Report on the possible strategies for mainstreaming of large-scale NBS

Deliverable D4.7

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Abstract (for dissemination, 100 words)	This report examines strategies for mainstreaming nature-based solutions (NBS) across five European river basins. Through extensive stakeholder engagement and co-creation activities, key barriers and enablers for NBS implementation were identified. Common challenges include lack of financial resources, limited political will, and insufficient public understanding. Enabling strategies focus on developing innovative financing mechanisms, integrating NBS into sectoral policies, enhancing cross-sector collaboration, and

	implementing demonstration projects. The analysis reveals a need for more robust legal and policy frameworks to support NBS, alongside improved coordination among stakeholders. By addressing these challenges and leveraging enablers, countries can accelerate the adoption of NBS for effective hydrometeorological risk reduction and climate change adaptation.
Keywords	Nature-based solutions; Mainstreaming; UpScaling, Stakeholder engagement; Barriers and enablers; Co-creation; Policy analysis

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Executive Summary

The aim of this report is to co-create options for mainstreaming NBS in the European Collaborator countries. At the core of the report is co-creation work based on the strong participatory methodology/close collaboration with various stakeholder, including a thorough analysis of the acceptability of NBS, a deep-diving barrier analysis, the identification of enablers that help to overcome barriers. We reviewed global, European, national and regional NBS relevant policies (with an emphasis on water, flood and disaster risk management relevant policies) to assess the extent to which they currently support the effective implementation of NBS.

This report complements site-specific pre-feasibility studies presented in D4.8 and develops context-specific mainstreaming options. Based on the upscaling framework developed in RECONECT (presented in D4.3), this report provides answers to a set of specific questions and, by doing so, develops specific options for mainstreaming. These questions include (1) What are the key barriers & enablers? Which stakeholders support the uptake of NBS? Which players might resist? (Scaling down); (2) How can participatory processes be designed to enable diverse stakeholders to shape the transformation towards and through NBS? (Scaling deep); (3) How can governance approaches be transformed to support the mainstreaming of NBS? (Scaling Up). As the options for mainstreaming were developed through a strong co-creation process, including more than 400 (n=415) stakeholders, this report provides options that can support any future effort for mainstreaming after the end of the project.

This report provides relevant information and aims at supporting policy-makers, practitioners, politicians, representatives of the civil society and/or scientists that are interested in a more effective implementation of NBS. They can use the information to get a better understanding of potential options for mainstreaming, including a specification of the roles of different types and groups of stakeholders and an overview of the existing policy instruments that can support NBS development and implementation at different levels.

This report identified enablers that provide options for supporting the mainstreaming of NBS in the European Collaborator sites. The most common barriers and enablers are categorized into two groups. The first group, Institutional and Governance barriers, encompasses the structural and political challenges inherent in decision-making processes and policy implementation. These barriers often stem from fragmented governance structures and short-term political cycles that struggle to align with the long-term benefits of NBS. The second group, Economic and Financial barriers, addresses the critical issues of funding allocation, perceived costs, and the long-term financial sustainability of NBS projects. These economic challenges are frequently exacerbated by traditional budgeting practices that favor conventional infrastructure solutions. To address these persistent barriers, the following recomendations can be concluded:

(1) European and national policies need to more effectively promote the uptake of NBS. While the significance of Nature-Based Solutions (NBS) is acknowledged in various EU policies, these policies are only encouraging the uptake of NBS but are not enforcing such an uptake with legally binding requirements and measurable targets. At the national

level, NBS also need to be integrated into various relevant sectoral policies, including water, biodiversity, climate change adaptation and others. To address institutional and governance barriers, several enabling strategies have emerged across the study sites. The development of integrated planning frameworks has been identified as a crucial enabler for overcoming silo thinking and fragmented decision-making. To tackle the challenges of limited political will and fragmented governance, cross-sectoral collaboration mechanisms have been proposed. Integrating NBS into various policy sectors was identified as a key enabler across sites. This approach aims to create a more supportive policy environment for NBS implementation.

(2) To address economic and financial barriers, several enabling strategies have been proposed. **Innovative financing mechanisms were suggested across the study area to tackle the lack of financial resources.** To counter perceptions of high costs associated with NBS, several sites emphasized the importance of demonstrating their cost-effectiveness and multiple benefits. Addressing the challenge of limited long-term financing, sites proposed strategies for ensuring sustained financial support. Hence, innovative and long-term financing mechanisms are key steps forward, including natural infrastructure funds, unleashing public government budgets, EU funds, and private investments but also payments for ecosystem services.

(3) **Further demonstrating the cost-effectiveness of NBS as well as their multiple benefits is needed** to counter perceptions of high costs associated with NBS, several sites emphasized the importance of demonstrating their cost-effectiveness and multiple benefits. Stakeholders repeatedly proposed implementing and showcasing successful NBS projects to build awareness and inspire replication.

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Abbreviations

CBD	Convention on Biological Diversity
EEA	European Environment Agency
EIB	European Investment Bank
GEF	Global Environment Facility
GCPF	Global Climate Partnership Fund
ICLEI	Local Governments for Sustainability (a global network)
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature and Natural Resources
NBS	Nature-Based Solutions
OECD	Organization for Economic Co-operation and Development
UNEP	United Nations Environment Program
UNFCCC	United Nation's Framework Convention on Climate Change
WEF	World Economic Forum
WWF	World Wildlife Fund

1 Introduction

Nature-based solutions (NBS) have gained significant attention in recent years as a sustainable approach to addressing societal challenges, such as climate change, biodiversity loss, and disaster risk reduction. While the concept has been embraced at local and pilot levels, the challenge now lies in mainstreaming and upscaling these solutions to have a broader impact. Mainstreaming NBS involves not just integrating them into policies, planning, and practices across various sectors and scales, as the realization of NBS is still confronted with a number of deep-rooted barriers, including rigid governance structures, lack of cross-sectoral coordination, and insufficient policy integration, but also financial barriers often arise from the high upfront costs associated with NBS and the difficulty in demonstrating their long-term economic benefits. Social barriers can be linked to public perception, stakeholder engagement, and the need for community buy-in.

In this report, we delve into identifying options for mainstreaming NBS and, by doing so, contribute to the realisation of the full potential of NBS. Based on our upscaling framework presented in D4.3, we organised our analysis around some overarching questions. What are the key barriers & enablers? Which stakeholders support the uptake of NBS? Which players might resist? How can participatory processes be designed to enable diverse stakeholders to shape the transformation towards and through NBS? How can governance approaches be transformed to support the mainstreaming of NBS?

The report focuses specifically on the RECONECT European Collaborators and is based on a strong co-creation process. At the heart of this process were four main components: (1) desktop research with elements of semi-structured interviews in order to understand and assess relevance policies shaping the current water, flood and disaster risk management; (2) site-specific workshops to assess local acceptance of NBS as well as relevant social, financial, (3) online surveys, and (3) national workshops with local stakeholders. Each of these elements played a crucial role in collecting different sources of information, gathering diverse perspectives, validating findings, and developing a comprehensive understanding of the challenges and opportunities for NBS implementation in different local contexts.

In total, 415 stakeholders were involved in the production of this report.

2. Conceptual specifications: mainstreaming in RECONECT

2.1 Mainstreaming NBS: the need for a transformative perspective

What do we mean by mainstreaming? While the term is well established in our day-to-day vocabulary, the conceptual basis of the term is often taken for granted. Through a systematic literature review, Adams et al. (2023) reveal that “clear, coherent, and consistent definitions and descriptions of the mainstreaming phenomenon are rare” (2023, 4). They argue that mainstreaming is often used interchangeably with policy integration, institutionalization, uptake, and policy adoption. In this context, mainstreaming is understood as a process that focuses predominantly on integrating Nature-based Solutions (NBS) into existing policies, planning, and decision-making processes so that they become a standard part of practices and strategies (Tozer et al., 2022) in sectors like urban planning, hydro-meteorological risk management, and climate change adaptation.

However, insights from recent research initiatives and EU projects indicate that this perspective is not only too narrow but also fails to reflect the actual challenges a mainstreaming strategy for NBS faces. These studies highlight the need for a broader perspective on mainstreaming that explicitly takes a transformative stance.

A broader perspective that includes governance and collaborative planning is identified as crucial by Hölscher et al. (2023) and the Connecting Nature Framework. They adopt a comparative case study approach, analyzing ten European cities to identify successful mainstreaming strategies for NBS. Their key findings emphasize the importance of developing governance capacities that enable systemic, inclusive, and reflexive planning and implementation of NBS. However, they also report persistent barriers that are challenging to overcome, including “opportunistic rather than consistent political support for NBS, short-term financing and procurement frameworks that emphasize costs over benefits, and insufficient organizational staffing” (2023, 54).

The relevance of policy enforcement that is aware of barriers is also identified as an essential element by projects like MERLIN and PHUSICOS. The EU MERLIN project (Deliverables 4.1 and 4.3) focuses on refining policy frameworks to better support NBS, particularly in the context of aquatic restoration. By employing methodologies such as questionnaires, interviews, and roundtable discussions, MERLIN assesses and elevates perceptions and integration of NBS into sectoral policies across the EU. Complementing this work, the EU PHUSICOS project (Deliverable 5.4) presents a systematic literature survey and meta-analysis comparing gray infrastructure barriers to NBS, contributing to a better understanding of how to structure NBS projects to overcome traditional planning limitations.

Scolobig et al. (2023) build a theoretical framework that allows for describing and assessing transformative processes. The framework is applied with reference to three government-led adaptation projects of NBS, including a river restoration project in Germany, forest conservation in China, and a landslide risk reduction project in Italy. The framework consists of the following core elements: vision, planning, institutional frameworks, and interventions. Their analysis shows that there is “little intent to scale the NBS, for instance, through duplication, enabling legislation and more permanent institutions, which is perhaps the most revealing result of the analysis” (ibid). However, their analysis also provides important insights indicating that “inclusive co-design planning processes and novel polycentric governance institutions can emerge from a process initially dominated by government authorities” (2023, 69). Furthermore, they see the realization of NBS as an option for the public sector to establish “cross-competing priorities

among agencies, cross-sectoral formal mechanisms, new dedicated institutions, and programmatic and regulatory mainstreaming" (ibid).

As a summary, the just mentioned studies suggest a different understanding of mainstreaming compared to more conventional framings: Instead of seeing mainstreaming as a question of integration, they propose that the realization of NBS needs to be seen in the wider context of transforming established planning processes, governance settings, and organizational structures towards more sustainable and equitable societies (Scolobig 2023). However, navigating transformation dynamics involves both nurturing innovations to replace unsustainable practices (phasing in) and actively destabilizing and phasing out problematic structures (Wittmer et al. 2021). This may include promoting NBS as an alternative to traditional, hard-engineered flood protection measures, while simultaneously working to dismantle policies and incentives that perpetuate unsustainable land use practices. In this reading, NBS mainstreaming can become a central driver for transformation in urban planning, hydro-meteorological risk management, and climate change adaptation.

