasizing a stronger commitment to transformative justice, is essential (McCauley, 2024). The financial system can allow adaptation and safeguard what already works by making financing conditional to justice-oriented objectives. It is important to provide systemic financial support and place justice at the core of financing different types of transformations. Hence, justice criteria can be among the critical requirements for approving and granting public budgets to related projects that are based on the nature-based transformation of the environment.

NbS frameworks often fail to materialize because of budget constraints in the public sector and the limits of traditional public financing models. Moreover, investing public money (and taxes) while considering limited resources is complex. It requires lots of research and knowledge development on what, why, where, when, whom, and how to prioritize. Assembling private funding systems is essential but they cannot replace public finance (Calliari et al., 2022). A review paper by den Heijer and Coppens (2023) confirms the alternative financing techniques need to be embedded into the political, economic, social and technological, legal/institutional, and environmental/spatial context. However, the embodiment is a challenge due to certain barriers/drivers revolving around seven main conflicts/tensions. They present the tensions as “new revenue and risk distribution vs. uncertainty, budgetary and legal pressure vs. political willingness and risk aversion, market demand vs. market failures, private sector engagement vs. social acceptance and risks, legal and institutional conduciveness vs. inertia, and upscaling potential vs. environmental risks and land use” (Heijer and Coppens, 2023: 1). Attracting private investment needs to be part of the economic plans to alleviate financial constraints and promote multiple dimensions of justice, including environmental and social justice. Initiating private funding is particularly important for regions with a large portion of private lands since public authorities generally have no (or very limited) ability to influence how those lands are used and managed.

Historical physical, political and social context

Multiple historical aspects need to be acknowledged and considered in the transformation of cities and regions. The background of each context plays an important role in the NbS decision-making. This includes the history of land ownership and land use, as in Emilia Romagna and Malmö, or the city's history of physical development, as in Odense being developed in the delta (covering the watercourses), as well as its long history of water-related issues or the history of the legal and governance systems, relevant to all the cases, etc. The diverse historical contexts of each model region and their country need to be considered in the formulation of policies, strategies, and principles for a just transformation by NbS. The specific historical context results in different kinds of prioritization of justice concerns.

For instance, one municipality might prioritize socio-economic marginalization and, via NbS, try to empower marginalized groups and compensate for past degradations. Meanwhile, another municipality might first need to address ecological degradations and prioritize efficient ecosystem restoration via NbS. The political history, ideologies, and structures shape governmental organizations and, in general, citizen perceptions of justice and its application. This can create differences in the level of preparedness and how regions perceive their possibilities to achieve just NbS. For instance, countries with stronger and longer traditions of social democracy and welfare state ideology might view and aim for operational justice differently than others. However, further research is necessary to determine whether this plays out in reality and how to consider the differences in implementing just NbS.

Research also confirms that the specific historical context influences the social, ecological, and environmental challenges faced. Riisager-Simonsen (2022) reveals that the ecosystem state of the context and, hence, the history affect the acceptance of NbS. The historical context shapes if the nature-based intervention may count as proper NbS in a specific context. The historical context affects defining and implementing NbS in a given environment. The context affects ecological goals and public acceptance, as well as whether the NbS is effective and appropriate.

NbS approaches that are not sensitive to local contexts and histories can worsen injustices by harming ecosystems, ignoring Indigenous knowledge, and having a mere technical interpretation of nature (Grabowski et al., 2022). The complexity of the historical context makes it challenging for municipalities and regions to implement NBS in a way that deals with multiple issues, such as climate change, biodiversity, and mental health crises, simultaneously. The historical context sometimes makes the prioritization processes even more difficult regarding who should use what and who should decide. Justice matters grow when examining and acknowledging past wrong decisions, knowing they have shaped present injustice and require larger responsibilities to be taken in a broader scope and with ethical implications (Young, 2011).

Inconsistent planning processes (and design)

In the focus group dialogues with the model regions, justice was often referred to as a matter of planning. According to the participants, planning practices play a crucial role in aligning actions on sustainability (NbS, mobility, energy, etc.), a concept that is supposed to address multiple dimensions of justice. Justice can serve as the primary objective for all plans particularly those aimed at enhancing sustainability. Plans have been referred to as operative in creating strategic frameworks that align decisions, knowledge, resources, and actions to benefit all communities through just adaptations, from national to local levels. Participants agree that achieving justice in the context of climate resilience by

NbS is complex and never fully achievable. However, planners need to prioritize adaptation measures based on the extent and type of risk, as well as costs and benefits, and balance the trade-offs.

The participants also discussed how operating justice by NbS is situational, mainly due to political wills and limited resources and funding, and cannot be fully met. Hence, prioritizing some justice matters is an essential reality for the model regions. Effective and regularly updated national climate adaptation strategies were frequently emphasized. It was mentioned that the strategic positioning of NbS in national plans can be used as a mechanism for socio-ecological (and multi-species) justice in climate and ecological resilience and streamline funding and implementation of NbS. According to some participants, integrating NbS into the plans helps consistency and alignment in resources, funding, and strategies towards just NbS. This enables a more just and equitable delivery of NbS opportunities and benefits connected to adaptation and mitigation measures.

An effective national climate adaptation plan has been stated as a tool for implementing justice in some regions. Some participants think that if the national plan focuses clearly on NbS and positions NbS at the center of climate resilience, it can help align policies and plans through a systemic approach. Furthermore, participants indicated that the lack of strategic and action regional plans can add to the incoherence of planning systems. To them, enhancing the alignment between different plans, along with promoting inclusive and bottom-up approaches, could improve the likelihood of achieving just and equitable NBS. Increasing climate resilience using NbS in each model region requires an effective and consistent planning system. Research also supports the insights from the dialogues (i.e., Wickenberg et al., 2021).

Planning practices play a crucial role in climate adaptation and aligning multiple sustainability objectives. Efficient planning centers on justice and not replicating the historical legacies of injustice (Anguelovski et al., 2016). In the book, Social Justice and the City, Harvey (1973) criticizes traditional urban planning and geography and highlights the need for the lens of justice to move the practice toward addressing the uneven distribution of resources. He explores key issues in city planning and policy, focusing on housing, zoning, transport costs, and poverty, in relation to social justice and space.

The dialogues also confirm that planning has a lot of power in shaping the city, rural, regional, and national landscape. Viewing NbS as part of a larger landscape needs to be embedded in the planning systems rather than viewing NbS as isolated spaces. Campbell and Marshall (2006) examine the application of justice within urban planning and highlight the failure of justice theories to turn to actionable planning guidance and integration of justice into everyday planning decisions, particularly in the absence of context-sensitive approaches. They present justice as a challenges to planners. “It is about starting from an understanding of the socio-economic and institutional context in which planning finds itself, not an idealization of that context, and then seeking to relate that context to a conception of justice which interweaves both substantive and process oriented elements” (Campbell and Marshall 2006: 250). Schmitt and Weck (2024) focus on the relationship between distributional justice and procedural justice in planning and refer to “just planning” as a nuanced planning approach that is concerned not only with the outcomes of its decisions and plans but also with the inclusivity of the processes and methods adopted. If justice becomes one of the main objectives of planning, the concept of just planning can become the core of planning systems and create active dialogue that promotes multi-level justice.

Another concern raised in the dialogues is the impact and influence of market-oriented planning systems. It is essential to find answers on how planning for NbS can be just and less affected by market-driven trends while at the same time turning just planning into a market trend for not only NbS but for all socio-ecological measures required for sustaining and improving life. In addition, planning practices involve highly technical aspects and need to look for more soft values and knowledge and find ways to incorporate them. Research highlights the necessity for a more inclusive and less technical approach to urban planning. For example, Herzog et al. (2024) examined the possibilities for integrating quantitative data into the planning process by identifying public values in urban spaces and recognizing the synergies and conflicts among them in the planning process.

The model regions mostly view NbS as a kind of nature-based space (environment) and a piece of the regional landscape that cannot be understood and implemented without considering other elements of the landscape. According to them, an efficient planning system is vital in creating just spaces and maximizes the function, and acceptance of nature-based interventions. Effective spatial planning can promote distributional (as well as procedural and recognition) justice by incorporating and overlapping diverse social, economic, and environmental data, strategies, and plans. Up-to-date spatial plans can acknowledge and elaborate on the complex relationships within and across the region (such as those between human health, biodiversity, population density, and environmental risks). This can facilitate integrated perspectives on the fair distribution of NbS, enable inclusive decision-making processes, and identify the needs of marginalized groups and non-human species within nature-based transformations in the region.

Some participants mentioned that justice lenses also need to be found in physical planning practices. The absence of justice views and criteria in physical planning systems leads to a failure to influence plans to improve socio-ecological justice and, hence, misses the great opportunity to utilize planning systems as an effective tool to operationalize justice. The issues with inconsistent physical plans have been extensively discussed in the focus group discussion with the Skåne region and slightly with the Funen region, in which municipal bodies play a crucial role in prioritizing, financing, and implementing climate adaptation measures and NbS. To them, legislative incoherence (as a hindrance to operational justice) is viewed as the failure to leverage physical planning systems to achieve and foster justice. Reviewing planning paradigms through the lens of justice can enhance coherence within legal systems and improve fairness in the (re)development of certain areas. Here is an example to clarify what planning inconsistency may refer to.

In Sweden, municipalities can use comprehensive plans to strategically coordinate various risk issues and provide guidance for future urban (re)developments. However, these comprehensive plans are not legally binding, which limits their effectiveness, for instance in implementing NbS, as they consist mainly of recommendations. On the other hand, detailed plans are legally binding and the most powerful planning documents, through which municipalities have the power to designate specific areas for particular functions to reduce specific identified risks. However, when detailed plans are issued, they turn into fixed regulations that are rarely, and only exceptionally, may be revised. The inflexibility of such legal documents resulted in many existing detailed plans being outdated and not adapted to current needs, such as climate change. Additionally, these detailed plans are limited to the specific area and do not extend beyond them. There is a clear need for more detailed relational planning since current

regulations make them overly rigid. This often hinders a just transformation of the environment. Facilitating pre-conditions for coherence between plans is a prerequisite for creating coherence, as there are usually numerous legal obstacles to this step.

Insufficient consideration of the interconnections between challenges and in relation to time, space, and scale can result in non-integrated plans created by spatial and physical planning processes. Aiming for just spaces highlights the concept of spatial justice, which refers to the spatial dimension of justice and the need for a spatial approach to recognize injustice and promote justice (i.e., Harvey, 1973; Lefebvre, 1996; Dadashpoor & Alvandipour, 2020). Spatial justice is also a multiscalar concept based on looking into inequality at different interrelated levels, elaborating on how decisions at one scale influence and are influenced by those at other scales. Madanipour et al. (2022) highlight the importance of adopting spatial justice frameworks in a broader context, in the EU territorial cohesion policy to ensure justice across all regions. They refer to the regional disparities and inequalities in the EU and criticize the territorial cohesion policy for not fully integrating the principles of spatial justice. They argue that although the policy addressed spatial imbalances, it still falls short in adequately responding to social inequalities.

Additionally, some participants emphasize the significance of recognizing the role of design in promoting justice. This was also confirmed by some scholars who have written on how injustices can be integrated into the built environment through design. They have highlighted the importance of inclusive design in achieving spatial justice and encouraged avoiding homogeneous lenses in design and even moving beyond human-centered approaches (e.g., Piazzoni et al., 2024; Fieuw et al., 2022; Shi et al., 2016). NbS as physical elements requires a just design and not only as a product (imposing certain human-nature relations) but also as a process (creating new human-nature meanings and relations). Co-planning and co-design are tools that enhance the inclusiveness of decision making and governance of NbS by encouraging everyone to participate in the processes.

Ineffective governance systems and power dynamics

The insight from the dialogues indicates incoherence in governance (as a concept) and its system (interconnected mechanisms and structure of governance), highlighting it as one of the most substantial obstacles for just NbS. Disparities across sectors and levels of governance (in general) were mentioned in relation to issues such as poor coordination, inconsistent policies, and contradictory objectives. Conflicting interests across governance levels can be obstacles to achieving just NbS if not properly dealt with, such as developing tourism infrastructure to support the national economy and regenerating local ecologies in the case of the model region in Croatia. The participants stated how these issues could end in significant conflicts when challenges are dealt with in silos and with short-term perspectives. They also stressed the lack of a clear positioning of NbS in governance systems, which makes implementing justice challenging because of the uncertainty around who does what and when.

Research also confirms that institutional obstacles, systematic fragmentation, and lack of time-space perspectives within and across different policy sectors influence the inclusivity, adaptability, and, in general, the efficiency of governance (i.e., Pröbstl et al., 2023; Jupp, 2021). Lack of alignment across sectors (such as the traffic and roads sector and the park and greenery sector) and lack of harmony of policies and actions at different local, regional, and national levels are crucial to be tackled through cross-sectoral collaborations and multi-level governance systems. Some research highlights a need for

reflexive governance as a response to such challenges (i.e., Wickenberg, 2022; van der Jagt, 2021). Reflexive governance acknowledges the interconnectivity of different sectors and their systems in addressing emerging challenges and supporting sustainability transitions. “A governance mode can be called reflexive if it includes the perspectives, values and norms of a variety of actors, which in turn has consequences for the interventions of the governance system. More specifically, these governance processes itself can become the object of the shaping strategies” (Feindt and Weiland, 2018: 665).

The participants also referred to the current distribution of power as a barrier to justice. Dominant power relations in governance are usually embedded in the traditions, culture, and history of governance structures. They can create rigid and inflexible structures and an imbalance in influences in decision-making processes. Hence, addressing power dynamics within governance systems is essential to give room to all voices and recognize needs. The dominant power distribution structure can play a significant role in resistance against operational justice. Some countries have very strong centralized governance systems, which may be helpful in efficiently aligning objectives and policies and offering some advantages. However, they can also be a barrier to justice and present hindrances to address inequities, for instance, due to the slow reaction time. Therefore, finding a balance between centralized and decentralized decision-making is key.

For instance, in the case of one of the model regions, regional authorities have many responsibilities in the implementation of the decisions made at the national level, while having limited influence on the national decisions. These top-down governance structures can work efficiently in some aspects; however, not questioning centralized systems and power relations can hinder a fair distribution of power and, hence, inequity and injustice impacts. Besides, imposing top-down decisions (such as those made at EU levels) can increase top-down effects for countries in which top-down approaches are already a tradition and, in some aspects, may result in more injustice. An adaptive and adjustable governance system is essential for balancing power to achieve equitable outcomes. Revising governance systems through the lens of justice can be very influential in the redistribution of power, making it more equitable by promoting collaboration and inclusivity in decision-making processes. However, this process requires navigating and dealing with the existing power structure, its tensions, and conflicts (van der Jagt, 2021).