2.2 Developing options for mainstreaming: Enablers for NBS

A second important strand of research included in our co-creation work for identifying options for mainstreaming NBS is the discussion of enablers. Previous research has identified several key enablers that can help overcome barriers to the implementation of NBS. A review of EU HORIZON projects and scientific literature reveals a range of strategies and factors that facilitate the successful adoption and scaling up of NBS. In this Deliverable, we have reviewed the following studies that have already analyzed the enablers of NBS adoption.

Table 1 shows the EU project reports and scientific papers that have been reviewed for this chapter.

Table 1 Reviewed EU project reports and scientific papers

Document	Method
PHUSICOS D5.2: Opportunities and barriers to NBS at the EU, national, regional, and local scales, with suggested reforms and innovations (Martin et al., 2023)	• A systematic review of workshop results (extracted from pre-workshop interviews and discussion groups), gray and peer-reviewed literature, analyzing 26 data sources in depth using quantitative content analysis methods. Enablers and barriers were classified according to different criteria
PHUSICOS D5.3: PHUSICOS Policy-Business Forum – Governance innovation for the design, financing, and implementation of NBS, and their application to the concept and demonstration projects (Scolobig et al., 2023)	• The semi-structured interviews, surveys, and workshops to gather data and insights on the governance of NBS. Key stakeholders from various sectors, including policy, business, and academia, participated in these activities to discuss and identify ways to enhance the adoption and effectiveness of NBS
PHUSICOS D5.4: Learning from NBS implementation barriers (Linnerooth-Bayer et al., 2023)	• A systematic literature survey and meta-analysis of 'gray' infrastructure implementation, including 201 screened reports/papers that identified 18 for analysis, followed by a quantitative content analysis and the classification of 12 barrier clusters • The analysis of the 12 'gray' barriers compared with their NBS counterparts as documented in PHUSICOS Deliverable 5.2

Document	Method
	• 13 semi-structured interviews with public-sector entities across Norway, including municipalities, country governors, and national directorates • 20 semi-structured interviews with private-sector professionals working in the provision of NBS services across Europe, including designers, construction companies, and consulting firms
NAIAD D3.2: Institutional analysis report: baseline analysis and policy recommendation (Rica et al., 2017)	• Mix of policy analysis, literature reviews, and stakeholder consultations to assess the governance of NBS across different levels. Included mapping of main policies, legal, and regulatory frameworks
MERLIN D4.1: Mainstreaming aquatic restoration using Nature-based Solutions (Bérczi-Siket et al., 2023)	• Questionnaires across the EU targeting sectoral experts • Interviews and Online Round Table Discussions (RTDs) to engage with sector representatives • Document reviews to identify current practices and perceptions towards NBS
MERLIN D4.3: Briefing on policy opportunities for mainstreaming freshwater Nature-based Solutions (Blackstock et al., 2023)	• Scoping discussions on policy transformations with policy analysts and stakeholders • Policy analysis of six focal EU policies, using data to fill assessment templates • Sectoral roundtables and webinars to discuss findings with policy actors • Synthesis of collected data through cross-case qualitative analysis • Engagement with policy implementation at various levels
Sarkki et al. (2024)	• Empirical materials from three participatory stakeholder workshops and an online questionnaire. Included participatory methods like backcasting, map-assisted discussions, and reflective discussions about concerns and aspirations linked to river basin management
Hölscher et al. (2023)	• Comparative case study of ten European cities to understand NBS mainstreaming strategies • Knowledge co-production and reflexive monitoring involving multiple stakeholders • Inter- and transdisciplinary peer-learning process • Application of the Connecting Nature Framework • Iterative steps for comparative analysis focusing on clustering activities and identifying governance conditions

Based on this, we have categorized the topics around enablers that have been identified during the review process.

Topic 1. Financing and Support Mechanisms

Financial resources and support mechanisms are crucial for the successful implementation and sustainability of NBS projects. The PHUSICOS D5.2 highlights the significance of financing as a critical enabler, emphasizing the need for available financial resources and support mechanisms for the planning, realization, and maintenance of NBS. Innovative financing schemes, such as the EIB EU Natural Capital Financing Facility mentioned in the NAIAD D3.2, can make NBS more attractive for investment.

The PHUSICOS D5.3 suggests several actions to mobilize public and private finance for NBS, including the establishment of the EU Taxonomy for sustainable finance, the deployment of financial instruments to de-risk projects, and the promotion of innovative financing mechanisms such as payment for ecosystem services. These measures can help unlock funding and create an enabling environment for NBS investments.

Topic 2. Governance Innovation

Governance innovation is identified as a critical enabler for NBS implementation. The PHUSICOS D5.2 emphasizes the importance of polycentric governance arrangements, NBS co-design through innovative stakeholder participatory processes, and financial incentives for community-based implementation and monitoring of NBS. The role of environmental advocacy coalition groups and individual champions in advocating for NBS is also highlighted.

The adaptiveness and flexibility of governance systems in response to changing climates and societal challenges are recognized as essential for NBS, as mentioned in the NAIAD D3.2. Supportive policies and legal frameworks, despite the current lack of NBS-specific regional policies in Europe, are seen as important for enhancing NBS uptake.

Stakeholder engagement and inclusive participatory processes are identified as crucial governance factors facilitating NBS implementation. The NAIAD D3.2 emphasizes the importance of engaging a wide range of stakeholders, including businesses, civil society, NGOs, and expert communities, in the decision-making and implementation process.

Hölscher et al. (2023) highlight the need to formalize collaborative governance models and ensure continuous engagement and communication with local communities to promote enthusiasm and engagement with NBS. The development of living labs and other stakeholder deliberative processes, as well as the integration of social justice and equity considerations in NBS development and appraisals, are suggested as innovative approaches to stakeholder engagement.

Topic 3. Knowledge Generation and Capacity Building

The creation of systematic NBS knowledge hubs and educational programs specifically designed for NBS design and implementation is emphasized as a means to address the lack of capacity and knowledge. The PHUSICOS D5.2 underscores the importance of developing educational and training programs tailored to NBS, integrating multidisciplinary competencies, and creating communities of practice for NBS contractors.

The PHUSICOS D5.3 highlights the need to strengthen the knowledge base through increased monitoring, stronger evidence on the effectiveness of NBS, co-benefit evaluation, and the development of formal standards. This can help build a solid foundation for informed decision-making and support the mainstreaming of NBS.

Topic 4. Policy and Institutional Support

Policy and institutional support are essential for creating an enabling environment for NBS. The PHUSICOS D5.3 suggests actions such as the enforcement of legally binding targets, the simplification of NBS approval procedures, and the integration of NBS into broader urban land use planning (p.106). The NAIAD D3.2 also highlights the importance of drafting spatial development policies that integrate NBS into urban planning, employing innovative tools and policy approaches (p.6).

Aligning NBS with broader urban development and sustainability goals can help gain support for their implementation (Hölscher et al., 2023). The establishment of formal mechanisms and bodies coordinating NBS public investment across sectors and government scales, as well as the creation of new institutions with independent budgets and clear political mandates devoted to NBS promotion, are suggested as potential governance innovations.

Topic 5. Cross-Sectoral Collaboration and Integration

Cross-sectoral collaboration and the integration of NBS into various sectors are identified as important enablers. The MERLIN D4.1 highlights the potential of adopting existing agricultural practices, such as reduced tillage and increased soil cover, to implement NBS. The integration of land use and water management strategies at a landscape scale is also seen as critical for developing climate resilience in the agriculture sector.

The MERLIN D4.3 emphasizes the role of the insurance sector in promoting NBS as risk reduction measures, both through financing NBS via life insurance and by considering the preservation, restoration, or establishment of NBS in legal requirements. The involvement of the insurance sector can help promote NBS as a means to mitigate natural disaster risks.

Table 2 links the outstanding barriers and their potential enablers in detail, as suggested by the previously mentioned studies and projects.

Table 2 Barriers and potential enablers from previous research

Barrier Theme	Potential Enablers
Lack of expertise and knowledge	▪ Development of educational and training programs specific to NBS design and implementation ▪ Integration of multidisciplinary competencies in NBS curricula, including on e.g. NBS legislation ▪ Developing NBS project preparation facilities for the private sector ▪ Creating and facilitating capacity building for NBS contractors ▪ Creating accelerator programs that offer the private sector NBS learning and development opportunities through funding and mentoring ▪ Creating communities of practice for NBS contractors with the public, academia, and civil society
Lack of evidence on NBS performance and co-benefits	▪ Development of long-term studies on the co-benefits of NBS in comparison to gray solutions ▪ Development of quantitative decision-making tools, such as cost-benefit analyses and indicators ▪ Integration of qualitative evidence on NBS, such as stakeholder narratives, in NBS policy options
Stakeholder conflicts and equity	▪ Development of living labs and other stakeholder deliberative processes ▪ Genuine co-design and co-creation processes ▪ Systematic implementation of NBS knowledge hubs where stakeholders can exchange on NBS ▪ Innovative benefit sharing and compensation mechanisms for landowners giving up land for NBS ▪ Development of stakeholder engagement processes that are inclusive of diverse visions, understandings, knowledge, livelihoods, and experiences ▪ Integration of social justice and equity considerations in NBS development and appraisals ▪ Integration of Indigenous knowledge in NBS decision-making processes

Barrier Theme	Potential Enablers
Path dependency	▪ Shift in the burden of proof to traditional gray infrastructure projects, for example by amending the EIA Directive 2011/92/EU
Lack and complexity of financing	▪ Establishment of the EU Taxonomy for sustainable finance ▪ Pledges and commitments to eliminate nature-harming subsidies through the Global Biodiversity Framework ▪ Deployment of financial instruments to de-risk projects (e.g., private or public insurance and provision of public guarantees) ▪ Deployment of public-private partnerships, blended financing, subsidies, and other public financing schemes for financing NBS ▪ Establishment of formal mechanisms and bodies coordinating NBS public investment across sectors and government scales ▪ Creation of new institutions with independent budgets and clear political mandates, devoted to NBS promotion
Lack of supportive policy and/or legal frameworks	▪ Development of risk reduction standards, insurance standards, liability guidelines, and risk management tools ▪ Development of nationally (and ideally, internationally) agreed technical standards, guidelines, and legal norms for NBS implementation ▪ Enforcement of legally binding biodiversity targets through the proposed New EU Restoration Law
Sectoral and/or administrative silos	▪ Polycentric governance arrangements ▪ Alignment of sectoral policy instruments to exploit synergies and address trade-offs between NBS and other policy domains ▪ Creation of a dominant steering instrument that can establish pathways for NBS policies at the MS level ▪ Establishment of semi-permanent institutional frameworks that are adaptive, multi-scale, and cross-sectoral to guarantee the delivery of NBS ▪ Establishment of cross-sectoral secretariats to assist agencies in the implementation of NBS strategies

2.3 Linking mainstreaming to RECONECT's upscaling framework

In this section, we explicate how the previously elaborated understanding of mainstreaming, including the discussion on enablers, relates to the RECONECT upscaling framework, as presented in D4.3 (Figure 1). In the first step, we provide a short overview of the framework and then proceed with specifying how we used the framework for our work on mainstreaming.

RECONECT's upscaling strategy pursues an explicit transformative, forward-looking and actor-oriented agenda. The framework identifies four different but interlinked strategies of scaling at its core. They all support the mainstreaming of NBS. The first three scaling strategies pursue an explicit transformative perspective, this includes (see D4.3):

- **Scaling down** takes predominantly an analytical perspective and is concerned with understanding the respective system in more detail. This includes barriers and enablers that hinder/block or enforce the uptake of NBS but also key players and stakeholders. In recent years, researchers have paid considerable attention to the barriers and drivers behind the mainstreaming and successful implementation of NBS (O'Donnell et al., 2017; Sarabi et al., 2019; Wells et al., 2019). As argued previously, it is important to detect and assess the relevance of such barriers thoroughly as they will have a large impact on the mainstreaming of NBS across Europe and beyond (see also: Wellstead et al., 2016). Wittmer et al. (2021) argue in a similar direction: Profound knowledge, including barriers, key leverage points, and effective interventions are essential for understanding the system to be changed. This also needs the inclusion of diverse perspectives and the inclusion of various practical, technical, and local knowledge. RECONECT has paid great attention to integrating the perspectives of stakeholders. This includes an analysis of the acceptance of different stakeholder groups and the stakeholders' perspectives on the role of NBS in managing site-specific hydro-meteorological risks (D4.5) as well as a thorough and comprehensive analysis of barriers (D4.6) and enablers (this document).
- **Scaling deep** describes a strategy that aims at impacting and changing rules and values (Moore et al., 2015). It is thus about a deeper transformative process addressing social interactions and forms of participation and recognizing that culture plays a powerful role in shifting problem domains, and change must be deeply rooted in people, relationships, communities, and cultures. In the previous section, the relevance of the co-design process of inclusive planning and decision-making processes has been highlighted. Also, in the literature on transformative governance, the relevance of emancipatory and agency-oriented approaches are highlighted. This calls for the creation of participatory spaces where stakeholders, including local communities and vulnerable populations, can actively contribute to the design and implementation of NBS (e.g. Wittmer et al. 2021). RECONECT's co-creation and upscaling methods directly address this need by fostering stakeholder engagement, participatory processes, and capacity building across all stages of NBS implementation. By empowering diverse actors to shape the transformation process, RECONECT aims to ensure that NBS policies and practices are inclusive, equitable, and responsive to local needs and priorities.
- **Scaling up** is a strategy that implies a higher "scale" or "level" to increase impact. In this sense, upscaling refers to a scale-related progression and "involves a mechanism where information from one scale is transferred to another, thereby reaching a higher level of scale and a greater impact" (van Doren et al., 2018, p. 177). The aim of upscaling processes is therefore to have an impact on laws and policies in such a way that they help to amplify the uptake of NBS (Moore et al. 2015). Also, the relevance of transforming existing policy frameworks has been highlighted previously.
- **Scaling out** is probably the most common strategy pursued in many sustainability-oriented initiatives and projects. It aims at impacting a great number of people and stakeholders and make them aware of an ongoing project, disseminate results to other stakeholders, replicate a well-tested practice in another location with a similar context, exploit project results, also economically, and build up capacities among practitioners and policy-makers to support the amplification of NBS in the future.

Based upon the upscaling framework, we develop a set of specific questions that guided our work on mainstreaming NBS.

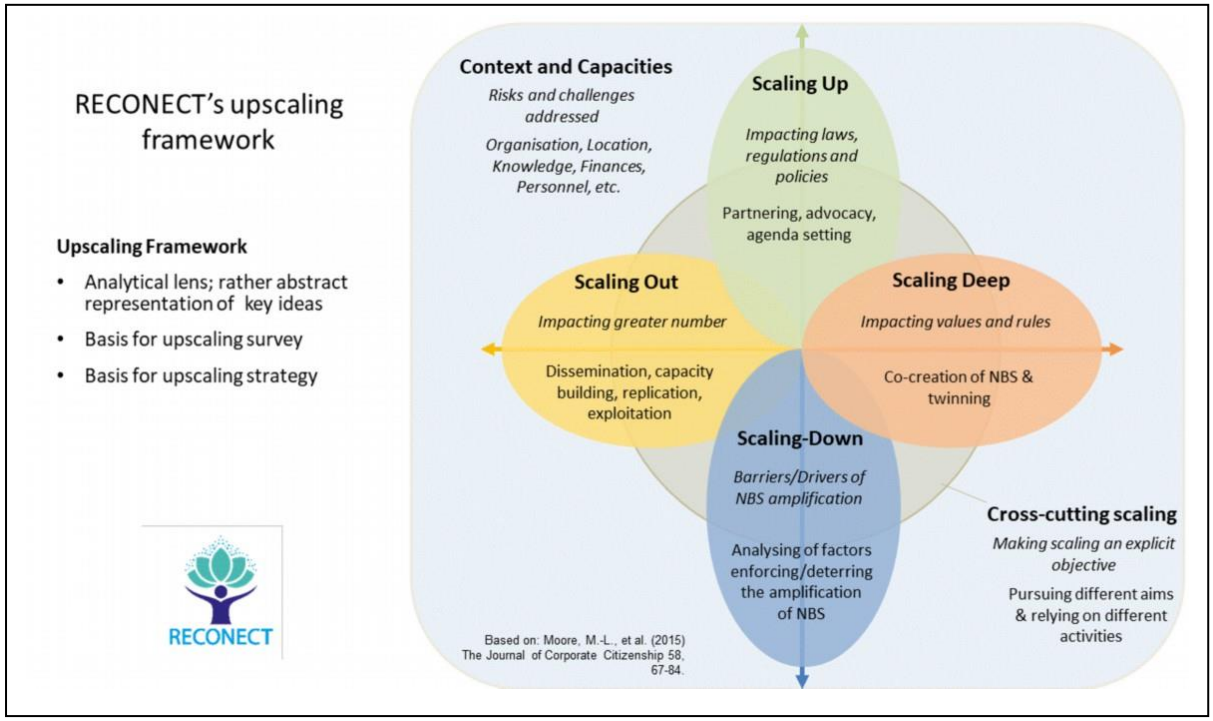

Figure 1 Different types of upscaling underpinning RECONECT's framework

Source: Adapted from Moore et al. 2015, p. 75

2.4 Key questions for co-creating mainstreaming options in RECONECT

Question 1.

Scaling down: What are the key barriers & enablers? Which stakeholders support the uptake of NBS? Which players might resist?

To effectively transform current flood management approaches and integrate NBS, it is crucial to gain a comprehensive understanding of the existing system. This involves analyzing the biophysical, social, economic, and institutional dimensions that shape flood risk management in each specific context. By examining the complex interactions between these factors, decision-makers can identify key leverage points and develop targeted interventions to facilitate the adoption of NBS.

The site-specific chapters (Chapters 5-9) delve into the system knowledge required for each RECONECT project site. The chapters explore the barriers and enablers for NBS implementation, considering factors such as institutional capacities, funding mechanisms, and stakeholder perceptions. By synthesizing this system knowledge, the chapters provide a foundation for designing context-specific interventions that can transform flood management approaches and enhance the uptake of NBS.

Question 2.

Scaling deep: How can participatory processes be designed to enable diverse stakeholders to shape the transformation towards and through NBS?

Participatory processes are essential for ensuring that the sustainability transformation towards and through NBS is inclusive, equitable, and responsive to the needs and priorities of diverse stakeholders. To effectively engage stakeholders in shaping this transformation, it is important to design participatory processes that create meaningful opportunities for dialogue, co-creation, and decision-making.

The site-specific chapters (Chapters 5-10) explore how participatory processes can be tailored to the unique local contexts of each RECONECT project site. This includes identifying the key stakeholder groups, assessing their interests, concerns and roles in NBS development and implementation processes, and developing strategies for their effective engagement. The chapters also highlight innovative participatory approaches, such as co-design workshops, citizen science initiatives, and community-based monitoring, that can empower stakeholders to actively contribute to the planning, implementation, and evaluation of NBS. Based on the insights from these co-creation activities, the chapters present findings on barriers to NBS implementation and potential enablers to overcome them. These insights provide valuable lessons on how participatory approaches can contribute to overcoming governance challenges and fostering broader acceptance and support for NBS in different local and national contexts.

Question 3.

Scaling Up: How can governance approaches be transformed to support the mainstreaming of NBS?

Transforming governance approaches is critical for creating an enabling environment that supports the mainstreaming of NBS. This requires moving beyond the status quo and embracing new modes of governance that are more inclusive, informed, adaptive, integrated, and accountable. Chapter 4 discusses the overarching EU-level policies and frameworks that shape the governance context for NBS. It explores how these policies can be leveraged to create incentives, remove barriers, and foster cross-sectoral collaboration for NBS implementation. The chapter also identifies gaps and opportunities for policy reform, highlighting the need for more flexible, adaptive, and integrated approaches to NBS governance. The site-specific chapters (Chapters 5-10) build on this EU-level analysis by examining the governance challenges and opportunities within each RECONECT project site. The chapters assess the current governance arrangements, including the roles and responsibilities of different actors, the decision-making processes, and the accountability mechanisms. They also explore how these arrangements can be transformed into better support for NBS, considering factors such as institutional capacity, cross-sectoral coordination, and public participation. More specific details are provided in the Annexes of this report.

3 Methodology

The methodology for identifying options for mainstreaming NBS in the RECONECT project sites was grounded in a co-creation approach through utilizing participatory methodology. This comprehensive and inclusive methodology was designed to address key questions outlined in Chapter 2, focusing on understanding the existing system, engaging stakeholders in shaping the transformation towards NBS and exploring ways to transform governance approaches. The process was carefully structured to ensure a thorough exploration of barriers and enablers for NBS implementation, while also fostering stakeholder engagement and ownership of the outcomes.

At the heart of this methodology were four main components: (1) desktop research with elements of semi-structured interviews, (2) site-specific workshops, (3) online surveys, and (3) national workshops with local stakeholders. Each of these elements played a crucial role in collecting different sources of information, gathering diverse perspectives, validating findings, and developing a comprehensive understanding of the challenges and opportunities for NBS implementation in different local contexts. In total, 415 stakeholders were involved in the production of this report.

Figure 2 Co-Creation activities conducted at the different sites

(1) First, desktop research with elements of semi-structured interviews to specify certain points/aspects was conducted by the local organizations at the NBS sites that were subcontracted for this task. The Subcontractors were trained and assisted by the UFZ on how to conduct it and what particular aspects to consider while exploring the site-specific official government documents, gray literature, media outlets, etc. as well as interviewing the related stakeholders. Its main purpose was to obtain the data for the analysis of the existing national, regional, and local policy framework for managing natural hazard-related risks, institutional actors and their legal competencies and capacities for managing natural hazards as well as perceptions on the use of NBS for managing natural hazard-related risks. It also helped to reveal several stimulating tools/instruments in the existing policy framework that can support NBS implementation and better understand the remaining gaps. An overview of relevant policies is provided in the Annex A, more details are provided in Annex B.