The dialogues also highlighted that decisions related to NbS are inherently political since politicians usually make final decisions on economic investments. Previous studies examined the politics of governance regarding NbS and confirmed that political values and priorities influence its adoption and affect mainstreaming enablers (i.e., Adams et al., 2024; Tozer et al, 2023). Lack of clarity and unity in the political will and temporality of the political positions and leadership is a challenge that can lead to insecurity in NbS decisions in achieving justice. The insights from the dialogues indicate that the governance of NbS needs to actively engage politicians, which requires the regions to effectively communicate with the politicians through indicators and indexes related to justice (i.e., in relation to health). This can also help prioritize NbS in financial decisions as a response to existing inequalities.

In addition, the participants often highlighted the gap between bottom-up initiatives and top-down strategies. In other words, there is a clear need for efficient hybrid and co-governance approaches through which policy makers and non-public sectors collaborate to bridge the existing gaps and deliver shared benefits to multiple actors (Toxopeus et al., 2020). This can be facilitated by looking for cross-

organizational frameworks and pathways to gain shared objectives, governance, funding, and data collection. It is important to enhance collaboration between public, private, and local actors (collective groups not being governmental and not part of business sectors such as NGOs, grassroots groups, and, in general, a group of people following the same goals) and to balance bottom-up and top-down governance approaches.

The main component of the NbS implementation is the process of establishing knowledge that is based on cooperation and co-development (Wickenberg et al., 2021). However, co-production and co-governance approaches can have both positive and negative effects on justice outcomes. To minimize tensions and negative effects, Toxopeus et al. (2020) emphasize the need for transparency in decision-making, maintaining public control over NbS, and applying context-sensitive knowledge produced in the intersection between community input and scientific expertise. It is very useful to involve citizens and learn about their real-world experiences. This brings more profound knowledge regarding contextual situations and needs and, more specifically, engages vulnerable groups and empowers them in decision-making processes.

Furthermore, some participants emphasized the need for facilitator and mediator bodies in operating justice. They were referring to the efficient role intergovernmental and trans-level organizations can play in integrating and coordinating actions. Trans-level bodies can be efficient in bridging local, regional, and national levels and promoting collaborative frameworks. They can play a mediator role, enhance communication, and facilitate dialogues. For instance, in some governance systems, municipalities have a very powerful role in decision-making over the needed projects, including implementing NbS (and maybe doing that in a just way). However, huge differences exist in the opportunities and resources between municipalities in the same region, which results in some aspects of injustice (such as distributive) related to NbS.

This can possibly be addressed at regional levels and by trans-level organizations. Regional bodies or units can facilitate governance coherence between national, local, and regional levels. In another context, municipalities have very little role in decision-making and mainly implement the decisions made at higher (national or regional) levels. In such regions, stronger bottom-up approaches and municipal roles are needed. In general, trans-level organizations can tackle disparities by prioritizing common goals and strategies and coordinating to reach them, as well as address the differences in resources and planning capacities and prepare the ground for just nature-based transformation of the region. They can also be influential in aligning laws and plans with EU-wide, National-wide, and regional-wide objectives.

This type of organization not only needs to be well established but also supported with resources and initiatives to promote justice. They can also play an important role in capacity building and sharing knowledge, which is vital for regions and municipalities that lack expertise and experience. For instance, the role of the EC as a transnational organization in setting guidelines and funding to address environmental challenges is more effective for some countries. Not all member states have the same level of resources and capacities to implement NbS strategies evenly. This is particularly important in promoting environmental justice to ensure all members have some opportunities to address ecological and climate challenges.

Insufficient assessing, monitoring and knowledge

The participants often mentioned achieving just NbS needs analyzing and assessing the context as well as the existing NbS to identify justice-related issues and approaches. This helps establish evaluation criteria and indexes for just and equitable NbS. Reviewing, assessing, and monitoring NbS and their effects can provide insights into their effectiveness and shortcomings, allowing measuring their socio-ecological impacts comprehensively. For example, the implementation of different sensors in the environment or the development of collaborative data collection systems, such as citizen science labs, were mentioned as very helpful by the participants. The participants also stressed the need for regional and national support to initiate such approaches. The support can as well enhance the co-production of knowledge by encouraging citizens to actively participate in qualitative and quantitative data collection and problem identification processes.

Research endorses the important role of evaluation and fact-based knowledge in reinforcing NbS decisions and confirms that knowledge gaps can create barriers to collaborative governance (Dorst et al., 2022). Pathways for just NbS can be implemented through a robust data-driven approach (Cousins, 2021). Van Lierop et al. (2024) explore the interplay between governance and assessing-monitoring of NbS and reveal that evidence-based knowledge empowers individuals and institutions to influence political commitment and builds capacities for collaborative actions. However, they also highlight the challenges of including some aspects of justice such as environmental justice in the evaluation.

The dialogues also indicate there is a need for spatial understanding and spatial mapping in relation to NbS. This knowledge is essential to address spatial justice. Efficient spatial understanding allows combining NbS and other layers of infrastructure. Spatial mapping can help reveal overlapped issues and enhance holistic and integrated decision-making, for instance, in terms of recognition of heatwaves and vulnerable areas (such as where elderly people live) and merging the required decisions and measures. Justice is contextual and situational. There is not only a need to find efficient methods to explore and assess justice aspects but also to assess them as relational matters. This needs understanding, predicting possible scenarios and situations, and developing models. The methods of data collection and measurement need to also be adjustable because every day, there is a new need based on the new situations.

To understand how NbS influences justice, there is a need for mixed methods approaches, hence facilitating qualitative analysis (i.e., Yazar and York, 2023) and research since measurements are currently heavily quantitative. Combining information and methods can integrate social, ecological, and technological values and identify meaningful places and relational values (Maurer et al., 2023). Micro-data about socio-demographic dimensions need to be collected and used to estimate the areas with higher inequalities and vulnerabilities (Pappalardo et al., 2023). According to Mohtat and Khirfan (2023), NbS planning remains a technocratic process (grounded in economic valuation approaches and technical justifications). Transformative co-production pathways can bring solutions to enhance the inclusion of different groups in decision-making. Just NbS requires recognizing and including the local experiential knowledge of under-represented groups by leveraging on, for instance, citizen science initiatives and participatory mapping and GIS analysis methodologies.

Moreover, as clearly stated by the European Commission (2021), just NbS impact assessment needs a comprehensive framework and a robust set of indicators across different societal challenge areas. Value

articulation pathway elaborates on this as successful evaluation of NbS performance and impact relies on the selection of the appropriate data collection methods and the quality of data and its inherent characteristics (e.g., granularity and homogeneity) generated throughout the NbS monitoring period. Information for NbS impact evaluation, including a crucial step of baseline assessment, can be obtained via multiple sources, including in-situ measurements, laboratory experiments, remote sensing, earth observation techniques, and citizen science. Furthermore, some participants also mentioned a gap in the collection and sharing of knowledge among municipalities and regions, which raises concerns about justice. Many municipalities and regions lack NbS or opportunities for learning by doing on this topic due to economic challenges or not having relevant issues that NbS can address. However, other municipalities and regions might have valuable experiences and knowledge to share, and the state (and the EU) can be very effective in making the knowledge available to all.

Incoherent legislation and regulation

Legislation and regulations are closely related to political, governance, and planning systems, yet they are not the same. They indicate more directly and firmly what (in the form of legal frameworks) and how (in the form of rules and guidance) to focus on in relation to NbS. The dialogues imply that existing legislation and regulations in the model regions influence NbS processes, implementations, and their justice dimensions. According to the participants, even if they manage to address all justice concerns in NbS processes, their fair and proper implementation can be hindered by legislative constraints. Hence, sometimes, due to the urgency of taking NbS-related actions, significant creativity and innovative strategies are needed from their side to navigate the laws and operate within gray areas.

Besides, NbS are introduced as multi-functional approaches, and hence, legal documents and regulations should facilitate and support their multi-functionality. This topic has not yet reached the legislative systems (probably due to the complexity). Another issue mentioned was that the regulation systems are often very fixed and inconsistent. The systems are usually old, operate in silos, and cannot compensate for the needs emerging (i.e., from climate change) so rapidly. Overall, the representatives of the model regions suggest that legal frameworks and rules need to become more adaptive to changing needs (since the laws are currently set very specifically) and that legal structures should allow faster adjustments.

Research confirms the obstacles that current laws and rules bring to NbS and to the effectiveness of GBI to be planned, implemented, and scaled up in a sustainable way (i.e., Bogdzevic, 2023; Duffaut et al., 2022). There is not only too little space for NbS and its implications within national and local legislation and regulatory systems but also a lack of multi-sectoral and multi-disciplinary frameworks to address these limitations (i.e., Bogdzevic, 2023; Ordonez-Barona et al., 2021). A non-integrated regulation system poses a challenge for operational justice. Here comes an example from the Skåne region regarding the planning principle of 3-30-300. To effectively implement the principle of 3-30-300, municipalities need to reduce the distance between infrastructural pipes and trees (the distance concerns the root's damage to the pipes). However, the regulations need to be redefined to foster a more creative, integrative, and collaborative approach.

The regulation gaps present a responsive approach to various aspects of justice, including multi-species justice, climate justice, and distributive justice, and call for new guidance and principles to adjust the regulatory systems in order to improve climate and environmental resilience (Farina et al., 2024). Pope

et al. (2021) examine the recent framework in earth system law and find it helpful in guiding legal principles to address socio-ecological crises via a justice model that is inclusive of human and non-human forms. By stressing the 'what,' 'who,' and 'how' of justice, they propose a transformative legal basis to guide law systems toward sustainability and planetary integrity. In addition, sometimes, modification is needed to reform the legal frameworks to align the rules to meet just environments. For instance, with regard to the spatial considerations of NbS, it is important to revisit the regulatory frameworks in a way that ensures these environments do not conflict and compete with spaces designated for or used by marginalized or underrepresented groups (who first need to be first identified), such as playgrounds for children. Instead, NbS should complement these areas (Mottaghi et al., 2021).

Lack of pilot projects and living labs

The participants emphasized the need for more pilot projects and investments in analyzing and, at the same time, researching the processes and outcomes of NbS. Such initiatives can help identify the undefined, unpredictable, and unintentional consequences of (existing) NbS and search for or embed justice in the process of (current and future) NbS. Within the framework of pilot projects, opportunities can be provided to engage citizens in honest dialogues between authorities and society to exchange concerns and shape knowledge and actions together. This also highlights the need for new competencies and the importance of research-based collaborations to reach efficient participatory methods in engaging diverse stakeholders in NbS processes (Wickenberg, 2024).

Although NbS is rooted in traditional ecological methods and practices, it is a new concept and critical tool for achieving sustainability by tackling environmental and climate changes. Understanding how justice is related to NbS requires learning by doing. Operating justice via NbS is relative and based on specific situations and conditions in the region. Some participants pointed out the need for going through the most important step, which is moving beyond inaction by realizing what is possible and can be utilized rather than waiting for a perfect condition and aiming for future improvements. However, it is not only important to put efforts into defending and generating nature-based interventions, but also defining and designing the projects/labs with a specific focus on justice as well as developing methods, initiatives, and frameworks to measure and track the fairness of NbS and ensure just NbS and processes in the later projects. Pilot projects/labs can play as test beds for justice dimensions particularly procedural and recognitional justice (Snep et al., 2023). They can also help in the identification of indicators and develop criteria and regulations for a just implementation of NbS.

According to the participant, increasing the number of NbS projects can also change the perspectives of stakeholders and communities, shifting views from potential resistance to supporting NbS. More NbS projects based on public-private corporations increase what/how-to-do knowledge and provide opportunities for experiential governance, planning design, and implementations (Eneqvist and Karvonen., 2021). They can provide direct contact to nature for people and develop meaningful actions. More implementation of NbS allows people to experience, interact with, and attach to nature in mundane life, and this affects perceptions of what NbS means to people and what they expect from it (Mottaghi, 2023). According to the insights from the dialogues, the project-based experiences enable (particularly some) regions to develop knowledge locally and update strategies at higher levels. However, it is important to be aware of the risk of leading to a generalization without contextualization. Furthermore adopting a relational lens to co-creation processes is essential, which highlights considering the uniqueness of each context and the embedded inter-relationality (Soini et al., 2023).

Increasing opportunities for collaborative projects, such as living labs, testbeds, innovation labs, etc., can reduce the gap between research and practice. They can open up opportunities for research by practice (practice-based research), which generates new knowledge and insights by engaging in real, practical processes and actions, and practice by research (research-based practice), which applies existing and up-to-date research and knowledge to improve methods and outcomes in practice. Although influential in the co-production of knowledge and co-ownership, they might as well initially result in more conflicts, disagreements, and pre-made decisions. However, they can initiate new types of conversations and disputes. Their impacts need to be understood in a long-term manner and in relation to empowering marginalized groups and reshaping mindsets and the role of different actors (Lupp et al., 2020). If the projects/labs and their processes are sufficiently designed, they provide a supportive environment for collaboration and testing, while also reducing sectoral silos (Sarabi et al., 2021). They are also instrumental in creating opportunities for more NbS assessment and monitoring as well as tackling another driver for unjust NbS, which is a lack of dialogue and proper communication.

Lack of dialogues and insufficient communication approaches

According to the participants, there is a considerable difference between NbS and energy refurbishment of buildings. The second is easier to digest since everyone can notice the difference before and after in their budget. This indicates the justice dimensions of NbS can be better communicated if done in the form of their impact on everyday life (of householders, politicians, etc.). Justice, NbS and the connection between them are not tangible concepts for citizens or politicians. Hence, it is important to measure and quantify the impact of NbS in relation to common concerns and challenges such as individual health or the economy. This also relates to the need for sufficient evaluation and communication of its result, possibly ending in citizens valuing NbS in another way and from a different angle. Some research highlights the effective role of communication and confirms that NbS needs to be integrated into existing policies via joint and constant dialogues between policy-makers, society, and scientists (Arlati et al., 2021; Ferreira et al., 2020). NbS are not always welcomed by everyone, and communication and dialogues need to be viewed through care lenses. Care is about exploring tensions, conflicts, and expectations, understanding concerns, and responding to them (e.g., through increasing awareness or economic compensation).