(2) The site-specific workshops with local stakeholders were conducted in two rounds for each project site. The first workshop focused on data collection, served as an initial platform for gathering insights on barriers and enablers for NBS implementation. This was followed by a second workshop aimed at validating and refining the findings from the first workshop. Both workshops brought together a diverse array of stakeholders, including representatives from public authorities and decision-makers, academia and research institutions, the private sector, and civil

society organizations. This multi-stakeholder approach ensured that the identification of barriers and potential solutions for NBS implementation was grounded in a variety of perspectives and experiences.

(3) To supplement the insights gained from the workshops, online surveys were conducted prior to the national workshops. These pre-workshop surveys were designed to evaluate potential enablers for key identified barriers. By providing both quantitative and qualitative data on the perceived effectiveness of various enablers, these surveys laid a solid foundation for more targeted and productive discussions in the subsequent national workshops.

(4) The national workshops represented the culmination of the co-creation process, bringing together a wide range of stakeholders at a country level. These workshops featured a variety of activities, including presentations on the RECONECT project and NBS concepts, stakeholder mapping exercises, and collaborative discussions on barriers and enablers for NBS implementation. These sessions provided a platform for synthesizing insights from the previous stages and developing a more comprehensive national perspective on NBS mainstreaming.

Throughout all stages of the co-creation process, careful attention was paid to addressing the key questions identified in Chapter 2. To understand the existing system, barrier analysis exercises were conducted during the workshops, and stakeholder mapping was used to identify key actors and their roles. The engagement of stakeholders in shaping the transformation was ensured through participatory processes throughout all co-creation activities and the inclusion of diverse stakeholder groups in workshops, interviews and surveys. Exploring ways to transform governance approaches was addressed through discussions on policy integration and cross-sectoral collaboration, as well as the identification of enablers related to legal and institutional frameworks.

The data collected through these co-creation activities was analyzed using a mixed-methods approach. This involved qualitative analysis of workshop discussions, interviews with stakeholders (conducted along with the desktop research) and open-ended survey responses, quantitative analysis of survey ratings for potential enablers, and a synthesis of findings to develop a comprehensive understanding of the barriers and enablers for NBS implementation in each context.

A key strength of this methodology was that it incorporated the validation and iteration steps. The second site-specific workshop allowed for refinement of initial findings, while the national workshops further validated and expanded upon these insights. This iterative process ensured that the final outcomes were robust and reflective of diverse stakeholder perspectives.

By employing this participatory and iterative methodology, the RECONECT project was able to conduct a deep exploration of the challenges and opportunities for mainstreaming NBS. The approach ensured that the findings were firmly grounded in local realities and stakeholder perspectives, providing a solid foundation for developing effective strategies for NBS implementation. This methodology not only generated valuable insights but also fostered stakeholder engagement and ownership, which are crucial for the long-term success and sustainability of NBS initiatives.

4 European and global policy landscape

4.1 NBS-related policies and policy instruments

This chapter provides the results of a literature review aiming to explore: (1) What policy instruments exist to support NBS implementation? (2) How are NBS and related concepts considered in the established global and EU policy framework? (3) What are the main drivers and obstacles to NBS realization within the existing policy framework? In doing so, the chapter analyses how global and European policy (e.g. UN, IUCN, EU, governments, and public institutions operating beyond the national and regional scales) supports NBS by strategically utilizing different policy instruments to overcome obstacles for NBS mainstreaming.

For this purpose, a body of scientific and gray literature was analysed, which includes 38 policy instruments (e.g. strategies, directives, programs, funding instruments, etc.) as well as 35 scientific papers on NBS-related policies. In particular, it encompasses webpages and publications that were publicly available at official government websites and official online repositories of the European Commission (EC), the International Union for Conservation of Nature and Natural Resources (IUCN), and the European Environment Agency (EEA). Additionally, the websites and reports of H2020 and Horizon Europe NBS-related projects were used (e.g. CONNECTING Nature, EKLIPSE, NATURVATION, Clearing House, Clever Cities, OpenNESS, etc.).

It is important to note that during this literature review, along with the NBS also other NBS-related terms and concepts (e.g. “green infrastructure/blue-green infrastructure”, “ecosystem-based management/approach”, “sustainable management”, “working with nature”, “nature-based innovation”) were considered.

The analysis revealed three NBS-related policy levels:

a) Global and European (macroscale)–e.g. EU directives, the strategies, agendas, and actions established by IUCN, UN Climate action, Paris Agreement, etc
b) National & regional (mesoscale)–e.g. national and regional adaptation plans and strategies
c) Local (microscale)–e.g. local governance arrangements

While this chapter provides a comprehensive analysis of NBS-related policy that promotes NBS at the global and European level/macroscale, a review of the national & regional, and local policy-related instruments will be provided in the next chapter.

Policy instruments are the tools through which policymakers realize their policy objectives (Mickwitz, 2003; Wurzel et al., 2013; van der Jagt et al., 2023). They include governance tools that have the potential to influence NBS adoption. That is why it is especially crucial to examine their role in NBS mainstreaming at higher levels of government as (supra)national regime-level structures, such as sectoral goals, exert significant influence over established practices at lower levels (Fuenfschilling and Binz, 2018; van der Jagt et al., 2023). Policy instruments include different directives, strategies, programs, and financing instruments but also a variety of so-called soft mechanisms (e.g. informational, organizational, capacity-building tools, etc.). Policy instruments associated with NBS explicitly acknowledge NBS-related concepts, but rarely contain quantitative and measurable targets relating to NBS deployment and quality (Davis et al., 2018).

Considering the existing typologies of policy instruments (e.g. by Borrás and Edquist, 2013; Lee et al., 2019; Mees et al., 2014; van der Jagt et al., 2023; Weber et al., 2014; Wurzel et al., 2023), three main types can be defined: ***regulatory, financial (or economic)*** and ***soft (or supportive)*** instruments. Recent studies also proposed an

additional type, such as a ***policy mix*** represented by a combination of traditional and new types of policy instruments (Edmondson et al., 2019; Kirsop-Taylor et al., 2022; Pedersen et al., 2020; Scordato et al., 2018; van der Jagt et al., 2023). A joint typology with the related examples is provided below (Table 3).

Legislative/regulatory instruments encompass a spectrum from authoritative directives/command-and-control regulations to negotiated agreements involving various groups of stakeholders at different levels of government, government agencies, politicians, lobby groups, and policy advisory organizations (Ryfisch et al., 2023; Wurzel et al., 2013). The primary goal of these instruments is the development of legislation, regulations, and policies, often aiming at avoiding or limiting specific behaviors (e.g. those that lead to biodiversity loss or can intensify climate change, etc.) (Dorst et al., 2021; Ravazzi Douvan, 2021; Xie et al., 2020). Among them are **formal regulatory** tools such as laws, regulations, prohibitions, environmental certification, and product declaration. **Informal legislative tools**, such as adaptation plans, strategies, etc. enable incorporation of climate science and vulnerability assessment of government and institutional services and ecosystem planning (Faivre et al., 2017; Mendonça et al., 2021; van der Jagt et al., 2023).

Economic/financial instruments provide financial services and offer specific economic incentives or deterrents that aim to encourage behaviour shifts, enhance a positive impact, and decrease negative externalities (Borrás and Edquist, 2013, Weber et al., 2014). Among the related stakeholders are banks, insurance companies, and institutional investors. The mechanisms contain: a) fiscal policies, investment, and financing policies (e.g. to mobilize SMEs in sustainability innovation projects), b) domestic private funding (e.g. to promote private investment, green credit, optimizing social financing mechanisms), and c) international cooperation funding (e.g. to support bilateral and multilateral cooperation) (Dorst et al., 2021; van der Jagt et al., 2023). They include carbon finance that involves the utilization of carbon credits to fund initiatives and facilitate the transition towards net zero (Bouzarovski and Haarstad, 2019; Calliari et al., 2022).

Soft (supportive) instruments involve informational and organizational tools designed to improve communication, training, and education processes (Borrás and Edquist, 2013; Wurzel et al., 2013). They aim at a) collecting and exchanging information (e.g. information systems & research tools such as data and knowledge base and platforms), b) generating knowledge and expertise for decision making (e.g. via policy briefs, expert guidance, technical reports, etc.), c) raising awareness and building capacities of different stakeholders to respond to societal challenges (e.g. through workshops, webinars, publications, etc.) and d) encouraging voluntary restructuring or reorganization of processes (e.g. via disseminating information, voluntary agreements within industries, or establishing non-hierarchical network opportunities with the government) (Mees et al., 2014; van der Jagt et al., 2023).

Mixes of policy instruments encompass the diverse combinations of tools that policymakers utilize to address complex intersectoral policy issues. While a wide range of policy instrument mixes is employed globally, the scientific literature and NBS-project-related publications (Costantini et al., 2017; Edmondson et al., 19; Kirsop-Taylor et al., 2021; Mees et al., 2014; Scordato et al., 2018; van der Jagt et al., 2023; Weber et al., 2014) mostly concentrate on the four prevalent types of instruments: knowledge-based instruments, market-based instruments, regulatory instruments, and policy mixes of participatory planning and knowledge/bottom-up oriented policy instrument mixes. The main characteristic features of these instruments are the empowerment of non-governmental actors and a higher prevalence of interactive governance models (e.g. through voluntary agreements and financial instruments that require a long-term, multi-actor, and multi-instrumental approach or polycentric governance for NBS) (Pedersen et al., 2020).

Table 3 Types of NBS-related policies and policy instruments

Types of NBS-related policy instruments	Main purpose	Examples of instruments	Existing instruments at the EU level
Legislative/ regulatory tools	*Policies, planning/building regulations, and legislation to avoid specific behaviours*		
Formal	To mainstream measures to tackle climate change and biodiversity loss, incl. specific behaviours' restrictions	Laws, regulations, prohibitions, environ-mental certification/ product declaration	Water Framework Directive; Strategic Environmental Assessment Directive; Habitats Directive, Biodiversity Strategy 2020 & 2030, The EU Taxonomy (incl. environmental criteria, either mandatory or voluntary)
Informal	To integrate climate and biodiversity-related issues and vulnerability assessment of government and institutional services and ecosystem planning	Plans, strategies, and other visioning and management documents	National Adaptation Plans (NAPs), Biodiversity plans, Ocean/coast/ land-use plans, Financing Sustainable Growth action plan, etc.
Economic instruments/fund ing	*To integrate positive impacts and negative externalities, to encourage behavior shifts (e.g. subsidies, charges, levies, taxes, tradable permits, and other payment systems)*		
New fiscal policies, investment, and financing policies	To influence business models and new markets to promote green technologies and to support neglected user groups	Fiscal incentives, establishing national funds, increasing public sector finance	Mobilizing SMEs in innovation action projects; The EU Taxonomy, Tradeable Development Rights; Public Procurement Laws, etc.
Domestic private funding	To encourage private investment, green credit; To optimize social financing mechanisms	Direct government investment, subsidies, supporting the trade of ecosystem products and/or services, grant schemes, favorable land purchase schemes, tax breaks	European Investment Bank's program "Investing in NBS", The Natural Capital Financing Facility (incl. soft loans to support innovation and sustainable entrepreneurship), etc.
International cooperation funding	To support bilateral and multilateral cooperation (e.g. via providing international funding)		Research & Innovation programs on NBS, Horizon Europe, LIFE+ programs, Biodiversa+, COST actions, Urban agenda for the EU, ENACT Partnership
Carbon market construction	To fund carbon action initiatives and facilitate the transition towards net zero	Carbon credits to fund initiatives & facilitate the transition towards net zero	The Foundation Future of the Carbon Market (to support innovative carbon market mechanisms and access emission reduction potentials), Clean development mechanism (CDM)
Soft instruments	*Informational and organizational tools to enhance communication, training & education processes (e.g. workshops, surveys, websites, articles, labels and certifications)*		
Information system & research	To support information collection, exchanges, and relevant research to deal with climate change and biodiversity loss	Disseminating information through databases (on NBS, climate, risk),	OPPLA, NetworkNature, Urban Nature Atlas, Nature-based enterprise platform, Climate-ADAPT, Climate Focus, Nature-based Solutions Task Forces, Urban

Types of NBS-related policy instruments	Main purpose	Examples of instruments	Existing instruments at the EU level
		knowledge-sharing platforms & networks	governance Atlas, EUI Portico Knowledge Platform
Knowledge and expertise	To generate (expert) knowledge used in decision-making; To support knowledge dissemination	R&D, technical reports, maps, etc.	Expert guidance & policy briefs; Pilot projects; Strengthening of researcher-practitioner interface, etc.
Tools related to organizational forms and actor networks	To facilitate voluntary restructuring or reorganization of processes; to develop sectors, networks & organisational forms that shape practices and contri-bute to innovation, building trust and mutual understanding	Voluntary agreements within industries, or establishing non-hierarchical network opportunities with government	Strengthening of researcher-practitioner interface; City Deals & Green Deals
Capacity building	To raise the awareness of communities, civil groups, and institutions to respond to climate change and biodiversity loss; To strengthen the related capacity-building	Workshops, webinars, journals and journals special issues, articles, etc.	Workshops and webinars by IUCN, EC, ICLEI, UNDP (Learning for nature), IWA WG NBS; Biodiversa+, CONNECTING Nature, CleverCities, NetZeroClimate, Journals: Nature-based solutions, Frontiers in Sustainability, Nature Climate Change, Ambio, Sustainability, LAND, etc.
Mix policy	To delegate some steering powers to non-governmental actors; to promote interactive modes of governance	Combinations of traditional and new policy tools, e.g. voluntary agreements & financial instruments, that require a long-term, multi-actor, and multi-instrumental approach	

Sources: authors, based on Borrás and Edquist, 2013; Bouzarovski and Haarstad, 2019; Calliari et al., 2022; Davis et al., 2018; Dorst et al., 2021; Edmondson et al., 19; Faivre et al., 2017; Kirsop-Taylor et al., 2021; Mees et al., 2014; Mendonça et al., 2021; O'Sullivan et al., 2020; Ravazzi Douvan, 2021; Ryfisch et al., 2023; Pederson et al., 2020; Scordato et al., 2018; Weber et al., 2014; Wurzel et al., 2013; van der Jagt et al., 2023; Xie et al., 2020

4.2 NBS in the current global and European policy level

NBS were initially advocated for by high-level stakeholders – the IUCN which introduced the concept in the 2000s and the EU which has adopted and reinforced it (e.g. EC DG Research and Innovation). However, there are other prominent players at the global level such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the United Nations Environment Program (UNEP), the UN Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change (IPCC), UN Climate Action, and World Wildlife Fund (WWF).

EU as promoter of NBS

EU has established itself as a promoter, frontrunner, and a global leader in NBS (EC, 2016, 2019; Hanson et al., 2020, O'Sullivan et al., 2020) providing support for their implementation through various policy instruments (Figure 3). The European Commission defines NBS as actions "inspired by, supported by, or copied from nature; both using and enhancing existing solutions to challenges, as well as exploring more novel solutions" to

"help societies address a variety of environmental, social and economic challenges in sustainable ways" (European Commission 2015:24). NBS provide the opportunity to generate ecosystem services and other benefits from nature that can be combined with conventional planning and development structures, turning environmental, social, and economic challenges into innovation opportunities (European Commission 2015, Cohen-Shacham et al. 2016, Scott et al. 2016). They offer a chance for transformative change because they contribute to "profound and fundamental alterations in social-ecological interactions in a way that sustains the Earth's biophysical systems while meeting human needs" (Palomo et al. 2021:731).

A variety of EU policies currently promote NBS. Among them are several *EU regulations that strengthen NBS* linked to existing and potential Natura 2000 sites, Biodiversity Strategy to 2020 (2013), but also to ecosystems protected through the EU's Birds and Habitats Directives (1992), Water Framework Directive (2000), Common Agricultural Policy (2013), Marine Strategy Framework Directive (2008), etc. In particular, NBS-related concepts such as "green/blue-green infrastructure" and "working with nature" are explicitly mentioned in the EU Biodiversity Strategies 2020 and 2030 (2011, 2020), and Green Infrastructure Strategy (2013), but also in the EU Forestry Strategy (2013), Adaptation Strategy (2013), and Urban Agenda (2016). "Sustainable management" is another NBS-related term that appeared in the Water Framework Directive (2000). Noteworthy, the Europe 2020 Strategy, adopted in 2010, does not incorporate any NBS-related term despite the prevalence of related concepts at that time. Other key legislative instruments include the European Environmental Impact Assessment Directive (1985), the Strategic Environmental Assessment Directive (2001), and the Protocol on Strategic Environmental Assessments (2008). They assess how projects or plans (often related to economic development) may negatively impact the environment. While these policies typically favour environment-friendly solutions, they don't always prioritize NBS. For instance, they require developers to describe reasonable alternatives to their plans and indicate why a particular option/solution has been chosen, considering its environmental effects. This requirement opens the door for NBS to compete with traditional gray infrastructure. Moreover, according to these instruments, developers (contractors and planners) must consider environmentally friendly alternatives, potentially leading to win-win solutions that meet development needs while benefiting nature and ecosystems. However, it remains unclear how often NBS are chosen over traditional gray solutions.

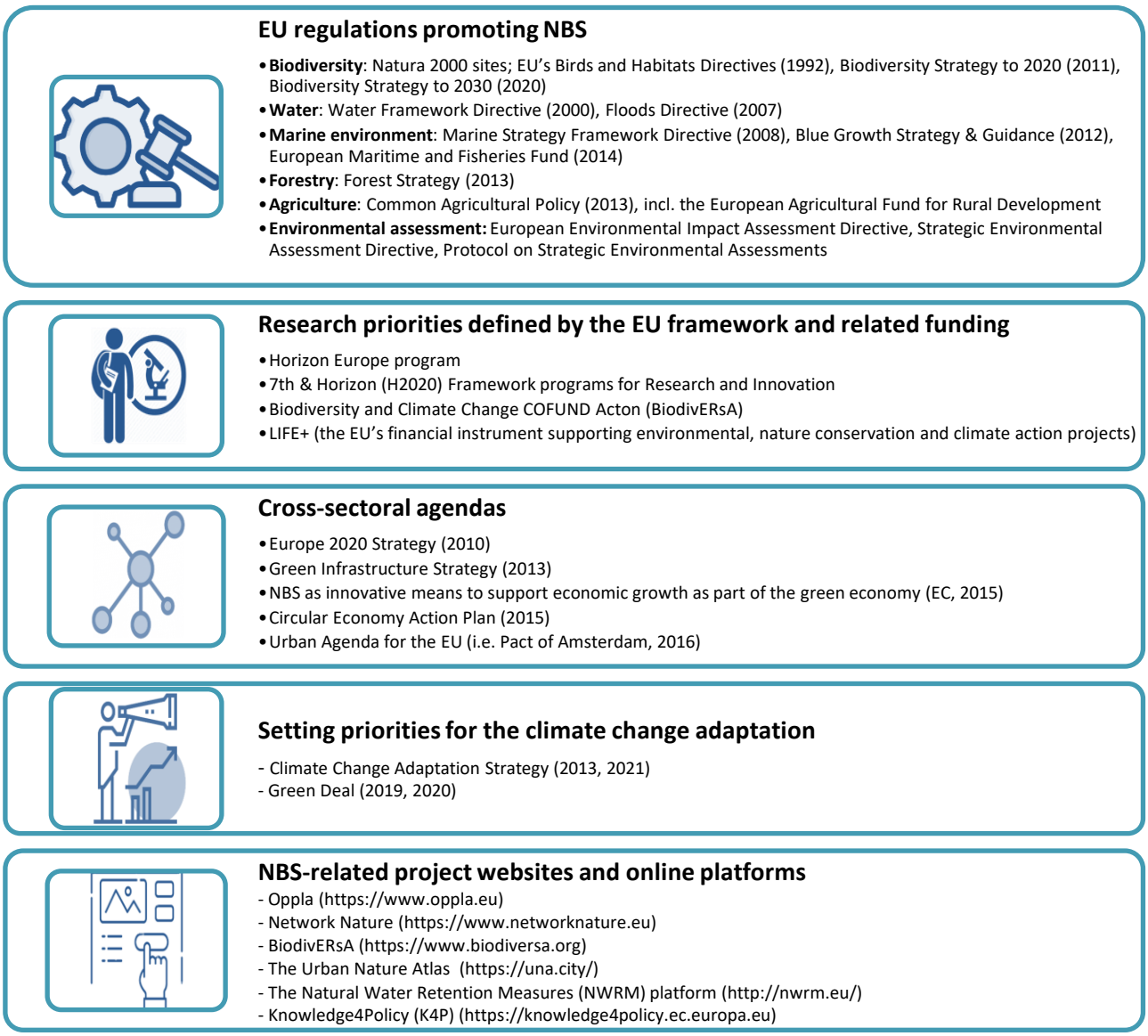

Figure 3 Policy instruments to support NBS at the EU level

Source: the authors

According to the results of the EU policy review conducted by NATURVATION (Davis et al., 2018), support for NBS was identified in the following EU policies:

1) EU Biodiversity Strategy 2020 (strong explicit support)
2) EU Biodiversity Strategy 2030 (strong explicit support)
3) Green Infrastructure Strategy (strong explicit support)
4) Marine Strategy Framework Directive (strong explicit support)
5) Forestry Strategy (strong explicit support)
6) Adaptation Strategy (strong explicit support)
7) Blue Growth Strategy (implicit support)
8) EU Urban Agenda (implicit support)
9) Europe 2020 Strategy (low/minimal support)
10) EU Circular Economy Action Plan (low/minimal support).

Strong explicit support entails that NBS or related terms are mentioned and integrated into the framework, encompassing objectives, policy measure design, and support actions. *Strong implicit support* involves a robust framing of nature as a solution for addressing specific societal challenges, with numerous references to or support for elements of NBS or types of NBS interventions, without explicit mention of NBS or related terms. *Low/minimal support* indicates that NBS are not prominently featured or reflected in policy measure design and support actions, and they are not considered relevant to the policy framework (Davis et al., 2018).