One of the participants stressed that decision-making processes need to be transparent rather than conservative and not open up sensitive discussions to avoid more conflicts, which adds to the complexity. Another participant refers to an example in the Odense region, which shows that when citizens are given the right information and communicated respectfully, they can make very different decisions. Previous research showed that lack of communication is one of the key barriers to implementing NbS (Kauark-Fontes et al., 2023; He et al., 2022; Sarabi et al., 2021). Facilitating communication between different stakeholders can help to even out power relations. Furthermore, political will is crucial for addressing justice issues, and it is often challenging to prioritize those concerns for politicians. Communication with politicians is also an area that needs to be improved. According to the participants, the role of political icons, such as the mayor of a city, in the transformation process, is very critical. Hence, it is often important to communicate facts with those politicians, and the role of research models and data is important here. Robust, fact-based narratives are needed in this regard. Formulating the narrative around justice is important to make justice central to the dialogue with politicians and turn achieving just NbS into a key concern for communities.

In addition, capacity-building programs and effective communication of valuable knowledge can empower society. For example, in relation to the issue that all model regions face, which is the NbS green waste that bothers people and makes them less attracted to NbS, offering people knowledge on how to get benefits from the waste, such as turning the bio-waste into fertilizer, could be beneficial. To facilitate co-learning, institutional spaces are needed to develop communication and collaborative skills (Frantzeskaki et al., 2020). Improving communication skills and methods is crucial and can enhance trust between various parties. This is discussed more under another driver for unjust NbS in this report which is the lack of community involvement. However, there is still a significant gap in how to mobilize dialogues and enhance communication approaches.

The absence of communication affects the fairness of the NbS measures. Justice is a continuous process that can become operational through active dialogues between all actors and collaborative decisions between governance and planning. This includes everyone engaged in decision-making, policy formulation, strategy development, planning, legislation, design, infrastructure, economic considerations, implementation, management, community engagement, and all other related aspects. Dialogues help centralize justice in NbS processes and promote and integrate multi-level and inclusive approaches related to NbS. Moreover, developing regional strategies and principles (such as the 3-30-300 principle in the Skåne region) can spark many meaningful discussions (for instance, around connecting green and healthy landscapes) with and within municipalities at regional levels. Such discussions can help make justice more tangible for communities and create a common understanding across individuals and groups. More NbS projects can also generate the basis for dialogues and add knowledge to the procedures and impacts.

Lack of community involvement and trust

According to the participants, community involvement is crucial for the success of NbS projects and initiatives. Enhancing climate resilience through NbS needs to prioritize bottom-up approaches that engage locals and address their concerns directly. Acknowledging and addressing diverse and collective interests, such as facilitating urban farming and community gardens, has been mentioned as one way to promote general public support for citizens and in relation to their interests and, at the same time, allow them to feel concerned and influence their environment, through which they can also develop attachments and connections to it. Citizens and communities need to believe in the potential of NbS and often experience NbS projects in reality. Efficient approaches need to be utilized to involve people and build trust.

Applying holistic and collaborative approaches that consider multiple dimensions of opportunities and risks is an important step for the co-benefits and just NbS. Involving citizens in NbS decision-making needs to be prioritized and approached carefully to ensure inclusive processes and avoid disappointment or ignorance. Research emphasizes the positive effect of co-creation based on participatory approaches that facilitate and improve collaboration and trust between different stakeholders and professionals (including scientists) (Giordano, 2020). These approaches are efficient in reducing conflicts and improving the fairness of NbS. However, participatory processes need to be context-specific and support systemic decision-making.

Thus, it is important for the participatory tools to be carefully designed and selected (Bogatinoska et al., 2022). According to Dushkova et al. (2024), there is a critical lack of user-friendly frameworks and

contextualization of methods. Participatory practices need knowledge and expertise and hence strongly rely on tackling another driver of injustice on lack of dialogues and proper communication to achieve shared understanding. Mabon et al. (2022) apply an epistemic-justice lens to explore whose knowledge and experience count in NbS decisions. Regarding the impacts of co-creation approaches in addressing procedural and recognition justice, they conclude that more participation "will not necessarily reduce the potential for claims to epistemic injustice, if participation comes at a stage or in a form where residents experiences and knowledges are not able to substantively alter the way in which the city's adaptation and urban nature vision is developed" (Mabon et al., 2022: 662).

It is important for cultural and behavioral knowledge to be included and prioritized in designing participatory processes rather than just gathering people and expecting them to feel they are included. Without smart and sensitive communication around justice and NbS, the results are unlikely to be efficient or successful. For instance, a top-down view over bottom-up participatory approaches and using community involvement as a tool to facilitate implementations of finalized plans and designs can neither be fair nor efficient in promoting justice. Moreover, it is important to be reflective and carefully explore alternative participatory approaches to better integrate community values into NbS processes (Diep et al., 2022).

Resistance to paradigm shifts toward human-nature harmony

According to the insights from the dialogues, NbS decisions have rarely been based on deliberations on justice issues. They usually involve specific prioritization, interests, and economics, which points to the lack of incorporation of justice frameworks into the decision-making processes. Many policy frameworks are justice-ignored, with no transparent trade-offs in political decisions. Justice is mainly referred to as a by-product of transformative projects. It has not been a direct consideration in many NbS projects in the model regions. However, all types of project processes and implementations affect the fairness of the outcome and the overall context surrounding those projects. In addition, the dialogues revealed a need for agreement on justice as a core value for NbS.

Although justice is a relational concept, it has central objectives and dimensions related to fundamental human needs, such as access to healthy and safe living conditions and environments. Justice also has secondary objectives and less critical aspects. These aspects should be recognized and agreed upon within each specific context, environment, and community, with goals assigned for future transformations. To explain via an emaple, Mabon et al. (2022) highlight that including multi-actor knowledge in NbS processes is an important step in achieving just NbS. However, this does not mean accepting all ideas equally, particularly in relation to the seriousness of climate change and its impact. Prioritize saving lives (looking at life as a whole) and positioning it above all objectives cannot be avoidable.

Some reflections by participants indicate that dominant paradigms in the form of accepted frameworks and patterns shape our surroundings. Hence, reviewing and redefining the norms and paradigms (e.g., car-centric developments) are essential to ensure enough space for a just nature. There is often a misalignment between social and ecological decision-making processes (based on trends and agendas) that also calls for paradigm shifts. This needs questioning our understanding of society and nature, avoiding seeing them in isolation and making sure pushing one aspect does not diminish another aspect. NbS research has discussed the need for a paradigm shift (and its barriers) to balance nature and human-

centered phenomena such as urbanization and densification (e.g., Lemes de Oliveira et al., 2024; Bark et al., 2021; Maller, 2021).

Paradigm shift concerns revisiting the basic concepts, standard routines, and norms in disciplines (mainly due to the change in the problems and focuses) and replacing them via new concepts and new ways of thinking (Kuhn, 1962). New patterns are essential in all practices and disciplines dealing with changing our environments. Patterns shaped in harmony with nature can also open room for NbS. Advocating for nature is essential across all levels of decision-making and in every sector. Paradigms evolving around justice can avoid creating opportunities at the cost of limiting other groups and lives opportunities. Grounding NbS in justice requires paradigm shifts and criticizing some dominant concepts, (such as the densification paradigm in urban design) towards more justice-oriented concepts.

Regimes related to urban and regional infrastructures must also change to facilitate employing NbS in cities and regions (Dorst et al., 2021). In addition, a new legal paradigm is needed to look into socio-ecological issues through justice, which calls for a more realistic approach to integrate social and ecological justice, rather than relying on traditional views of what NbS does. By getting distance from the too-optimistic view on nature-based innovations and technologies, the target for achieving just NbS shifts from overly focused on a fair distribution of resources and environmental advantages (and harms in some cases) to operate justice for all individuals and nature regarding rights, participations, and benefits and as interplaying (between nature and society) matters which interact in complex ways (Pope et al., 2021).

NbS can act as a powerful tool and an active agent in regulating the relationship between to humans and nature and reforming it as a just relationship. While more research is needed to investigate how NbS can align with justice approaches, some existing research on the topic exists. For example, a study by Perera et al. (2024) demonstrates that incorporating nature-based justice objectives into real estate development can effectively address societal challenges within the housing sector. King et al. (2023) question the current governance and actor networks and highlight the need for a paradigm shift in environmental management practices. They emphasize the role of the community of practice and its role in providing platforms for faster social learning in this regard, which can drive the required changes.

The paradigm shift requires viewing issues through a justice lens. It helps repair living environments based on acknowledging tensions and conflicts that have developed over time in the environment. A shift that concerns the quality of the environment and elaborates on the recognition of justice angles. This also needs knowledge improvement in setting objectives and developing caring relationships to achieve them within and across the involved organizations and stakeholders. This significantly influences persistence in maintaining active and meaningful dialogues to do things and make decisions. According to the participants, preparedness is important at all levels, and one way to increase it is by shifting mindsets and seeing ourselves in a broader and more dependent context. This can also efficiently deal with the “not in my backyard” mentality in society, which is currently a challenge for just nature-based transition.

Mercado et al. (2024) advocate for a more inclusive and holistic approach, called Nature-based Thinking (Randrup et al., 2020), to integrating nature within urban environments. They emphasize the notion of nature with people—not for people and elaborate on the need for new governance paradigms

that encourage cross-sectoral coordination and local stakeholder engagement beyond traditional organizational frameworks. Human-nature links are important to be considered in the paradigm shifts. Nevertheless, more research is needed on how to apply and address this link to improve our environments as well as how to transform the environments in the context of climate change in a way to scale up the human-nature relations (in size, capacity, and range). Furthermore, training the next generation of public, private, and societal actors (including politicians) is essential to facilitating paradigm shifts. In addition, incorporating ecological considerations into the management and maintenance of infrastructures is essential to foster greater sensitivity and care for nature.

Pineda-Pinto et al. (2022b), through analyses of peer-reviewed records, present a highly human-centered perspective in delivering NbS and in relation to social justice in planning. However, their work confirms that ecological justice aspects are missing from the literature, not elaborating much on the dimensions of ecological justice. Research criticizes traditional planning practices and calls for a new paradigm that moves beyond traditional models and quantitative standards (while taking advantage of them) in planning and strong linkage between NbS and other infrastructures (i.e., Ronchi et al., 2020). NbS planning is a mechanism for achieving justice and fairness in urban ecosystems, and a justice-driven paradigm shift in planning is necessary (Pineda-Pinto et al., 2022b). Previous studies also confirm that the NbS paradigm could better integrate diverse, context-specific knowledge and perspectives through a more critical assessment of NbS practices and research (i.e., Woroniecki et al., 2020). Regional strategies and plans can play important roles in facilitating paradigm shifts and efficiently addressing socio-ecological and multi-species disparities.

Justice gaps in sustainability frameworks

Looking into the reflections from all model regions on their established frameworks for climate resilience and sustainability (prior to the dialogues) sent by email reveals that there is insufficient attention paid to the relationship between justice and NbS. Moreover, generally, there is a lack of emphasis on justice and fairness within urban and regional frameworks for climate resilience and sustainability. Furthermore, while some regions appeared to recognize this gap based on their written responses, not all did. This discrepancy became more evident when the authors of this report went through the documents the regions referenced, which indicates significant differences in how the regions interpreted them in relation to justice compared to how the authors understood them. The dialogues presented the lack of justice concerns in sustainability frameworks as one of the barriers to operational justice. The dialogues strongly confirm the existence of important gaps in the relationship between concepts of justice and sustainability, both in the existing materials and in the perspectives of representatives. There is a noticeable diversity within and across the regions in how they interpret their policies, strategies, principles, and plans regarding the two concepts of justice and NbS.

According to the participants, some model regions have recognized the potential for NbS to become embedded in their country and region's climate adaptation strategies. They stress that by prioritizing justice in climate resilience objectives, NbS can better align with justice ethics and principles, adopting pathways for equitable and just transitions. This also enables the regions to be obliged to facilitate more opportunities for fair and just development of NbS in order to meet higher goals. However, enhancing the link between NbS and justice demands revisiting and reinterpreting the notion of sustainability. Justice needs to be better integrated into sustainability goals and climate resilience agendas. Particularly

since NbS, as a concept, is assigned to largely contribute to the sustainable development of our environments.

Stumpf et al. (2015) argue that the concept of justice can be used to explain the normative aspect of sustainability. They refer to "sustainability justice" and explain it as dependent on two parameters. "First, the specification of the elements of justice should fit the concept of sustainability with its core characteristics and underlying ontological, epistemological, and ethical assumptions; and second, the elements should be consistent with each other (for example, claims and informational base)" (Stumpf et al., 2015: 7459). Wijsman and Berbes-Blazques (2022) underline the need to investigate and refine existing frameworks of sustainability and justice to improve their execution in practice. There are explicit conflicts between the implementation policies in practice and theoretical understanding in improving justice. McCauley et al. (2024) advocate a greater focus on transformative justice via integration between economic, social, and environmental dimensions of sustainability. Grossman et al. (2022) advocate a framework alteration from sustainability to socio-ecological justice as a more effective framework to address environmental concerns and integrate social justice into policymaking simultaneously.

As being mentioned before, during the dialogues, justice was dominantly referred to as social justice for the current society. Caring about other species and future generations (indicating multi-species justice and intergenerational justice) was almost absent from the discussions. One reason might be that most of the participants are partners in ARCADIA, and since ARCADIA looks into NbS for climate resilience, they have not been as prepared for other angles. However, the absence of recognition and advocacy for nature and future generations is evident generally in governance, planning and design frameworks (i.e., Birkeland, 2022; Fischer et al., 2024). One solution is to raise awareness and ensure that their needs are also considered in NbS processes. Scholars, planners and activists can be effective in advocating them and highlighting their needs by critically engaging in NbS decision-making (Cousins, 2021).

One of the participant argued, there is a serious need to represent and position nature explicitly in the NbS concept and be committed to nature, not only implementing certain projects to get benefits only for humans. Research confirms human species' needs, like food and health, and nonhuman species' needs, like habitat, are dependent (Robinson et al., 2024). Thus, any nature-based transformation needs to improve the quality of life for both. In the book, Staying with the Trouble, Haraway (2016) emphasizes the need for a multi-species view based on acknowledging and facilitating human-nonhuman coexistence. Thus, NbS concept needs to evolve around seeing ourselves as part of nature and understanding the importance of nature and safeguarding it. There is a need to respond to the needs of human and non-human species in relation to one another. In other words, we need to apply a unified multi-species view in the nature-based transformation of our environments to assign clear objectives for multi-species justice. Hence, the biodiversity aspects of NbS are really important.