Another important instrument refers to *research priorities defined by the EU framework* (e.g., H2020, Horizon Europe) to targeted actions for further development of a knowledge base on NBS. It has shaped the NBS concept established in 2012 and provided *conditionalities for funding/financing of related research* (Davies et al., 2021, Mendes et al., 2020; Ramírez-Agudelo et al., 2020, Ryfisch et al. 2023; Sarabi et al., 2020). *NBS-related funding and economic policy instruments for NBS* as well as their effectiveness present a significant challenge, indicating a need for more efficient methods of financing NBS (Kauark-Fontes et al., 2023; Mendonça et al., 2021). In particular, the utilization of established sustainability policy instruments, like eco-taxes, for implementing NBS is still deficient (van der Jagt et al., 2023). Moreover, several studies (Hawxwell et al., 2019; Kauark-Fontes et al., 2023) mentioned that economic instruments can either hinder or facilitate NBS adoption, depending on their formulation, underscoring the importance of aligning the NBS agenda with the particular departments handling economic matters.

The integration of NBS across sectors (*cross-sectoral agendas instruments)* is crucial for translating concepts into actionable implementation (Ramírez-Agudelo et al., 2020, Sarabi et al., 2020). For instance, policy instruments could involve jointly developing biodiversity and climate plans at regional or national levels. However, it's essential to consider trade-offs, like those between biodiversity conservation and urban development goals. This may involve balancing NBS promotion with opportunities for new development, housing, or parking (e.g., Green Infrastructure Strategy).

EU sets political cornerstones for *climate change adaptation* through Strategy on adaptation to climate change (2013, 2021) and Green Deal (EC, 2019, 2020) which have references to NBS. In particular, the Climate Adaptation Strategy 2013 prioritizes coherent, flexible, and participatory approaches and emphasizes among its aims a) the ensuring more resilient infrastructure… "through the full mobilization of ecosystem-based approaches to adaptation" incl. green infrastructure, and b) "promoting better-informed decision-making by addressing gaps in knowledge about adaptation and further developing the European Climate Adaptation Platform (Climate-ADAPT)" as one of the first data and knowledge base on NBS (ibid). Recently, the EC approved its new EU strategy on adaptation to climate change on 24 February 2021 (see EC, 2023). It outlines how the EU can adapt to the unavoidable impacts of climate change and become climate resilient by 2050. This strategy emphasizes three climate adaptation topics "calling on testing and demonstrating transformative solutions on a) increasing climate resilience of the agriculture and/or forestry sector, b) protecting critical infrastructure from climate change, mainstreaming NBS, and c) building resilience towards health risks caused by the effect of climate change" (EC, 2023).

NBS play a pivotal role in the European Green Deal (2019, 2020), especially, through updating and promoting the policies related to biodiversity and climate change. The European Green Deal comprises a series of policy measures designed to steer the EU toward a green transition, striving for climate neutrality by 2050. It aims to transform the EU into a just and prosperous society, coupled with a modern and competitive economy. Emphasizing a comprehensive and cross-sectoral approach, it calls for collaboration across various policy domains to collectively advance climate-related objectives. The initiative encompasses areas such as climate action, environmental protection, energy,

transportation, industry, agriculture, and sustainable finance. The European Green Deal presents a timely framework for research, policy formulation, and decisive action to not only support NBS implementation but also to fast-track their financing on a broad scale.

NBS-related project websites and online platforms. Many platforms and websites provide background information on NBS. Among them are:

a) *OPPLA platform* shares practical knowledge on natural capital, ecosystem services, and NBS presenting a variety of NBS cases, products, and tools;
b) *Urban Nature Atlas* established by the H2020 NATURVATION project provides valuable resources on NBS for climate, containing nearly 1,000 examples of NBS and their benefits from different European cities.
c) *Network Nature* resource library and case study finder facilitate systemic knowledge transfer on NBS for climate mitigation and adaptation.
d) *Natural Water Retention Measures (NWRM) platform* compiles information on Green Infrastructure (GI) applied to the water sector, featuring a substantial catalogue of actions and case studies.
e) *BiodivERsA database* provides information on biodiversity research and associated ecosystem services in Europe, covering projects, programs, and funding. It features ongoing projects resulting from a specific call on biodiversity and climate change, with NBS/Ecosystem-based adaptation being one of the focal topics.
f) *Knowledge4Policy (K4P)* serves as the EU Commission's platform for evidence-based policymaking. It includes a handbook on the impact of NBS for practitioners, as well as a State of Finance for Nature.

To sum up, the EU has established a variety of policies that promote NBS, first of all through *key regulations that are binding* (mandatory), e.g. the Biodiversity Strategies 2020 & 2030, the EU Birds and Habitats Directives, the Marine Strategy Framework Directive, the Water Framework Directive, Forestry Strategy, Green Infrastructure Strategy, and the Adaptation Strategy. In all these strategies/directives, NBS or related terms (such as "ecosystem-based adaptation", "green/blue-green infrastructure" and "working with nature") are emphasized and integrated into the framework, encompassing objectives, policy measure design, and support actions. Additionally, there are several instruments such as Environmental Impact Assessment Directive and the Strategic Environmental Assessment Directive (providing both mandatory and advisory requirements) which also support NBS by requiring developers to consider environmentally friendly alternatives. However, it remains unclear how often NBS are chosen over traditional gray infrastructure solutions.

Another instrument refers to the *research priorities and conditionalities for funding* of related research provided by the EU (e.g. H2020 and Horizon Europe) that prioritize NBS and set conditions for funding. However, effective financing of NBS remains a challenge, indicating a need for more efficient methods, such as eco-taxes. *Economic instruments* can facilitate NBS adoption by a) providing fiscal incentives, establishing national funds, increasing public sector finance, and b) stimulating the implementation of green technologies (through NBS) via direct government investment, subsidies, grant schemes, tax breaks, etc. In this regard, it is important to align NBS with economic policies. Cross-sectoral and cross-national integration, especially through the Green Deal and Climate Adaptation Strategy, is crucial for implementing NBS and requires joint biodiversity and climate plans at regional and national levels. Moreover, many *soft/supportive instruments* such as data and knowledge bases and platforms on NBS (e.g. OPPLA, Urban Nature Atlas, Network Nature, BiodivERsA, K4P), NBS-related policy briefs, networks, webinars, etc. contribute to capacity building by providing practical knowledge and resources, supporting evidence-based policymaking and research, enhancing communication, training and education processes for NBS development and realization.

4.3 Global context: other NBS promoters

Besides the EU, NBS have gained significant attention in recent years globally. A number of international efforts have promoted their use, in particular the strategies, agendas, and actions established by technical organizations (e.g. IUCN, OECD), scientific bodies (e.g. IPBES, IPCC), business and financial organizations (e.g. World Bank, World Economic Forum – WEF), international governmental (UN and its units such as UNEP, UN CBD, UNFCCC, UN Climate Action) and non-governmental (ICLEI, WWF) organizations. Table 4 provides an overview of these NBS promoters at the global level and explains how they enrich the variety of EU instruments and tools.

In particular, **IUCN**–**the International Union for Conservation of Nature–**introduced the NBS concept two decades ago and provided the first global definition of NBS (2016). IUCN sets some formal regulations (e.g. The IUCN Red List of Threatened Species) as well as plans and strategies (IUCN Global Standard for NBS that features 28 indicators across eight criteria to guide their implementation and evaluation, also highlighting the importance of integrating NBS into policy frameworks and achieving national and global sustainability goals). There are several plans and strategies developed by the IUCN Commission on Ecosystem Management (CEM) and its NBS Thematic Group as well as the Nature 2030 IUCN Program. IUCN in its "Call to Action for an Equitable, Carbon Neutral, Nature Positive World" (2020) emphasizes the pressing necessity for a shift towards a nature-positive economy and increased investment in NBS. IUCN as a Project Agency for the Global Environment Facility (GEF) and as a part of the Green Climate Fund provides various international cooperation funding (e.g. IUCN grants supporting conservation actions (also through NBS), IUCN Business, and Biodiversity). It also contributes to the development of information systems and research (via the IUCN Open Project Portal) and knowledge and expertise (via IUCN policy briefs and position papers). It supports governments and other actors in mainstreaming NBS in national policies and strategic plans, helps communities and NGOs (e.g. through IUCN NBS Management Hub) as well as contributes to capacity building (e.g. through workshops and webinars by IUCN on NBS, IUCN Academy).

UN/United Nations and its units/programs such as UNEP, UNFCCC, CBD, UN Climate Action, etc. provide several instruments promoting NBS. Specifically, UNEP urges member states to adopt a country-driven and participatory NBS approach (e.g. through UNEP/EA.5/Resolution 5 adopted by the UN Environment Assembly 2022). Since NBS can complement the ecosystem-based approach, CBD perceives NBS as a concept and practical tool that can positively drive biodiversity action and increase the chances of achieving the CBD's objectives (UN Convention on Biological Diversity and National Targets, UN UNEP CBD). A series of regulations (e.g. UN Paris Agreement and carbon neutrality) and strategies and actions (e.g. UN Climate Action, IPCC Guidelines for National Greenhouse Gas Inventories, UN FCCC nationally determined contributions) highlight NBS as one of the key tracks in climate adaptation and mitigation. Among the financial instruments provided by the UN are Climate Investment Funds (CIF), UN public domestic spending, nature-focused Official Development Assistance (ODA), UN CBD joint grants, Multilateral development banks (MDBs) as well as Climate Investment Funds. A variety of soft mechanisms established by the UN involves the UN CBD portal on national biodiversity strategies, thematic programs, cross-cutting issues, and tools for stakeholder involvement, the UNDP toolkit for mainstreaming NBS into Nationally Determined Contributions, the UNDP Guidebook for the Design and Establishment of National Funds to Achieve Climate Change Priorities, UN CBD thematic databases. Especially in IPCC assessment reports (2021, 2022) NBS are ranked among the top five most effective strategies. Several instruments contribute to developing the actor networks on NBS such as the UN Global Compact (Coalition for NBS to Address Climate Change), the UN CBD platform, UN Climate action "NBS for Climate Manifesto" (a coalition for NBS supported by 70 governments, NGOs, academia, private sector).

IPBES/Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, specifically in its resolutions, decisions, and summaries for policymakers, emphasized NBS as a cost-effective measure to assist in achieving the SDGs which are crucial for global sustainability (IPBES 2019). Promoting NBS is underlined as one of the key actions and pathways to achieve transformative change (IPBES, 2019, p.46) since they address critical needs while conserving nature, restoring biodiversity, and maintaining and enhancing ecosystem services. IPBES network and webinars contribute to knowledge transfer and capacity-building in regard to NBS realization.

ICLEI–Local Governments for Sustainability as an international non-governmental organization also promotes sustainable development through NBS by providing technical consulting to local governments to identify and meet sustainability objectives. It also contributes to the development of knowledge and expertise (e.g. through ICLEI position papers and statements), building capacity (e.g. via ICLEI UrbanByNature capacity-building program, workshops, and webinars by ICLEI), and providing funding opportunities (e.g. through ICLEI Action Fund).

WWF–World Wildlife Fund created a Nature-Based Solutions Origination Platform (NBS-OP) as a pioneering initiative to catalyze large-scale impact for communities, climate, and ecosystems within targeted tropical forest regions/Global South. By endorsing a range of conservation strategies like preservation, enhanced stewardship, and rehabilitation, the NBS-OP seeks to produce measurable outcomes in key landscapes through a combination of blended financing mechanisms. Its overarching objective is to stimulate the global demand for transparent and high-quality NBS and to provide an overview of national and regional policies for scaling NBS (e.g. WWF report on conditions enabling NBS).

Moreover, 2022 is marked globally as a crucial turning point year for the integration of NBS into major intergovernmental agreements. In particular, in 2022, the 5th UN Environment Assembly approved 14 resolutions aimed at bolstering actions for nature to achieve the Sustainable Development Goals and provided an official definition of NBS (UNEP/EA.5/Res.5). At the same time, UNFCCC COP27, NBS were highlighted for their potential in combating climate change. IUCN also introduced the ENACT initiative/ENACT Partnership for NBS which provides international cooperation funding. The Kunming-Montreal Global Biodiversity Framework, particularly in targets 8, 11, and 12, adopted during the 15th meeting of the Convention on Biological Diversity Conference of the Parties (CBD COP15) emphasized NBS and outlined a path to achieve global harmony with nature by 2050. Additionally, NBS were incorporated into resolution XIV.17 of the Ramsar Convention on Wetlands COP14. Both the IPBES and the IPCC recognized the importance of NBS in tackling the dual crises of biodiversity loss and climate change.

To promote NBS, several global platforms on NBS were established:

a) The NBS Evidence Platform and the NBS Policy Platform are established by The NBS Initiative to provide resources on the science, policy, and practice of NBS. It offers two associated global platforms.
b) The UN Framework Convention on Climate Change (UNFCCC) hosts a database on ecosystem-based approaches to Adaptation within the Adaptation Knowledge Portal.
c) The EbA Solution Portal encourages the sharing of case studies and examples of Ecosystem-based Adaptation from various regions and ecosystems worldwide.

Table 4 The role of different policy actors and their relevance to promoting NBS at the European and global levels

Types of NBS-related policy instruments	EU	IUCN	UN	Others
Legislative and planning instruments				
Formal (laws, regulations)	- Natura 2000 sites - EU's Birds and Habitats Directives - Water Framework Directive - Floods Directive - Marine Strategy Framework Directive - Agriculture: Common Agricultural Policy - Forest Strategy - Biodiversity Strategy 2020, 2030 - Green Infrastructure Strategy	The IUCN Red List of Threatened Species	- UNEP (2022) UNEP/EA.5/ Resolution 5 adopted by the UN Environment Assembly 2022 (urges member states to adopt a country-driven & participatory NBS approach) - UN Paris Agreement and carbon neutrality - UN Convention on Biological Diversity and national targets	
Informal (plans, strategies)	- Blue Growth Strategy & Guidance - Europe 2020 Strategy - Circular Economy Action Plan - Urban Agenda for the EU (i.e. Pact of Amsterdam) - National Adaptation Plans (NAPs) - Biodiversity plans - Ocean/coast/ land-use plans - Financing Sustainable Growth action plan, etc.	- IUCN Global Standard for NBS; - IUCN Commission on Ecosystem Management (CEM) and its NBS Thematic Group. - the Nature 2030 IUCN Programme	- UN Climate Action (NBS as one of the key tracks in climate adaptation & mitigation) - UN UNEP CBD (n/a) The biodiversity plan for life. Global Targets for 2030 of the Kunming-Montreal Global Biodiversity Framework SDGs 2030 - IPCC Guidelines for National Greenhouse Gas Inventories - UN FCCC nationally determined contributions, long-term low greenhouse gas emission development strategies, spatial planning, national development plans	- IPBES resolutions and decisions - WWF conservation strategies (e.g. preservation, enhanced stewardship, and rehabilitation)
Economic /financing instruments				
Fiscal policies, investment, and financing policies	- The EU Taxonomy - Tradeable Development Rights - Public Procurement Laws - European Maritime and Fisheries Fund - European Agricultural Fund for Rural Development - EU Land-use Finance Toolbox	-	Climate Investment Funds Knowledge Center (CIF)	-
Domestic private funding	- European Investment Bank's program "Investing in NBS" - The Natural Capital Financing Facility (incl. soft loans to support innovation and sustainable entrepreneurship)	-	UN public domestic spending, nature-focused Official Development Assistance (ODA)	-
International cooperation funding	- Research & Innovation programs on NBS (H2020, Horizon Europe) - 7th & Horizon (H2020) Framework programs for Research and Innovation	- IUCN grants supporting conservation actions (also through NBS) - IUCN as a Project Agency	- UN CBD joint grants (Websites on related organizations to get funding on biodiversity and nature conservation for business)	- WWF financing mechanisms to support NBS

Types of NBS-related policy instruments	EU	IUCN	UN	Others
	- Biodiversity and Climate Change COFUND Acton (BiodivERsA+) - European Regional Development Fund (ERDF) - European Social Fund Plus (ESF+) - Cohesion Fund - LIFE+ programs - COST actions, - Urban agenda for the EU, - ENACT Partnership	for the Global Environment Facility (GEF) - IUCN as a part of the Green Climate Fund - IUCN Business and Biodiversity	- Multilateral development banks (MDBs)	- Global Environment Facility (GEF) - Global Climate Partnership Fund (GCPF) - Water Funds - ICLEI Action Fund
Carbon market construction	- The Foundation Future of the Carbon Market - Clean development mechanism (CDM)		- Climate Investment Funds	
	Soft/Supportive instruments			
Information system and research	- OPPLA, NetworkNature, Urban Nature Atlas, Nature-based enterprise platform, Climate-ADAPT, Climate Focus, Nature-based Solutions Task Forces, Urban governance Atlas, EUI Portico Knowledge Platform	IUCN Open Project Portal	- UN CBD portal on national biodiversity strategies, thematic programs, cross-cutting issues, and tools for stakeholder involvement - UNDP toolkit for mainstreaming NBS into Nationally Determined Contributions - UNDP Guidebook for the Design and Establishment of National Funds to Achieve Climate Change Priorities (Blending Climate Finance Through National Climate Funds) - UN CBD thematic databases (Ecosystem approach Sourcebook, Database on scientific assessments, Database on incentive measures)	WWF NBS Origination Platform (NBS OP)
Knowledge and expertise	- Expert guidance & policy briefs; Pilot projects; Strengthening of researcher-practitioner interface, etc. - EEA reports on NBS: Policy, Knowledge and Practice for Climate Change Adaptation and Disaster Risk Reduction	- First global definition of NBS (2016) - Introduction of the NBS concept and NBS core principles - UCN policy briefs and position papers	- UN National reports on CBD targets - IPCC assessment reports (e.g. 2021, 2022 rank NBS among the top five most effective strategies)	- IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ES - IPCC Climate Change 2021 & 2022 reports - ICLEI position papers and statements
Tools related to organizational Forms and actor networks	City Deals Green Deals	- IUCN NBS Management Hub (supports governments in mainstreaming NBS in national policies and strategic plans, helps	- UN Global Compact - Coalition for NBS to Address Climate Change - UN CBD platform - UN Climate action “NBS for Climate Manifesto” (a coalition for NBS supported by 70	IPBES network

Types of NBS-related policy instruments	EU	IUCN	UN	Others
		communities and NGOs)	governments, NGOs, academia, private sector)	
Capacity building tools	Workshops and webinars by EC, Biodiversa+, CONNECTING Nature, CleverCities, NetZeroClimate, etc.	- Workshops and webinars by IUCN on NBS - IUCN Academy	Workshops and webinars by UNDP (Learning for Nature)	Workshops and webinars by ICLEI, IPBES Capacity-building webinars, e-learning, ICLEI UrbanByNature capacity-building program

Source: the authors

4.4 Summary: Promotion of and obstacles to the NBS realization within the existing policy framework

The analysis of policies and policy instruments at the global and EU level has revealed that they actively promote and encourage the use of NBS. The EU advocates for transitioning from traditional grey infrastructure to green solutions (NBS) and aims to integrate both types of solutions into planning processes to maximize the benefits and co-benefits of NBS (Faivre et al., 2018; Mendonça et al., 2021; Pontee et al., 2016). In particular, this can be summarized in the following statements:

NBS is a response to the current societal challenges, especially in addressing climate change and biodiversity loss as well as for achieving SDGs. Several EU, UN, IUCN Laws, Strategies, Directives, and Action plans indicate that NBS appear as innovative solutions to a variety of challenges faced by the regions worldwide. Moreover, regardless of the purpose (be it NBS for biodiversity support or climate change mitigation/adaptation), NBS are emphasized for their ability to provide multiple co-benefits in addition to their main objective. This is the reason why the international organizations mentioned above promote NBS in comparison to conventional gray solutions that are presented by single-objective practices.

A spectrum of NBS policy instruments is quite broad including legislative/regulatory, economic/financing, and soft instruments aiming to avoid specific behaviors, encourage behavior shifts, and enhance communication, training, and education processes in the field of climate change adaptation and mitigation and biodiversity loss.

Diverse funding sources and innovative financial mechanisms are represented by new financing policies (e.g. fiscal incentives, deterrents, establishing national funds, increasing public sector finance), domestic private funding (subsidies, government investments, tax breaks, etc.), international cooperation funding (e.g. through research and innovation programs on NBS such as H2020, Horizon Europe, etc.), carbon market construction to fund climate actions initiatives and facilitate green transition.

A well-developed system of information and research-related tools support knowledge generation and exchange on NBS and their impact (various open-access EU and global platforms provide background information on NBS and their application; a set of policy briefs, expert guidelines, technical reports, and handbooks for practitioners supports knowledge dissemination on NBS).

Capacity building via policy advice, virtual and physical training, workshops, and publications is a key for NBS mainstreaming. It allows that NBS-related ideas, attitudes, activities, and practices are shared and recognized as normal by all stakeholder groups.

Other soft tools facilitate voluntary restructuring and reorganization of processes to support the research-policy-practice interface. Since a wide range of actors, networks, institutions, and intermediaries, often spanning multiple disciplines, sectors, and policy areas, have to collaborate on the design, development, and implementation of NBS, it is important to develop cross-sectoral and multifactor collaboration with the use of such tools as voluntary agreements within industries, non-hierarchical networks with the government.