Moreover, the separation between them and us (here and there) was also an impression from the discussions in the dialogues. Us-and-them connections can elaborate on the interdependency of justice matters on a larger scale beyond the local context. The absence of this view results in disparities between environments, municipalities, regions, countries, and continents and brings spatial injustice. This is not in line with the core of sustainability. However, due to many reasons (such as lack of resources),

decisions are frequently made in the absence of taking responsibility for the influence of local actions on larger contexts and in longer terms (Buijs et al., 2024). Learning from the history of significant injustices that usually occur systematically, such as colonialism and imperialism, offers valuable insights into how nature-based transformations can happen justly.

Most fundamental injustices emerged from the wide-reaching bearings of many local actions, such as the impact of local deforestation on climate change (i.e. Dobai and Riemer, 2024; Sealey-Huggins, 2017). A clear focus on respecting and regenerating nature for all in NbS processes, as well as providing redress and taking responsibility for previous actions/decisions with negative impacts, not only locally but also at different scales (enhance restorative justice), can serve as a solid foundation for transforming space and reaching spatial justice. This requires reviewing and learning from the large-scale impacts of human political, economic, etc. actions and presents another entry into the need for a systemic approach to achieve just space and environments.

Chapter 6: REFLECTIONS

This chapter presents a set of six key reflections based on this report, which builds on a scoping literature review and focus group dialogues with five model regions from the ARCADIA project. First, findings and lessons on how to navigate the complex relationship between justice and NbS, and begin the process to operationalise justice in NbS projects. Second, presenting 12 drivers for unjust NbS. Third, providing tentative recommendations of principles to guide NbS. Fourth, positioning NbS in the context of paradigm shifts. Fifth, applying spatial justice thinking to NbS to facilitate transformative change. And finally, considering nature, marginalised groups and future generations in NbS.

Navigating justice and NbS

The concept of NbS is emerging and potentially represents a game-changing approach to responding to the current local and global climate crisis and biodiversity loss as well as contributing to transformative change and sustainability transitions. However, the notion and scope of NbS needs clarification. In the case of the regions in this report, NbS is mostly considered as an implementation of physical objects/environments that adopt natural systems to address environmental challenges, such as flooding or heat, while carrying social and ecological effects that are usually intrinsically connected, such as fostering biodiversity and human well-being. This interconnectedness stresses the importance of understanding NbS as socio-ecological interventions that do not always support society and nature in conjunction.

In sustainability transitions, this link needs to be identified and delved into without isolating social and natural processes. Hence, matters of justice can be considered as concerns [or matters of concern as Latour (1996) refers to in order to emphasise the production of issues and their liveliness through connections] that are likely to be overlooked in decision-making and require extra attention in any nature-based transformation. Matters of justice are not just additional considerations but are fundamental to sustainability transitions and need to be embedded into the decisions and policies that guide NbS. This research shows the main challenge is not only the lack of identification of the concerns but, more importantly, that the concerns need to be deeply integrated into governance and planning policies and frameworks.

The conceptual analysis in this report suggests that an underlying goal for NbS is to contribute to distributive justice. But to determine what is a fair distribution, procedural justice is required (i.e. a fair process to determine what is a fair distribution). If the process is fair, its outcome should be fair by definition. To determine who (and what) are stakeholders and rightsholders in the process, and what counts as a stake or right that should be taken into account in the procedure/process, recognitional justice is needed. Finally, intergenerational justice is about a specific aspect of recognitional justice: not only the present generations, but also future generations are relevant.

Restorative justice is also about the time aspect, but past-oriented: restoring existing injustices, at least partly. It is also about who are stakeholders and rightsholders and/or about which stakes/rights should be considered. Thus it can be said to be also about recognitional justice: who and what to take into account in the process, but now also looking back in time. For each of the aspects, criteria need to be formulated regarding a) who should be involved (or adequately represented), b) what is considered

eligible in the discussion on what constitutes a fair distribution versus out of scope, c) which procedures should be followed/what constitutes a fair process to d) arrive at a fair distribution of benefits and costs.

Uncovering twelve drivers for unjust NbS

Through the detailed exploration in the case study approach, this report identifies 12 drivers for unjust NbS in the regions, which indicate a need for revising the positionality of justice in relation to NbS (see Table 4). The drivers also emphasize the requirement for significant paradigm shifts that can promote operational justice by enabling collaborative transformation in the NbS governance, planning (and design), stewardship, and knowledge production. The 12 categories reflect and address the three distributive, procedural, and recognition interconnected dimensions of justice while highlighting their entanglement with the multiplicity of scale (in relation to time, level, scope, magnitude, space, etc.).

Table 4: Overview of the twelve drivers for unjust NbS

Ambiguity of NbS and justice	Lack of financing NbS and economic inequality	Historical physical, political and social context
Inconsistent planning processes (and design)	Ineffective governance systems and power dynamics	Insufficient assessing, monitoring and sharing knowledge
Incoherent legislation and regulation	Lack of NbS pilot projects and living labs	Lack of dialogue and insufficient communication approaches
Lack of community involvement and trust	Resistance to paradigm shifts toward human-nature harmony	Justice gaps in sustainability frameworks

Emerging tentative recommendations for principles to guide NbS

In addition, it is key to determine at the outset of any transition process whether the focus will be on ensuring that vulnerable groups benefit from NbS and are not left behind, or on addressing the underlying socio-economic mechanisms that make some groups more vulnerable to a changing climate. By carefully considering these two transition purposes, regions can better design inclusive, just, and climate-resilient futures. Being clear about the scope will avoid a mismatch of expectations among stakeholders. Based on the analysis of literature on justice, the dialogues with regions, and the suggested 12 drivers of unjust NbS, a number of tentative recommendations for key principles can be identified to guide nature-based interventions (see Table 5).

It is key to recognise that justice in terms of climate resilience is context-specific (Coggins et al., 2021). How justice can be achieved in climate resilience via NbS depends on place-based meanings and domains. The suggested principles in this report reveal the contextuality and diversity of justice matters, and are to be interpreted as guidance for regions rather than strict rules to follow and apply. The key principles are also interconnected and involve both synergies but also tensions between goals. Overall,

the principles are considered living ideals that need to be shaped and used in relation to different conditions and contexts.

Table 5: Tentative recommendations for key principles to guide NbS

Principles	Descriptions
Respecting rights, identities, knowledge and values	Recognize and respect the rights, identities, and values of all affected groups, especially marginalized ones (recognitional justice). This principle stresses understanding the socio-political and cultural contexts of these communities and ensuring that these values are integrated in decision-making.
Sharing benefits and costs	Ensure that the benefits of NbS are shared equitably, minimizing negative impacts on vulnerable populations (distributional justice). The focus is on reducing disparities in benefits and avoidance of exacerbating existing inequalities
Creating inclusive and transparent decision-making processes	Ensure inclusive and transparent decision-making processes where all voices, particularly those from marginalized and vulnerable communities, are recognised (procedural justice).
Repairing historical injustices and environmental harms	Acknowledge, address and repair historical injustices and environmental harms by focusing on compensation and rehabilitation of communities and ecosystems disproportionately impacted by past activities (restorative justice).
Thinking of future generations and non-human species	Safeguard the rights of future generations and non-human species by designing NbS that ensure long-term sustainability (intergenerational and multi-species justice).
Addressing overlapping vulnerabilities	Address overlapping vulnerabilities that different social groups face due to factors like gender, class, race, and age Intersectionality. The compounding disadvantages experienced by groups with multiple marginalized identities must be considered (relationality of justice matters).
Making sense of justice through caring	Keep on making sense of the meaning of justice in the different steps to design, decide, and implement NbS to avoid a mismatch of expectations among groups (Caring).

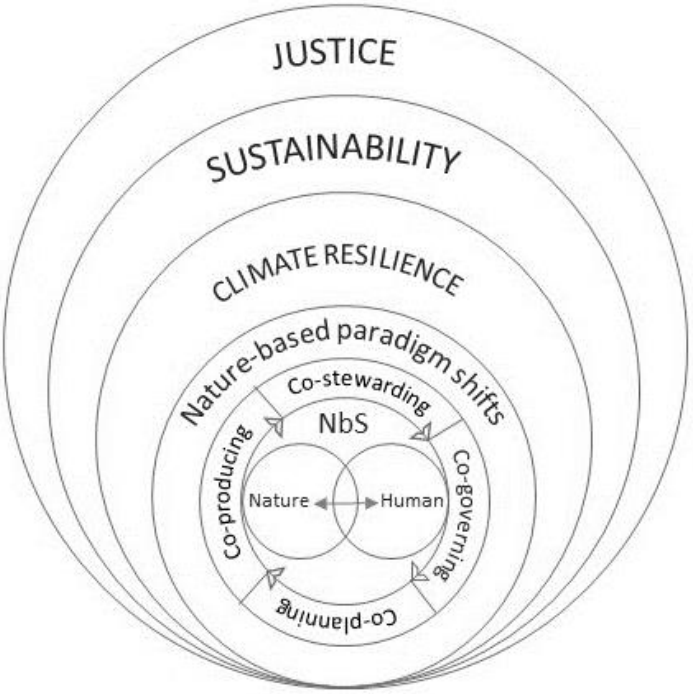
Situating NbS in the context of addressing paradigm shifts

Following on from the 12 drivers for unjust NbS and the emerging key principles for NbS, we propose prioritizing matters of justice in climate resilience objectives, situating NbS as a tool for achieving just and fair climate resilience transformation processes (see Figure 3). This draws attention to the need for a focus on paradigm shifts. We present here an overarching conceptual framework for applying the

justice lens as a common viewpoint for creating consistency in sustainability transitions, climate resilience, and NbS. It, moreover, accentuates NbS to be decided, implemented and scaled up based on multispecies justice, considering humans and nature as interconnected.

This conceptual framework also highlights the need for a significant nature-based paradigm shift that prioritizes and allows collaboration in forms of co-governance, co-planning (and design), co-production (of monitoring, validation and knowledge), and co-stewardship (sense of ownership, belonging and responsibility). The need for a paradigm shift, specifically the four identified cooperative areas mentioned, is based on the 12 drivers for injustice. In short, we argue that nature-based transformations first require positioning justice in the context of addressing systemic inequality, and second, in terms of engaging in paradigm shifts to ensure multispecies, intergenerational and restorative justice.

Figure 3: Situating NbS in the context of addressing paradigm shifts



Applying spatial justice thinking for NbS

While conducting the research for this report, we realized that many participants in the dialogues view NbS as a physical object/environment (in the form of landscape technology to deal with environmental challenges) that offers a kind of space (with nature-based functions) having some extra social implications. Hence, when it comes to action, NbS has an explicit spatial identity for the regions in the ARCADIA project. Using NbS in any space transforms it into a nature-based space and hence requires spatial thinking in NbS decision-making processes.

Karvonen (2024) emphasizes the role of regional infrastructures in shaping spatial meanings regarding human-nonhuman relationships and refers to their impact on the territoriality of the region. “Regions are much more than spatial containers that reside between the local and national. Instead, they exhibit

distinctive characteristics that are produced through the territorialization of space" (Karvonen, 2024: 885). Thus, we need to reimagine regions and look for answers on how NbS and the GBI (as an infrastructure) can play efficient roles in the reterritorialization of regions.

This report views NbS as more than nature-inspired solutions. It highlights the importance of understanding NbS as an approach resulting in the production of nature-based spaces. Viewing NbS through the lens of space by Lefebvre (1991) acknowledges that NbS are socially constructed by political, cultural, environmental and economic pressures, norms, and ideologies that significantly influence issues of justice and equity of NbS. Accordingly, exploring the socio-spatiality of NbS plays an important role in the context-based identification of principles of NbS in the production of a just space.

Looking at space through the lens of justice is what takes us to the concept of spatial justice. Spatial justice lies at the intersection between distributional justice, recognitional justice, and procedural justice. Since the ARCADIA project involves ongoing initiatives and processes that are mostly defined as physical environments or policies related to shaping them, spatial justice is important to be recognized as a core for the transition of the environments in the regions. Focusing on spatial justice in meeting climate resilience via NbS can avoid viewing just space from a narrow perspective and instead see it as achievable through deliberate actions. Spatial and physical planning, along with the design of NbS, plays a critical role in promoting spatial justice.

Considering nature, marginalised groups and future generations in NbS

After reviewing the dialogues, an important impression is that the participants did not reflect much upon the recognition of nature (and non-human species) and human future generations as possible stakeholders (via having representatives) in decision-making processes. Acknowledging nature in NbS processes is important and efficient in lifting up the importance of protecting nature for its nature rather than exploiting it for humans (i.e., using NbS as a means for justification of measures and greenwashing). Integrating NbS into transformative change requires recognizing their socio-spatial dimensions and justice-oriented foundations. The socio-spatiality of NbS underscores that they are not neutral or purely ecological interventions but they are deeply embedded in the political, cultural, environmental, and economic contexts that shape them.

This aligns with the principles of transformative change by emphasizing systemic and interconnected approaches to addressing climate resilience. This perspective ensures that NbS not only contribute to GBI but also foster equitable outcomes for all stakeholders. Vulnerable groups, such as marginalized communities, indigenous peoples, economically disadvantaged populations, and those disproportionately affected by climate impacts, must be prioritized in this process. Recognizing their voices and needs ensures that NbS address historical injustices and current inequities, thereby promoting inclusive, community-driven solutions that enhance resilience across scales.

A justice-centered approach to NbS also involves rethinking decision-making processes to include under-represented stakeholders, including vulnerable human populations, non-human species, and future generations. Vulnerable groups often bear the brunt of environmental degradation and climate change, lacking access to resources, representation, or the ability to adapt. NbS must intentionally address these disparities, creating opportunities for these groups to actively participate in shaping

equitable, nature-based interventions. Additionally, acknowledging nature as a stakeholder emphasizes its intrinsic value while reinforcing its role in sustaining life.

By embedding these considerations within the transformative change, NbS can transcend superficial solutions or greenwashing, becoming tools for creating just and sustainable spaces and regions. This systemic, justice-oriented integration can contribute to sustainability transitions towards climate resilience that are not only facilitating transformative change but also inclusive, addressing the needs of the most vulnerable while fostering a future where human well-being and ecosystem health are deeply interconnected.

ACKNOWLEDGEMENT

We would like to thank everyone from the model regions who helped us collect information, documents, and related reflections. We especially express our gratitude to the participants in the focus group dialogues for the valuable insights they shared. Without their input, this report could not have been shaped in its current form.

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ANNEX

Appendix 1 - Mapping justice in the ARCADIA project and beyond

Justice throughout the ARCADIA project

This report is deeply interconnected with several key tasks across the ARCADIA project, as justice is a cross-cutting issue that permeates multiple sectors, scales, and governance levels of NbS (Hanson et al., 2020). These interconnections are essential to ensure that principles of justice and equity are embedded consistently throughout the co-creation, design, and implementation processes of NbS. This report is a contribution to the overall activities in the ARCADIA project and in particular to the five regions participating in the ARCADIA project.

In the ARCADIA project, first and foremost, the co-innovation labs (WP1-5) serve as the main spaces where these principles can be put into practice. These co-innovation labs are foundational spaces where equitable principles can guide decision-making processes, ensuring that diverse stakeholder voices are respected and included in the design and co-creation of NbS. Ensuring that marginalized communities participate in knowledge generation can empower these groups and help mitigate biases in decision-making. By fostering an inclusive environment, these co-innovation labs can actively challenge existing power dynamics and promote collaborative governance, thereby reinforcing the overarching goals of the ARCADIA project of social equity and environmental sustainability.

In the context of WP6, which focuses on guiding, stimulating, and monitoring regional activities, justice is central to ensuring fair distribution of resources and knowledge among all the regions. WP6 provides the opportunity to align the work of the ARCADIA project with justice principles by embedding equity considerations into its regular progress reviews, peer exchanges, and cross-regional workshops. For instance, when WP6 organizes knowledge-sharing sessions or evaluates progress, it can ensure that all regions, regardless of their capacity or resources, have equal access to shared knowledge and are fairly supported in achieving their objectives thereby ensuring that interventions do not reinforce existing inequalities (Ganzleben & Kazmierczak, 2020). Additionally, the WP6 role in comparative analysis can help identify and address disparities between regions, making sure that successful strategies are shared with those that may face greater challenges in achieving justice through NbS.

In WP7, which addresses societal values, attitudes, and behavioural change, there is a possibility for fostering a deeper understanding of how justice is perceived by different communities. By examining societal values and preferences, WP7 can reveal how different groups interpret fairness and equity, which is fundamental when designing and implementing NbS. This understanding is crucial for avoiding top-down approaches that can impose justice frameworks not reflective of local realities (Kauark-Fontes et al., 2023). Instead, WP7 can help ensure that NbS designs are grounded in bottom-up approaches in the specific social contexts of the regions (Mahmoud & Morello, 2021). Furthermore, the behavioural change strategies developed within WP7 can be designed to promote equity and inclusivity by encouraging pro-NbS attitudes that are aligned with values of social justice, fostering broader societal support for fair and equitable NbS interventions (Anderson & Renaud, 2021).

Furthermore, in the context of WP8, which deals with the design and performance assessment of NbS, it is crucial to recognize that modelling practices are rarely neutral, and this aspect is often overlooked. In fact, modellers carry biases and assumptions (Melsen, 2022), which can result in a narrow selection of indicators and model parameters (Mabon et al., 2022). These choices can inadvertently shape modelling outcomes (Mosleh& Negahban-Azar, 2021), potentially leading to decisions that may exacerbate existing injustices or marginalize vulnerable communities (Holländer et al., 2014, Remmers et al., 2024). This underscores the importance of embedding just principles in the modelling processes following existing practices that integrate socio-environmental principles into modelling and ensuring that diverse perspectives inform the frameworks and tools used to evaluate NbS effectiveness (ter Horst et al., 2023; Jakeman et al., 2024).

Moreover, the principles outlined in this report can serve as a benchmark for assessing synergies across other tasks in WP9, particularly those focused on financial and business innovation strategies . By ensuring that funding mechanisms and investment opportunities are aligned with the principles of equity and justice, the project can effectively stimulate broader adoption of NbS while mitigating potential risks of social exclusion (Chausson et al., 2023; Thompson et al., 2023).

Overall, ensuring the integration of justice principles across these work packages enhances the legitimacy and social sustainability of the outcomes of the ARCADIA project. By embedding equity in the co-innovation labs (WP1-5), knowledge synthesis and evaluation (WP6), societal value analyses (WP7), design and performance assessments of NbS (WP8), and fostering just governance and financing strategies (WP9), the ARCADIA project can ensure that NbS are not only effective in addressing climate risks but also contribute to creating more just and inclusive communities (Borelli et al., 2021; Cousins, 2021).

European projects on NbS

European projects such as Horizon Europe and LIFE programs funded by the European Commission are essential in implementing just NbS and scaling them up across the member states. On CORDIS, the primary platform of the European Commission for disseminating information about research and innovation projects, we identified 107 projects with a focus on “nature-based solutions” and “green and blue infrastructure”. The projects reflect a growing focus on transformative change, inclusivity, justice, and co-innovation. A more targeted exploration based on keywords such as “transformative”, “transformation”, “transformative adaptation”, “just”, “justice”, “equitable”, “inclusive”, “inclusion”, and “co-creation” “co-innovation” “co-development”, “governance” and “policy” in the search engines on CORDIS revealed how projects are positioned in relation to these key terms (see Table A1).

The ARCADIA project is associated with several key terms, including “NbS”, “Transformative”, “Transformative adaptation”, “Co-innovation”, and “Policy". Several other projects show overlapping keywords and common themes with ARCADIA, highlighting shared objectives and focus areas, such as: NATURESCAPES and NATURANCE for their emphasis on environmental benefits and sustainability; COEVOLVERS, which addresses co-creation and collaboration among stakeholders; and MERLIN and REGREEN for their focus on urban resilience and sustainable practices. While all five projects contribute significantly to the discourse surrounding NbS, the ARCADIA project is designed to make significant efforts and progress on implementing NbS through co-innovation labs.

Table A1: Overview of research and innovation projects on NbS

Keywords	Number of projects	Acronyms of projects
“NbS”	107	
“NbS”+ “Transformative” or “Transformation” or “Transformative Adaptation”	15	eNaBlS, NATURESCAPES, NATURANCE, UGPplus. RESOLVE,DRYAD DesirMED, NBRACER, NATALIE, LAND4CLIMATE, ARCADIA, INTERLACE, FutureMARES, MERLIN, COEVOLVERS, trans4num
“NbS”+ “Inclusive” or “Inclusion” or “Participation”	19	COEVOLVERS, NATURANCE, NiD4OCEAN, DesirMED, NBSoil, DuneFront, INTERLACE, UNALAB, REGREEN, FutureMARES, MERLIN,

		CLEVER Cities, URBiNAT, ISLANDR, URBREATH, CONEXUS, DivAirCity, PHAROS, ALBATROSS, CARDIMED
"NbS"+ "Equity" or "Equitable"	3	NATURESCAPES, SCREEN4CARE, NATURANCE
"NbS"+ "Marginal"	2	COEVOLVERS, ISLANDR
"NbS"+ "Justice"	3	NATURESCAPES, GO GREEN NEXT, Niche4NbS
"NbS"+ "Just"	7	TRANS-Lighthouses, COEVOLVERS, NBS EduWORLD, NATURESCAPES, NBRACER, GO GREEN NEXT, JUSTNature
"NbS"+ "co-creation" "co-innovation" "co-development"	20	ARCADIA, PACT-NBS, SONATA, NBSINFRA, TRANS-Lighthouses, COEVOLVERS, DRYAD, PHAROS, GreenInCities, DuneFront, NATALIE, ALBATROSS, JUSTNature, UNALAB, REGREEN, NICE, CLEVER Cities, GO GREEN ROUTES, NATURVATION, URBAN GreenUP, MERLIN
"NbS"+ "governance"	24	OptFORESTS, NATURESCAPES, NATURANCE, DRYAD, eco2adapt, BIOFIN, GoNaturePositive, NORDBALT-ECOSAFE, NATALIE, DesirMED, A-AAgora, LAND4CLIMATE, COEVOLVERS, URBiNAT, RECONECT, NATURVATION, REGREEN, CONEXUS, Phusicos, JUSTNature, CLEVER Cities, Nature4Cities, CLEARING HOUSE, INTERLACE
"NbS"+ "policy"	35	ARCADIA, D4RUNOFF, OptFORESTS, GO GREEN NEXT, NATURANCE, wildE, eco2adapt, Biodiversa-plus, BIOFIN, GoNaturePositive, trans4num, NORDBALT-ECOSAFE, NBSoil, NATALIE, NiD4OCEAN, DesirMED, ISLANDR, LAND4CLIMATE, NetworkNaturePLUS, NBS EduWORLD, COEVOLVERS, PACT-NBS, ThinkNature, RECETAS, FutureMARES, MERLIN, NICE, CONEXUS, PONDERFUL, OPERANDUM, MICS, NetworkNature, CLEARING HOUSE, INTERLACE, NBS2017

The ARCADIA project brings local communities, public administrations, and businesses into the process through co-innovation labs. These spaces where new ideas can be developed collaboratively, ensuring that the solutions are both scientifically sound and socially accepted. This deep involvement

of stakeholders is critical, as it builds local capacity to adapt to climate change while also promoting economic and policy reforms. ARCADIA also focuses on knowledge sharing across regions. Overall, the ARCADIA project aims to contribute to transforming European regions into hubs of climate resilience through a combination of cutting-edge science, collaborative governance, and scalable solutions. It is a key part of the broader European mission to mitigate climate change and help regions adapt in sustainable ways.

European missions and key regulations for NbS

The European Commission designed the EU Missions as "concrete solutions to big societal challenges by putting research and innovation into a new role, combined with new forms of governance and collaboration, as well as by engaging citizens" (European Commission, 2023). The five key EU Missions were established on the following topics: Adaptation to Climate Change (including societal transformation), Cancer, Healthy Oceans, Seas, Coastal and Inland Waters, Climate-Neutral and Smart Cities, and Soil Health and Food. In this regard, the EU has launched several missions that closely line up with NbS (and GBI) as inherent parts of its sustainability and climate strategies (EEA, 2021; Liu et al., 2021; Andersson et al., 2022).

Through the integration of GBI and NbS indeed, EU Missions aims to drive Europe's transformation into a greener, healthier, more inclusive, and resilient continent, enhancing climate resilience, restoring and protecting ecosystems, and promoting sustainable urban development, strengthening its leadership in climate change mitigation and adaptation. El Harrak et al. (2023) highlights four that are particularly relevant for Nature-based Solutions (NbS) and green-blue infrastructure (GBI) which are Adaptation to Climate Change, Healthy Oceans, Seas, Coastal and Inland Waters, Climate-Neutral and Smart Cities, and Soil Health and Food.

European laws influence the integration of NbS into the development regulations of the member states. The European Union has positioned itself as a global leader in climate action and biodiversity preservation through a legislative framework that champions sustainability, resilience, and ecological restoration. Central to this vision are NbS (and GBI), which can serve as essential tools for meeting climate, biodiversity, and societal objectives. There is a collection of laws that offer a foundation for regulatory practices to promote the implementation of NbS, ensuring their contribution to the broader frameworks of sustainability and climate adaptation and mitigation (see Box A1).

Box A1: Overview of key regulations in Europe for NbS

The European Green Deal serves as the overarching framework aiming for climate neutrality by 2050. Within this paradigm, NbS are critical to addressing challenges such as carbon sequestration, urban heat island mitigation, and flood resilience. NbS plays a significant role in reducing greenhouse gas emissions and enhancing ecosystem services, further supporting the achievement of the Green Deal's ambitious goals (European Commission, 2019; EEA, 2021).This initiative also ensures fairness in transitioning, especially for regions economically dependent on high-carbon industries, by establishing a just transition mechanism. Participatory processes engage diverse stakeholders, ensuring that NbS implementations reflect a wide array of community needs and perspectives.
The EU Adaptation Strategy (2021) emphasizes proactive measures to mitigate climate change impacts, identifying NbS as cost-effective and multifunctional tools. Wetland restoration for flood management, green roofs to reduce urban heat, and the enhancement of biodiversity through NbS are all highlighted within the strategy as vital steps toward increasing climate resilience in both urban and rural areas (European Commission, 2021). These measures underline the role of NbS in fostering resilience and preparing communities for future climate challenges. Not only, the focus on "just resilience" underscores equitable adaptation to climate change,

addressing vulnerabilities across different socio-economic groups. The strategy promotes inclusive governance, encouraging active participation from communities in urban and rural settings.
Legally binding commitments under the EU Climate Law (2021) further reinforce the necessity of NbS. The law mandates that the EU achieves net-zero greenhouse gas emissions by 2050, with NbS being central to achieving these targets. Natural carbon sinks such as forests, wetlands, and coastal ecosystems play a vital role in sequestering carbon, and the law acknowledges their importance in addressing both climate change and biodiversity loss (European Parliament, 2021). The integration of NbS within this framework ensures a comprehensive approach to achieving net-zero emissions while fostering ecosystem health. Legally binding and focused on achieving net-zero emissions, this law directly addresses uneven economic burdens by providing support mechanisms for regions facing higher transition costs. Public consultations ensure that NbS strategies align with citizens' concerns and needs.
Complementing climate efforts, the EU Biodiversity Strategy for 2030 aims to reverse biodiversity loss and restore degraded ecosystems, with NbS serving as a key tool in meeting these targets. The strategy focuses on restoring critical habitats, increasing pollinator populations, and enhancing agroforestry practices. NbS are integral to promoting biodiversity-friendly practices and maintaining ecological balance across Europe (European Commission, 2020). By embedding principles of equity as well and NbS in biodiversity restoration, the the strategy prioritizes community involvement in biodiversity restoration projects, ensuring that benefits like improved natural spaces are accessible to marginalized populations. It supports equitable sharing of resources derived from restored ecosystems. EU supports the achievement of its broader sustainability goals while enhancing ecosystem services.
The EU Nature Restoration Regulation (2022) introduces legally binding targets to restore 20% of degraded ecosystems across the EU by 2030. This regulation outlines specific objectives, including the restoration of urban green spaces, river connectivity, and habitats critical for biodiversity. NbS are essential for the implementation of these restoration efforts, offering scalable and adaptive solutions that can be tailored to local conditions while contributing to broader ecological goals (European Commission, 2022). The NRR emphasizes the importance of integrating NbS into urban and rural environments, ensuring that restoration efforts contribute to both ecological health and human well-being. Additionally, this regulation emphasizes creating inclusive processes for identifying and implementing restoration targets, ensuring access to urban green spaces for all, reducing social disparities.
The EU Soil Strategy (2021) addresses soil degradation and promotes sustainable land management practices, with NbS such as reforestation, agroforestry, and wetland restoration playing crucial roles in improving soil health and combating desertification. These practices align with the EU's broader climate and biodiversity objectives, helping to prevent soil erosion, enhance soil fertility, and reduce greenhouse gas emissions (European Commission, 2021). NbS contributes to the restoration and conservation of soils, reinforcing the EU's sustainability goals. With a focus on rural resilience, this strategy ensures that farmers and disadvantaged communities benefit equitably from improved soil health and fertility.

Together, these legislative measures can create a cohesive framework for integrating NbS and GBI into the EU climate and biodiversity strategies. The legislative push to incorporate NbS into national and regional policies not only addresses immediate environmental challenges but can also position the EU as a global leader in climate adaptation and ecological restoration, driving forward its mission for a sustainable, resilient future. Hence we need approaches to NbS that view society and nature as interdependent and equally important in turning sustainability transitions into an opportunity for enhancing both in combination with key regulations and the related EU Missions.

Sustainable development goals and NbS

Beyond Europe, we can also consider NBS (and GBI) in the context of the United Nations (UN) Sustainable Development Goals (SDGs) as part of 2030 Agenda for Sustainable Development, where NbS can play a pivotal role (de Oliveira et al., 2022; Pinto et al., 2023). The SDGs propose a global framework for promoting sustainability by aligning policies, projects, initiatives, and missions. Regarding the UN global framework, Pinto et al. (2022) report on the linkage between GBI and NbS with the SDGs, underlying also how these implementations may contribute within the well-being dimensions.

Specifically, within the SDG 1 (No Poverty), SDG 2 (Zero hunger) and SDG 3 (Good Health and Well-being), NbS and GBI play a crucial role in alleviating poverty (de Macedo et al., 2021) and enhancing food security by promoting sustainable agricultural practices and improving access to resources (Wójcik-Madej & Sowińska-Świerkosz,2022). They also contribute to public health by improving air and water quality, providing green spaces for recreation, and enhancing community well-being (Liu et al., 2021; Pinto et al., 2023; Dushkova, et al.,2021).

In relation to SDG 6 (Clean Water and Sanitation) and SDG 7 (Affordable and Clean Energy) and SDG 8 (Decent Work and Economic Growth) instead,NbS and GBI contribute to improved water management by filtering pollutants and enhancing water quality (Macedo et al., 2022), which supports public health (Anderson et al., 2023). They can also promote energy efficiency through green infrastructure, such as green roofs that reduce energy consumption (Bayulken, et al., 2021). Additionally, NbS creates green job opportunities in planning, implementation, and management, thereby fostering economic growth (ILO, UNEP and IUCN, 2022).

Pertaining to SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 12 (Responsible Consumption and Production), NbS and GBI drive innovation in sustainable practices, promoting sustainable industrialization and fostering economic growth and development (O'Sullivan et al., 2020). They also support the development of sustainable infrastructure (Quattrone, 2023) and foster a circular economy by promoting the reuse of materials and reducing waste through eco-friendly technologies. Lastly, implementing NbS in cities enhances urban resilience and planning, improves quality of life, and ensures accessible green spaces for communities (Calheiros, et al., 2022).

Finally, focusing on SDG 13 (Climate Action) and SDG 14 (Life Below Water) and SDG 15 (Life on Land), NbS and GBI contribute significantly to climate action by enhancing carbon sequestration, regulating local climates (Goodwin et al., 2023), and promoting biodiversity. NbS can help maintain healthy ecosystems in both aquatic and terrestrial environments (Sowińska-Świerkosz et al., 2021), reducing pollution, restoring habitats, and improving resilience to climate change impacts (Vazin et al., 2024).

Appendix 2 - Describing the five model regions in the ARCADIA project

Here we present some background on the five regions in the ARCADIA project. The five regions include Funen in Denmark, Skåne in Sweden, Krapina-Zagorje and Zagreb in Northern Croatia, Lower Austria, and Emilia-Romagna in Italy. This report investigates how justice is being interpreted and implemented through NbS projects and initiatives. The five regions represent contrasting contexts in terms of history, culture, and geography but also provide an overview of activities around NbS emerging across Europe.

Description of the model region Emilia-Romagna

Emilia-Romagna (RER) is among the most climate innovation-prone regions in Italy and in Europe. RER is a regional host of the EIT Climate-Knowledge Innovation Community, and a home to a truly European research, innovation & industrial hub which includes the Copernicus Data Centre and the National Agency for Meteorology and Climatology. RER instituted Regional Coordination Platform and the Observatory of climate change impacts. The coordination platform aim is to ensure coherence and exploit synergies among the various regional planning instruments, and to harmonize the monitoring and evaluation of the progress made. In 2018, RER approved its Climate change mitigation and adaptation strategy and, in 2020, adopted a multi-stakeholder Partnership Agreement for Climate and Jobs, setting the carbon neutrality goal by 2050, signed by business, industries, local governments, schools, universities, civil society organizations and financial organizations. Some 11 cities are piloting urban blue and green interventions in with national funds and 2 major cities (Bologna and Parma) developed urban adaptation & mitigation plans and joined the EU Mission: Climate-Neutral and Smart Cities. RER is a signatory of the Mission Adaptation Charter (see Box A2).

Box A2: Emilia-Romagna - geography, population, land use and recent history

The Emilia-Romagna Region is one of the 20 Italian regions. It is located in the Northern-Italy and it covers an area of 22.510 km2 (sixth in Italy in terms of area). Nearly half of the region consists of plains (47%) while 28% is hilly and 25% mountainous. On the East side the border is represented by the Adriatic Sea coastline. Total population is about 4.460.000 inhabitants (48% male and 52% female), corresponding to 7.5% of the total Italian population. The 18% of the area is classified as medium level of urbanization and average density is 198 inhabs/kmq. The Utilized Agricultural Areas (UUA) covers 46% of the total region. Emilia-Romagna farms represents the 4.7% of the italian farms although in the last decades the number of farms decreased (from more than 170.000 in 1982 to about 53.000 in 2020). Arable lands cover 80% of the total UUA, followed by permanent crops (11%) and meadows and pastures (6%).

Husbandry (mainly cattles, poultry and pigs) are an important part of the regional agricultural sector contributing to about 50% of the total agricultural Gross Daleable Production (GSP). The regional forest area, according to the latest data from the National Forests and Forest Carbon Sinks Inventory (INFC2015) covers about 640,000 hectares, corresponding to 28% of the regional territory and 6% of the national forest stock. Only 4% of the regional forests are located in lowlands. State forests have an highest environmental value and cover about 37.000 ha and are mostly located in the highest Apennines. The regional economy is characterized by world-wide well-known and appreciated products (agriculture, food industry, automotive, chemical and biomedical industry). Tourism sector is well developed both in the hinterland and on the coastline areas.

Description of the model region Lower Austria

Lower Austria government was the first in Austria to commit to the “climate action programme” (CAP) in 2004 and to declare climate mitigation as a basic law in its state constitution in 2007. The 2021 revision of the Program addressed adaptation actions as key for the regional climate path. The vast experience in nature-based initiatives include projects for flood and forest management, urban restoration, agriculture biodiversity, water and soil protection. A number of municipalities are part of the KLAR!-programme (Climate-Adaptation-Model-Region), building a vital network to share knowledge and expertise to increase awareness of climate impacts in local communities. Nature-based solutions and the climate innovation ecosystem is well-developed in Lower Austria through innovation

platforms & clusters managed by Ecoplus (ARCADIA partner) which support local R&D organizations and companies (see Box A3).

Box A3: Lower Austria - geography, population, land use and recent history

Lower Austria (German: Niederösterreich), is a federal state located in the northeast of Austria. It is the country's largest state by area, covering approximately 20,000 Km2. Geographically, Lower Austria is diverse, encompassing parts of the Austrian Alps, the Danube corridor, and extensive flatlands and rolling hills in the north and east within the Pannonian Basin. The region features lush vineyards, forests, and agricultural land, making it an important agricultural hub. The population of Lower Austria is around 1.7 million people. The current administrative capital is St. Pölten, but only since 1986. The historical capital of Lower Austria was Vienna (and also the largest city and economic centre), but since the establishment of the 1st Republic of Austria in 1920, Vienna is a separate federal state surrounded by Lower Austria. Further urban centres include Amstetten (in the west), Krems (centre), as well as Wiener Neustadt and Baden (in the south).

In recent history, Lower Austria has experienced steady economic development, partly due to its proximity to Vienna and its role in agriculture and industry. The state has invested in infrastructure and tourism, promoting its historical sites, natural landscapes, and cultural heritage. The integration of modern industries and preservation of traditional agriculture and viticulture have been key focuses. Lower Austria is also known for its historical significance, with numerous castles, monasteries, and ruins that reflect its rich past. The region's cultural and natural attractions draw visitors year-round, contributing to its thriving tourism sector.

As for land use, Lower Austria holds a share of around 50% of all arable land in Austria, playing a key role in supplying the Austrian population with agricultural products. Therefore, the protection of the arable land is crucial. Vineyards are important, especially in the famous wine regions of Wachau, Kamptal, and Weinviertel. Forests cover a substantial portion of the land, particularly in the southern Alpine fringe (which belongs to the mountain biogeographical macroregion – and not to the continental one as the rest of Lower Austria) and in the northwestern part (called Waldviertel, being part of the Bohemian Massif). Like in the rest of the Austrian Alpine regions, there exists a robust timber industry. Lower Austria also hosts industries such as manufacturing and technology, particularly in areas South of Vienna (called Industrieviertel due to the rooted industrial tradition since the Middle Ages).

Not least, Lower Austria hosts two national parks: the Danube Wetlands (Nationalpark Donau-Auen) eastwards from Vienna and the Thaya Valley (Nationalpark Thayatal) along the borderlands with the Czech Republic. In addition, Lower Austria hosts 20 natural parks stretching 55,000 hectares, 50 municipalities and around 200.000 inhabitants. 70% of the protected area is also protected under Natura 2000.

Description of the model region Zagreb & Krapina-Zagorje

Krapina-Zagorje and Zagreb counties in Northern Croatia based their climate policies and strategies on nature protection and restoration. The Krapina-Zagorje public policy prioritizes a green and sustainable management of the natural and built environment, in order to be part of the EU Climate Resilience Mission. The city of Zagreb, the cultural, scientific, economic, political and administrative centre of Croatia, is one of the EU 100 climate-neutral and smart cities by 2030 (Cities mission), recognising the importance of existing urban forests for the quality of life and resistance to climate change. Implementation of nature-based solutions is well-established in several urban areas, with the aim of enabling the efficient use of energy and contributing to the process directed towards CO2-free emissions. This is reflected in the SECAP and Energy Atlas in Zagreb, in the County Climate Resilience and Adaptation Plan for Krapina-Zagorje area, and in the several nature-based projects implemented in the area (ProGiReg, REGREEN, City Window in Nature, and many others) (see Box A4).

Box A4: Zagreb & Krapina-Zagorje geography, population, land use and recent history

City of Zagreb

Zagreb is the capital of the Republic of Croatia and functions as its economic and administrative hub. It hosts key state institutions - the legislative, judicial, and executive branches - as well as institutions for finance, defense, healthcare, culture, education, transportation, and others. The city comprises 69 settlements and 17 urban districts. According to the 2021 census, the city of Zagreb has 767,131 residents, accounting for 19.8% of the total population of the Republic of Croatia. This is a decrease of 2.9% compared to the 2011 census. Zagreb is situated in the interior of Croatia, in the Pannonian Basin. To the north, it reaches the southern slopes of Medvednica Mountain, while to the south, it extends to the flatlands along the Sava River. Most of Zagreb is located in a lowland area at an elevation up to 200 meters above sea level.

Due to its location, Zagreb enjoys a humid continental climate. However, recent times have witnessed alterations in the Köppen-Geiger climate classification across all meteorological stations within the city. Agricultural land in the City of Zagreb represents an important economic natural resource. 21,733.1 hectares of the City of Zagreb's area is covered by agricultural land. Therefore, out of the total 64,135.3 hectares that make up the City of Zagreb, 33.89% falls under agricultural land, 35.92% under natural vegetation (forests), 4.56% is maintained vegetation, and 0.93% is water surfaces. In contrast, 24.27% of the area is urbanised.

Krapina-Zagorje County

Krapina-Zagorje County is located in Croatia's northwestern part. It is a distinct geographical unit that stretches from the peaks of Macelj Highlands and Ivančica Mountain in the north to Medvednica Mountain in the southeast. The western border, which is also the national border with the Republic of Slovenia, is marked by the Sutla River. In contrast, the eastern border follows the watershed of the Krapina and Lonja river basins. Krapina-Zagorje County is almost entirely situated in the drainage basins of the Krapina and Sutla rivers.

In terms of area, it is one of the smaller counties (1,229 km²) but has a population density above the national average. According to the 2021 census, Krapina-Zagorje County has 120,942 inhabitants, which is 9% less than in 2011. The territory of Krapina-Zagorje County is divided into 32 local self-government units, specifically 7 towns and 25 municipalities. Agricultural land covers 57.7%, and arable land 50.4% of the County's total area. Forest land consists of smaller forests, reduced by clearing and conversion to agricultural land, and occupies 35.5% of the County's area.

Description of the model region Skåne

Skåne Region is the southernmost county of Sweden, overlooking the strait of Øresund, that connects it with Denmark. It is an important area for agricultural and food production and centre for economic development. Skåne has the ambition of taking leadership in regional climate change and climate adaptation challenges. The regional development strategy, The Open Skåne 2030, aims for a climate neutral and fossil fuel-free Skåne. To this end, the City Council of Skåne, Skåne Region and the Association of municipalities in Skåne adopted a common Climate- and Energy strategy, to develop a stronger regional climate cooperation in the region. The sustainable development of the region passes through the research and innovation council of Skåne (FIRS). FIRS consists of leading triple helix organizations in the region with the objective to act fast and smart to benefit from arising opportunities and address joint challenges. In the context of various projects nature-based solutions were developed for urban environments (BiodiverCity, Naturvation, Blue Green City Lab). Malmo, Lund and Helsingborg are part of the EU Mission Cities (see Box A5).

Box A5: Skåne - geography, population, land use and recent history

Skåne County is the southernmost county of Sweden. It covers around 3% of Sweden's total area, while its population of 1.3 million comprises 13% of Sweden's total population. Skåne County is administered by Region Skåne, one of the 20 county councils of Sweden. Its main responsibilities are for the public healthcare system and public transport. Skåne County contains 33 municipalities, the largest by population being Malmö Municipality (340,000 inhabitants), Helsingborg Municipality (145,000), and Lund Municipality (130,000 inhabitants). Although the county is of only moderate size, it is of great importance as a food producer in Sweden, which is why it is often called the “granary of Sweden.” Among the chief crops are wheat, rye, barley, oats, potatoes, raps and sugar beets.

Description of the model region Funen

Funen County is located on an island in the Region of Southern Denmark. It houses the Odense River and Fjord, the largest catchment area in the region, that is mainly devoted to agricultural production. Recently, the region has adopted important strategies and plans for climate adaptation. They cover water resources and rivers management (Climate Change Adaptation Plan for Odense Fjord), sustainable urban development and pollution (DK2020 Climate Adaptation Plan; Zero Urban Pollution Programme), and biodiversity and multifunctional land-use protection (Biodiversity Strategy for Odense and Odense River and Fjord; Multifunctional distribution of land-use). The adaptation path is supported by the "Odense Fjord Corporation", a community of practice initiative funded in 2022, gathering academic, industrial, regulatory and societal stakeholders, i.e. four municipalities, water, energy and waste companies, and agricultural organizations, industries and the regional green, recreational, and nature conservation NGOs. The Corporation is supported by the University of Southern Denmark, which ensures evidence-based decisions and promotes knowledge sharing in the framework of the EU´s Climate Adaptation Mission. Important adaptation projects addressed nature based solutions to reduce the risks of climate change and synergistically re-establish ecosystem services and improve water quality and biodiversity (see Box A6).

Box A6: Funen - geography, population, land use and recent history

Approximately 246,000 inhabitants live in the Odense Fjord catchment area, of which approximately 182,000 live in Odense city, the third largest city in Denmark. Odense has grown significantly since the Second World War. Many construction projects both inside the old city centre and outside the city limits have significantly changed the city's space, and the city has gone from being an industrial city to a service and university city. Approximately 90% of the population in the catchment area discharge their wastewater to a municipal treatment plant. The remaining 10% of the population live in unsewered areas outside urban centres. In total, there are approximately 6,900 residential properties located in the open countryside outside urban centres and sewered catchment areas. The catchment area of Odense Å/Fjord is approx. 1046 km2 and includes approx. 1100 km of open watercourses and 2600 lakes and ponds (>100 m2). The catchment area of Odense Fjord makes up about 1/3 of Funen and the fjord flows into Kattegat through a relatively narrow strait, known as "Gabet", in the northern part of the fjord.

The last ice age 11,500-100,000 years ago created the landscape of Funen as we know it today. Most prevalent in the landscape are moraine surfaces covered by moraine clay. The meltwater that flowed away from the ice formed meltwater valleys. One example is Odense valley was formed by a meltwater river that had much the same general course as the river has today. Clay soil types are slightly dominant and cover about 51%, while sandy soil types cover about 49% of the area. Funen's moraine soil is particularly suitable for growing agricultural crops. Agriculture has therefore left its mark on the landscape. Deep ploughing, liming and the like have made the surface soil more uniform. As in the rest of Denmark, land use in the catchment area of Odense Fjord is dominated by agricultural production. Agricultural land accounts for 68% of the catchment area. The remaining area is made up of approximately 16% urban areas/roads, 10% forest and 6% natural areas (meadows, bogs, pastures, lakes, and wetlands).

Appendix 3 - Presenting key documents informing the five model regions

Region Emilia-Romagna - reflection on justice in existing frameworks

The text below is the reflection from the region on the existing documents and materials the region believes they directly or indirectly elaborates on the link between justice and NbS within the regions established frameworks (primarily) on climate resilience and sustainability. The two documents the region shared are the Pact for work and climate and the regional strategy on the 2030 Agenda for sustainable development.

Emilia-Romagna has recently experienced the effects of climate change, facing new challenges that had previously been only marginally considered. The flooding events in Romagna last spring highlighted the urgency of quick action to preserve both the economic vitality of the region and the integrity of its territory.

The floods in May destroyed infrastructure that had withstood normal weather conditions for decades. This event, involving an estimated total volume of 350 million cubic meters of water, flooded a vast area of the plains, covering approximately 540 km². In the hilly and Apennine areas of Bologna, Ravenna, and Forlì, more than 70.000 landslides occurred, affecting an area of 72,21 km². These events led to the isolation of some communities, the evacuation of numerous families, and severe damage to road infrastructures, farms, production districts, public and private buildings, hydraulic defenses, and essential service networks.

The highest density of landslides was recorded in the high hills and low mountain areas, where the most intense rainfall occurred, confirming the close link between the weather event and its impact on the land.

The health of our planet is critically compromised, and we must now work to ensure that every action taken drastically reduces the overall balance of climate-altering gases, while simultaneously increasing the absorption and resilience capacities of our forests. Emilia-Romagna has over 600.000 hectares of forest, covering 25% of the region's surface area, with 10% consisting of high-trunk forests, and 20% of the total being regionally owned.

This introduction aims to preview the steps the region is taking to mitigate the destructive power of increasingly frequent extreme events, while also improving the resilience of our forests and acknowledging the intrinsic value of wood resources and the potential supply chain it could support.

An important process has been initiated to recover from years of neglect of the forest-wood sector at the national level. We must now reclaim the significance this sector once held in the regional economy, particularly in the mountain areas. This will become increasingly strategic, given the importance of the wood and furniture sectors in our region.

In 2015, the Emilia-Romagna region reinvested in human capital by launching a vocational training support program that enabled nearly 1.400 forestry operators to enhance their knowledge of the sector. This effort was crucial to ensuring that forestry workers understand the importance of safe operations while maintaining productivity.

Specific training is also necessary to raise awareness among forestry workers about the importance of preserving the rich environmental heritage of our region. It should not be forgotten that Emilia-Romagna, in addition to its network of regional parks, is home to two National Parks and Italy's first National Integral Nature Reserve, Sasso Fratino, established in 1959.

In Emilia-Romagna, training and research form the foundation of any sustainable economic growth strategy. Numerous projects have been promoted, often financed by European programs, but also through internal resources. These projects aim to enhance our undervalued Natural Capital.

We recently completed a LIFE project called CO2PES&PEF, which in 2022 led to the approval of a Council Resolution on policies to reduce CO2 emissions in the forest-wood supply chain, the creation of a protocol for the cascading use of wood, and the identification of forest management practices that can increase the resilience of forests, reducing the damage caused by extreme events.

The forest also plays an important protective role alongside its productive potential, which led to the creation of the regional table on Forests and Forestry Supply Chains, as provided for by the "Testo Unico in materia di Foreste e Filiere Forestali" (Consolidated Text on Forests and Forestry Supply Chains).

The process of creating the Regional Register of Forest Ecosystem Services has also been completed. This represents an additional opportunity for forest managers in Emilia-Romagna to secure resources needed for Active and Sustainable Forest Management, as outlined by the National Forestry Strategy.

In addition to forestry, the region has initiated environmentally innovative actions to improve its territory. Through a tender for green and blue infrastructure managed by the Culture and Landscape Department, the region prioritized projects that promote the de-paving of urban areas, connect protected areas, or create new green spaces by planting trees.

The 17 municipalities (out of more than 60 that applied) whose projects were eligible for funding planned the planting of 50.000 trees and 122.000 shrubs. This not only increases plant biomass but also creates ecological corridors that can be used by citizens through integration with soft mobility.

In the area of tree planting, new urban reforestation initiatives were launched for public bodies in areas subject to EU air quality infringements, as well as for private companies. From 2021 to 2024, more than 100.000 new trees were planted. A similar initiative was part of an agreement between the Emilia-Romagna Region and the managers of major infrastructures (ASPI, ANAS, RFI), enabling the planting of an additional 60.000 trees.

Finally, it is worth mentioning the free distribution of new trees to citizens and associations for planting on private property, through agreements with accredited private nurseries. Through this initiative (alongside the two previous ones included in the mandate objective 'Let's put down roots for the future' - 4.5 million new trees), approximately 2.200.000 trees and shrubs have been distributed. With the upcoming autumn distribution campaign and the evaluation of three new tenders, a total of more than 3,000,000 new trees could be planted.

Creating a Community in Dialogue with Institutions

The actions listed above also aim to create more job opportunities and services to reduce disparities between territories. In Emilia-Romagna, nearly all forest areas are located in mountainous or hilly regions. These territories have contributed to the increased destructive power of water due to the material carried by numerous landslides. At the same time, they are crucial for a genuine environmental transition, which so far has been theoretical and has not been fully shared with those living in these areas.

ARCADIA is not only an innovative element in forest management processes but also a foundational study tool for a potential ecological transition. This transition must acknowledge that without active human involvement in a territory's biodiversity, the area becomes more vulnerable to extreme events like those recently experienced.

The territory of Emilia-Romagna, like the rest of Italy, is the result of centuries of human intervention that have created the marvel of the Italian landscape. However, due to disordered socio-economic evolution, some areas have been abandoned. In their slow evolution toward a natural equilibrium, these areas show great fragility, which can only be compensated for by active human intervention.

The abandonment of mountain areas, historically used for agro-sylvo-pastoral activities, is identified (Pettenella, Motta, and others) as a contributing factor to the severity of floods. This highlights the need to keep mountain communities alive and engaged in well-defined sectors, such as agro-sylvo-pastoral activities, to reduce the destructive force of these events. To achieve this, equal services and job opportunities must be provided to these communities, at least comparable to those in the rest of the region.

Therefore, it is necessary to consider not only new forms of territorial management and development but also the existing relationship between local communities and institutions. This relationship is strongly tied to the understanding and correct application of regulations that affect the territory, whether they are European, national, or regional.

Territorial planning is subject to a multitude of regulations that sometimes conflict, making interaction difficult and leading to different interpretations and applications that can impact both socio-economic development and the ability to enhance Natural Capital.

For this reason, ARCADIA is considered a valuable evaluation tool to identify the correct layering of regulations (laws) and guidelines (strategies) that operate in individual territories. Particular attention is given to those aimed at enhancing the protection of the environment and local communities. To this end, it is necessary to compare the laws establishing national and regional parks, recent regulations such as the Consolidated Text on Forests and Forestry Supply Chains and its implementing decrees, the National Forestry Strategy, and the National Biodiversity Strategy. Otherwise, these regulations risk being implemented through a cold technocratic interpretation, without genuine consultation with local populations and ignoring the true intent of the legislator. This could lead to conflicts that impoverish the remaining mountain communities in Italy and weaken their ability to withstand increasingly frequent extreme events, resulting in a drastic decline in the Natural Capital of these areas

Region Lower Austria - reflection on justice in existing frameworks

The text below is the reflection from the region on the existing documents and materials the region believes they directly or indirectly elaborates on the link between justice and NbS within the regions established frameworks (primarily) on climate resilience and sustainability.

Lower Austria, like other regions in Europe, integrates justice with sustainable development through various key documents, policies, guidelines, and regulations. Some of these are specific to the region, while others are broader European or international frameworks that Lower Austria adheres to. These materials have a significant influence on the planning and implementation of Nature-based Solutions (NbS) projects. Here are some notable ones:

1. Lower Austrian Regional Development Program (*NÖ Landesentwicklungsprogramm*):

This document outlines the development strategies for Lower Austria, focusing on sustainable economic growth, social justice, and environmental protection.

- *Influence*: This program sets the strategic direction for regional development, ensuring that NbS projects align with regional goals of sustainable economic growth, social justice, and environmental protection.

- *Implementation*: NbS projects are planned to contribute to regional development goals, such as enhancing biodiversity, promoting sustainable land use, and providing social benefits like improved quality of life and community well-being.

2. Lower Austrian Climate and Energy Program (*NÖ Klima- und Energieprogramm*):

It sets out policies and actions for reducing greenhouse gas emissions, increasing energy efficiency, and promoting renewable energy, with emphasis on social equity.

- *Influence:* This program emphasizes reducing greenhouse gas emissions and promoting renewable energy, which NbS projects support through carbon sequestration and energy-efficient designs.

- *Implementation*: NbS projects like afforestation, wetland restoration, and green infrastructure are implemented to enhance carbon sinks, improve energy efficiency in urban areas, and mitigate climate change impacts.

3. Austrian Climate Protection Act (*Klimaschutzgesetz*):

This national legislation provides the legal framework for climate action in Austria, setting targets for emission reductions and mechanisms for regional implementation, including Lower Austria.

- *Influence*: This national legislation mandates specific emission reduction targets and climate action plans, providing a legal framework for NbS projects aimed at climate mitigation and adaptation.

- *Implementation*: NbS projects are designed to meet legal requirements for emission reductions, enhance climate resilience, and integrate into broader climate action strategies.

4. Austrian Sustainability Strategy (*Österreichische Nachhaltigkeitsstrategie*):

A national strategy that aligns with the UN Sustainable Development Goals (SDGs), focusing on integrating economic, social, and environmental dimensions of sustainable development.

- *Influence*: Aligning with the UN SDGs, this strategy ensures that NbS projects contribute to sustainable development goals, including those related to justice, equity, and environmental sustainability.

- *Implementation*: Projects are evaluated for their contributions to the SDGs, particularly Goal 11 (Sustainable Cities and Communities) and Goal 16 (Peace, Justice, and Strong Institutions), ensuring they provide inclusive and equitable benefits.

5. Austrian Strategy for Adaptation to Climate Change

The ad-hoc tool when it comes to CCA at national level. It has been revised in 2024.

- *Influence*: Justice is one of the aspects that should be minimized when dealing adaptation measures, according to the overall objectives of this Strategy. When dealing with maladaptation it mentions a number of criteria to enable its avoidance. One of these criteria is social sustainability and mentions measures that must not lead to an unfair distribution of costs and benefits between social groups, or disproportionately burden vulnerable groups or disadvantaged regions.

- *Implementation*: In its Recommendations for Action, one of the overall principles is social aspects of CC, meaning that a balanced consideration of the consequences of CC on both ecosystems and the socio-economic system is necessary when it comes to adaptation measures and minimization of the risks to democracy, health, security, and social justice in society. In addition, it declares that special attention should be payed to employment and distributive justice. Also, social integration and cohesion must be supported, fundamental rights and cultural diversity respected, equality of men and women guaranteed, and discrimination of any kind prohibited.

6. European Union Cohesion Policy:

The EU's framework for reducing regional disparities and promoting sustainable development across member states, which Lower Austria implements through various regional programs and funding mechanisms.

- *Influence*: The EU's framework for reducing regional disparities influences the funding and implementation of NbS projects, promoting sustainable and inclusive regional development.

- *Implementation*: NbS projects receive funding and support under EU programs, prioritizing projects that address regional disparities and promote social cohesion and environmental sustainability.

7. United Nations Sustainable Development Goals (SDGs):

- Although not a specific document, Lower Austria aligns its policies and initiatives with the SDGs, particularly those related to justice (Goal 16: Peace, Justice, and Strong Institutions) and sustainable communities (Goal 11: Sustainable Cities and Communities).

- *Influence*: The SDGs provide a global framework that Lower Austria adheres to, ensuring NbS projects align with international sustainability and justice goals.

- *Implementation*: NbS projects are designed to meet multiple SDG targets, such as improving ecosystem health (Goal 15), promoting sustainable cities (Goal 11), and ensuring inclusive and participatory decision-making (Goal 16).

8. Austrian Spatial Development Concept (ÖREK):

- A strategic framework guiding spatial development in Austria, promoting balanced regional development, sustainable land use, and social inclusion.

- *Influence*: This concept guides spatial planning and land use, emphasizing balanced development and sustainable land management, which are critical for effective NbS implementation.

- *Implementation*: NbS projects are integrated into spatial plans to ensure they contribute to sustainable land use, enhance green infrastructure, and support balanced regional development.

9. Lower Austrian Social Policy Program (*Sozialpolitik-Programm Niederösterreichs*):

- This program addresses social justice, including measures for social inclusion, poverty reduction, and equal opportunities, integrating these with broader sustainable development goals.

These documents collectively guide the integration of justice and sustainable development in Lower Austria, ensuring a holistic approach to regional development that balances economic growth, social equity, and environmental sustainability.

- *Influence*: This program ensures that social justice considerations are integrated into NbS projects, promoting social inclusion, equal opportunities, and poverty reduction.

- *Implementation*: NbS projects are planned with a focus on providing social benefits, such as job creation, community engagement, and improving access to green spaces for all societal groups.

10. Energy and Environmental Agency of Lower Austria (eNu).

- *Influence*: advices municipalities, companies and individuals when it comes to any strategy related to the topic of climate. The eNu has an own climate dept., which includes CCA. The eNu is ARCADIA partner.

Summary

These policies, guidelines, and regulations ensure that NbS projects in Lower Austria are not only environmentally sustainable but also socially equitable and economically viable. They provide a framework for:

- *Strategic Planning*: Ensuring projects align with regional, national, and international sustainability and justice goals.

- *Funding and Support*: Leveraging financial and technical support from regional, national, and EU programs.

- *Inclusive Implementation*: Promoting projects that benefit all societal groups, enhance community well-being, and involve local stakeholders in decision-making.

- *Legal Compliance*: Ensuring projects meet legal requirements for environmental protection, climate action, and social equity.

Through this integrated approach, Lower Austria effectively promotes sustainable development that balances ecological, social, and economic dimensions.

Region Zagreb & Krapina-Zagorje - reflection on justice in existing frameworks

The text below is the reflection from the region on the existing documents and materials the region believes they directly or indirectly elaborates on the link between justice and NbS within the regions established frameworks (primarily) on climate resilience and sustainability.

On the National level

<u>Development Program for Infrastructure in Urban Areas for the Period 2021 to 2030</u>

The Development Program for Infrastructure in Urban Areas for 2021 to 2030 has been created to establish sustainable, resilient, safe, and pleasant-to-live-in cities and municipalities in Croatia.

For the development of infrastructure in urban areas of the Republic of Croatia, the Program proposes three specific objectives:

- Quality planning and management of infrastructure development
    - Improved, widespread, connected, and easily accessible infrastructure in urban areas
    - High level of knowledge and social awareness on sustainable development of urban areas through infrastructure development

Energy Renovation Program for Family Houses for the Period 2014 to 2020

EnergyThe objectives of the Program include determining and analyzing energy consumption and energy efficiency in the existing residential stock of the Republic of Croatia, identifying potential and possibilities for reducing energy consumption in existing residential buildings, developing measures to promote the improvement of energy efficiency in existing residential buildings, and evaluating their impact. Amendments to the Program on March 26, 2015, provided equal opportunities for all citizens of the Republic of Croatia to receive subsidies, shortened the timeline for the implementation of energy renovation, and simplified the implementation process. In July 2021, the Government adopted a Decision extending the deadline for exercising the right to co-finance the energy renovation of family houses until December 2021. As a new Renovation Program for Family Houses (until 2030) has yet to be adopted, this decision ensures the continuity of energy renovation even before adopting the latest program that will cover the period until 2030.

National Development Strategy of the Republic of Croatia until 2030

The Strategy is the overarching document for strategic planning that serves to shape and implement the development policies of the Republic of Croatia. The strategy itself is divided into four development directions, one of which is the digital and green transition to ensure a fair and inclusive transition towards climate neutrality. This development direction contains four strategic objectives:

- Ecological and energy transition for climate neutrality
    - Food self-sufficiency and development of the bioeconomy
    - Sustainable mobility
    - Digital transition of society and the economy

On the Regional level

City of Zagreb

Development Plan for the City of Zagreb Until the End of 2027

The plan calls for introducing a viable and participatory governance framework, which is considered part of justice regarding sustainable development. This involves enhancing civic participation, improving the efficiency and transparency of public administration, and ensuring that governance processes are inclusive and representative of all citizens. Also, the plan incorporates environmental justice by ensuring that sustainable urban development does not disproportionately affect marginalized communities. This includes strategies for managing urban spaces sustainably, addressing climate change, and ensuring that the benefits of green and digital transitions are equitably distributed.

Green Urban Renewal Strategy of the City of Zagreb

The document incorporates the concept of justice into sustainable development by emphasizing inclusivity, social equity, and participatory approaches in the planning and managing of green infrastructure and urban renewal in Zagreb. The strategy explicitly promotes inclusivity by advocating for the involvement of all stakeholders, including residents, civil society organizations, private sector entities, and public sector stakeholders, in the planning and management processes. The strategy also underscores social equity by ensuring that green infrastructure development is accessible and beneficial to all residents of Zagreb. It seeks to distribute green spaces and resources evenly across the city, ensuring that all neighborhoods, regardless of socio-economic status, have access to parks, recreational areas, and other green spaces.

Krapina-Zagorje County

Spatial Plan of Krapina-Zagorje County

The Spatial Plan stresses the importance of protecting natural resources, such as water, air, and soil, to ensure these essential resources remain available for all communities. Measures like preventing pollution and promoting sustainable land use are highlighted as crucial for maintaining ecological balance, a foundation for social justice.

Region Skåne - reflection on justice in existing frameworks

The text below is the reflection from the region on the existing documents and materials the region believes they directly or indirectly elaborates on the link between justice and NbS within the regions established frameworks (primarily) on climate resilience and sustainability.

The primary document for regional planning in Skåne is the Regional Plan for Skåne 2022-2040. The regional plan serves as a guide for municipal planning, especially comprehensive planning. There are sections with clear links to justice, health-promoting planning, and NbS, although these connections are not always specific or clearly interlinked. The regional council adopted the plan in 2022, and it is currently in the implementation phase. The plan is used as a basis for statements on various matters concerning regional physical planning, mainly planning issues related to municipal comprehensive and detailed plans. Based on the regional plan, new knowledge bases are developed, and various dialogue processes are carried out to support both municipalities in their work and Region Skåne's efforts with the plan's review and revision. Below, certain parts of the plan are highlighted, with a clear focus on justice, health, and nature-based NbS.

Under the **"Utvecklingsinriktning"** (Development Direction) chapter, there are six planning strategies. Particularly relevant strategies are ***3) Strengthening the diversity of attractive and health-promoting living environments with access to recreation, 4) Growing efficiently with balanced and sustainable land and water use*** and ***5) Planning for a good environment and sustainable resource use.***

In the **"Tematiska fördjupningar"** (Thematic Deep Dives) chapter, relevant principles are presented in several sections, primarily in section *1. Development of Built Areas,* which addresses the built environment, and in section *3. Green Structure*, which has a stronger connection to landscapes. See below:

1.2 Climate-adapted Urban Development with Planning Principle. *1.2 i - Adapt the built environment to higher average temperatures, heatwaves, rising seas, and increased precipitation*. This section highlights the importance of working with green spaces and water environments as a way to manage downpours and heat in the urban environment, emphasizing that this is especially important for vulnerable groups.

1.3 Designed (Gestaltad) Living Environment with Planning Principle. *1.3 i - Apply the designed living environment perspective at all stages of planning*. There is a clear link to social justice, though not specifically to NbS. The designed living environment is one of the bases for questions about how we shape society in an inclusive way and based on human needs. See also Region Skåne's strategy for the designed living environment. Designed living environment in a holistic view focuses on what architecture, form, and design do and how these, in different ways, shape society and the everyday life of the inhabitants and how they can contribute to solving and discussing society's challenges.

1.6 Health-promoting Living Environment with Planning Principle. *1.6 i - Plan health-promoting and green environments that encourage physical activity and help reduce negative impacts on people's health*. It states, among other things: *"Thoughtful design of the living environment and applying cultural and health aspects into development work can*

contribute to equal public health through preventive measures essential for good health and reduced health disparities. Today, there are significant differences in public health depending on where you live, age, and socio-economic conditions. These are challenges that physical planning needs to address. Children and young people's access to appropriate environments is especially important to respond to their mental and physical needs."

***1.7 Urban Green Structure with Planning Principles**. 1.7 i - Plan and manage the urban green structure with the aim of strengthening its ability to produce ecosystem services and promote biodiversity to create benefits for the whole of Skåne,* and *1.7 ii - Densify cities and urban areas with consideration for the existing green structure*. This section addresses the importance of good access, reachability, and quality of green spaces, water, and nature near and in close proximity to residences as well as school and caregiving environments. The section highlights the aspect of justice in the following statement: *"Access to local recreational areas is important for everyone, but especially for children, the elderly, and people with disabilities, as well as in areas with a high proportion of socio-economically disadvantaged households."*

In the same chapter *Tematiska fördjupningar* (Thematic Deep Dives), section ***3. Green Structure*** mainly highlights blue-green structures and their value for outdoor recreation, biodiversity, water regulation, food production, etc., on a more overarching scale. Several planning principles support nature-based solutions in the landscape, primarily related to water, but contain few social aspects.

Additionally, in relation to the regional plan for Skåne, two projects have emerged from its implementation:

"3-30-300 in Skåne" Project
This project is a method development and analysis based on the 3-30-300 rule concerning canopy cover and accessibility to green spaces in the nine largest towns in Skåne. The 3-30-300 rule defines a level of urban greenery that helps create health-promoting urban living environments. The rule states that each person should be able to see 3 trees from their home, each neighborhood should have a canopy cover of at least 30%, and everyone should be able to reach a green area within 300 meters of their home. The results can be used for continued work on climate adaptation (primarily heat) and social aspects related to the fair distribution of greenery.

Ongoing Project "The Role of Green Infrastructure from an Equality Perspective"
This project is a collaboration between Region Skåne, SLU, and the City of Malmö. It primarily aims to develop an Equality Index for green infrastructure that combines access to green areas with socio-economic aspects. The index is intended to be based mainly on data readily available to municipalities via SCB (Statistics Sweden) and Geodata Collaboration. The method/model combines indicators GSS (Green Space Status), Green infrastructure indicators combined into a unified measure, and SES (Socio-Economic Status), Socio-economic indicators combined into a unified measure. The synthesis of GSS and SES forms the basis for a representative equality index for green infrastructure.

The text above reveals the consideration of justice at a **regional level** and that is directly or indirectly relevant to NbS. In general, justice and equity are clearly part of Swedish **national legislation**. For example, under the foundation of the state and about public power it has been stated, *"The general public must promote sustainable development that leads to a good environment for current and future generations. The public must work to ensure that the ideas of democracy become guiding principles in all areas of society and protect the individual's privacy and family life."* Law (2010:1408). However, in Sweden, **municipalities** hold significant power in forming the cities and have the main responsibilities concerning the sustainable development and increasing the climate resilience of their areas. Each municipality has its own legislative frameworks and planning structures, including those that connect Climate resilience, NbS, and justice.

For the city of Malmö, the main document that the city draws on is first the comprehensive (general) plan (Översiktsplan för Malmö 2023), which has several strategies connected to justice (especially distributional). The 3-30-300 regional principle has been also integrated into this plan. The second main document is the yearly budget (Malmö stads budget 2024), which highlights that injustices are visible in the consequences of climate change and emphasizes regardless of where you live in Malmö, you must have access to nature, green spaces, and trees. In summary, justice and NbS are clear priorities for the city. However, their implementation has primarily been project-based. The city believes the momentum generated by the 3-30-300 initiative may help integrate distributional justice better into the city's practices moving forward.

For the city of Lund, there are three specific programs for social sustainability (Lunds kommuns program för social hållbarhet 2020-2030), ecological sustainable development (Lunds kommuns program för ekologisk hållbar utveckling)

and green Lund Lund Grönprogram. These, together with the new comprehensive plan (Lunds kommuns översiktsplan), bring up some justice considerations in relation to NbS. However, we do not discuss them in detail here.

For the city of Helsingborg, there are two programs: Quality of life (2016-2024) [Livskvalitetsprogrammet (2016-2024)] and Plan for equal opportunities (2022-2025) [Plan för lika möjligheter (2022-2025)]. They both elaborate on equal Helsingborg and are integrated into other plans such as the city comprehensive plan (ÖP 2021 Översiktsplan för Helsingborgs stad). The main connection between NbS and justice in these documents is around access to recreation, proximity and distribution of recreational and natural spaces, influence over urban development, health aspects, and the varying impacts of climate change on different areas.

Region Funen - reflection on justice in existing frameworks

The text below is the reflection from the region on the existing documents and materials the region believes they directly or indirectly elaborates on the link between justice and NbS within the regions established frameworks (primarily) on climate resilience and sustainability.

Odense Municipality's Climate Adaptation Plan 2023 (link) states in the Introduction on Water Management, page 33:

"Climate adaptation must add value. The management of extreme rainfall is only relevant a few days a year. For example, a low-lying area that can serve as a water storage during extreme conditions can be used for something else the rest of the year - something that makes sense locally and is accessible to the general public. Nature-based projects are not possible in every location, but each project considers the accessibility for the walking and visually impaired, etc. as well as the interaction with nature."

In Odense Municipality City Strategy 2023 (link), there is a focus on social justice from page 36 and onwards under "Everyone should have access to the city's common spaces " related to the vision of the city.

- On page 22, the vision for being Denmarks greenest city is outlined which connects water, climate and green spaces before urban development and construction.

Odense Impact Goals (Effectmål - link) provides an overview and evaluation of the targets set by the municipality. Under the following impact goals, there could be something of interest in how Odense Municipality seeks to move the development of the city in a sustainable direction:

- En klima- og miljøvenlig storby (A climate and eco-friendly city)
- Byudvikling med kvalitet (Urban development with quality)

The accountability report of the water utility company, VandCenter Syd (link) (also a partner in ARCADIA), connects the management of water with sustainability like social measures internally in the company and general society (students, partnerships etc), energy production and resource usage.

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