However, in the analyzed EU and international policies, NBS instruments are primarily statements that do not always require actions (are binding) or instruments that only encourage voluntary actions. These statements often provide information on NBS benefits or urge Member States to adopt NBS or related practices. Mandatory instruments are less common and are mainly found in directives such as the Habitats Directive (mandates the creation and maintenance of Natura 2000 sites), and the Water Framework Directive (WFD), which vary in their level of enforcement, particularly concerning flood risk management plans and natural retention areas. The EU Biodiversity Strategy also mentions mandatory instruments but focuses on establishing strategic frameworks for ecosystem restoration. Across policy fields, instruments primarily encourage voluntary actions, especially in forestry, agriculture, regional policy, adaptation, and cohesion and growth. Biodiversity-related instruments predominantly promote voluntary actions (except IUCN Red List, Natura 2000, EU's Birds and Habitats Directives, and Biodiversity strategy), while environmental assessment instruments are entirely mandatory due to requirements for developers to review 'reasonable alternatives' during environmental impact assessments. **The most common obstacles are provided below**:

- **Very few EU regulations are binding/mandatory:** this lack of regulatory authority may impede the effective integration of NBS, particularly when ecosystems fall outside the scope of existing policies (Ryfisch et al., 2023);
- **Many EU-level NBS policies rely on soft measures:** which means that they are not mandatory for implementation at the local level and remain entirely voluntary (Scolobig et al., 2020);
- **In several cases, EU has prioritized generating 'green growth' through NBS over biodiversity and societal co-benefits,** e.g. by focusing on building a strong response to climate change through carbon emission strategies (Davies et al., 2021; Maes and Jacobs, 2017; Mendes et al., 2020; Nesshöver et al., 2017; Pauleit et al., 2017; Welden et al., 2021), therefore, **a complex green transformation in such situation cannot be realized** in full (Melanidis and Hagerman, 2022)
- **Implementation of NBS depends on the ambition, capacities, and capabilities of lower-level authorities** (Ryfisch et al 2023), e.g. municipalities frequently allocate funds from their budgets for NBS projects, and regional and local policies play a pivotal role in driving the adoption of NBS initiatives, however, their ability to fully intervene may be hindered due to limited funds or other prioritized national agendas. The EU's Horizon Europe research policy will likely influence which ecosystems will be used and financed as NBS, while the exact ambition and selection of NBS rests with lower-level authorities or individuals.
- **Limited education and communication are already known as crucial barriers to the scale-up of NBS** (Pauleit et al. 2017, Davies and Lafortezza 2019,

Sarabi et al. 2019). Although there is a number of communication platforms and networks on NBS, the NIMBY phenomenon often appears to be a barrier to NBS integration and planning, despite commonly occurring in large infrastructure projects (Mendes and Oliveira 2019, Dorst et al. 2022, Vojvodíková et al. 2022). This emphasizes the role of increasing institutional feasibility and raising public awareness and acceptance of NBS.

To sum up, there is not yet a legal initiative or policy coordination on an EU level requiring Member States to invest in NBS. Considering that NBS is still a relatively new term/concept, there is currently only fragmented and uncoordinated legislative and financial support for NBS scattered throughout various policy documents and sectors. However, when NBS initiatives operate within hybrid governance models involving both public and private entities (so-called policy mixes), there may be a tendency to prioritize economic revitalization and attracting investment over enhancing ecological and social benefits. Common contradictions arise concerning transparency, accountability, justice, and democracy, particularly regarding the distribution of costs and benefits over time. This fragmentation underscores the need for cohesive and coordinated efforts to promote the widespread adoption of NBS within the EU policy framework.

In the following chapters, we focus on the mainstreaming options for the different Collaborator sites.

5 Bregana River Basin, Croatia: Options for Mainstreaming NBS

5.1 Introduction to the site

The River Bregana serves as a boundary between the Republic of Croatia and the Republic of Slovenia, stretching 26 km in length with a catchment area of 92 sq. km, mostly located in Croatia.

The climate is moderately warm and rainy with a mean monthly temperature of the coldest month higher than -3°C and lower than 18°C. Topography is represented by the upper course mountainous as well as the middle and lower flood plain. The highest relief point of the basin is at an altitude of 859 m a.sl, while the lowest is at 130 m a.sl. Soils have a low degree of infiltration, dominated by Rendzina on dolomite and limestone. The basin is mostly covered by forest and agricultural land.

Fluvial floods and flash floods along with the erosion processes represent the main hydrometeorological hazards. The flood events have resulted in the flooding of houses, posing threats to reinforced embankments and causing material removal. The flooding has led to the destruction of concrete cascades, bridges, and culverts, and damage to asphalt and macadam roads, while sediment deposition has impeded the flow of the mainstream in certain sections. The root cause of these damaging events largely stems from the incomplete regulation of the watercourse, rendering it incapable of accommodating even 10-year floodwaters along most of its course. Additionally, the presence of obstructed profiles in certain segments exacerbates flooding issues within the narrow valley.

Proposed large-scale NBS measures within RECONECT include retention ponds, detention basins, upper watershed restoration, natural bank stabilization, deepening water bodies, removal of obstacles from river channels, and afforestation.

5.2 Co-creation activities

The analysis of barriers and enablers for NBS implementation in the Bregana River Basin, Croatia, is grounded in a series of participatory co-creation activities. These activities were designed to engage a diverse range of stakeholders, ensuring that the insights gathered represent a comprehensive view of the local context. Figure 4 illustrates the timeline and components of these co-creation activities.

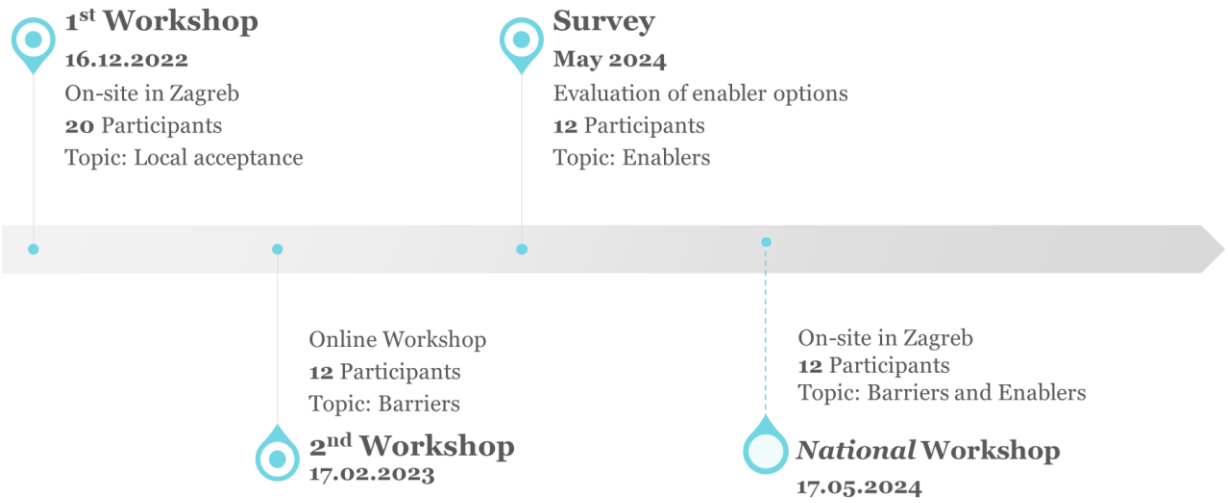

Figure 4 Co-creation activities in Croatia/Bregana River Basin

The co-creation process consisted of three main components:

1. Workshops for Bregana River Basin

- First workshop (Data Collection): December 16, 2022, in Zagreb (20 participants)
- Second workshop (Validation): February 17, 2023, online (12 participants)

These workshops brought together representatives from various sectors, including public authorities, political entities, academia, and the private sector. The diverse participation ensured a multi-faceted approach to identifying barriers and potential solutions for NBS implementation.

2. Pre-workshop survey

- Online, May 2024 (12 participants)
- Focus: Evaluation of potential enablers for key identified barriers

This survey provided quantitative and qualitative data on the perceived relevance of various enablers, laying the groundwork for more targeted discussions during the subsequent national workshop.

3. National Workshop

- May 17, 2024, in Zagreb (12 participants)
- Sectors represented: Authority, Private sector

A key activity during this workshop was to identify key stakeholders, including potential agents of change and sources/agents of resistance to NBS implementation in Croatia. Participants engaged in collaborative discussions to identify key stakeholders and their roles in overcoming the previously identified barriers to NBS adoption.

The insights, data, and stakeholder perspectives gathered through these co-creation activities form the foundation analysis presented in this chapter. By grounding our findings in these participatory processes, we ensure that the barriers identified and the enablers proposed are deeply rooted in local realities and reflect the collective knowledge of those most intimately familiar with the challenges and opportunities in the Bregana River Basin and the respective social, cultural, institutional and political context.

The following sections will delve into the specific outcomes of these co-creation activities, exploring the identified barriers, potential enablers, and the roles of various stakeholders in driving or resisting change toward NBS implementation in the Bregana River Basin, Croatia.

5.3 Local acceptance of NBS in Bregana River Basin

The acceptability study conducted during the first workshop in the Bregana River Basin provided crucial insights into local stakeholders' perspectives on NBS implementation (detailed in RECONECT Deliverable 4.5). The findings indicate a generally positive attitude towards NBS, contingent upon addressing key procedural aspects and effectively communicating benefits. Key findings are as follows:

1. **Stakeholder support**: There is broad support for NBS projects, provided that:
    a) Stakeholders are meaningfully involved in the NBS planning and implementation processes.
    b) The benefits of NBS are clearly articulated and understood.
2. **Fair land acquisition process:** Stakeholders strongly emphasize the importance of a fair land acquisition process as a crucial factor in increasing the acceptance of NBS projects. This underscores the need for transparent and inclusive procedures that ensure the rights and interests of affected landowners are respected and adequately compensated.
3. **Preference for visible solutions:** Stakeholders express a preference for visible and physical flood risk reduction methods. This suggests that tangible and demonstrable measures are more likely to garner public support and confidence in the effectiveness of NBS.
4. **Knowledge gap:** The study reveals that many stakeholders do not yet fully comprehend how NBS would work in their specific area. This highlights the need for targeted education and awareness-raising efforts to enhance stakeholders' understanding of NBS and their potential benefits.
5. **Perception of impacts:** Notably, stakeholders strongly disagree with statements suggesting potential negative impacts of NBS. They do not believe that NBS would adversely affect the aesthetic value of the area or fail to significantly improve the quality of life for local residents.
6. **Willingness to participate:** Stakeholders reject the notion that they are unwilling to participate in the planning and implementation processes of NBS projects. This indicates a readiness to engage in the realization of NBS initiatives.
7. **Political acceptance:** Despite community support, the current political acceptance of NBS is perceived as limited. Political actors are viewed primarily as observers, with their support being more declarative than executive in nature.

In conclusion, the following points need to be considered for more local acceptance of NBS in the Bregana River Basin:

- Prioritizing community engagement in planning and implementation processes
- Ensuring transparent and fair land acquisition procedures
- Demonstrating NBS effectiveness through visible and tangible outcomes
- Enhancing education and awareness about NBS functioning and benefits
- Addressing the gap between political rhetoric and actual commitment to NBS implementation

5.4 Overcoming key barriers to NBS implementation

The co-creation activities revealed several key barriers to the implementation of NBS in Bregana river basin (detailed in RECONECT Deliverable 4.6), as well as potential enablers to overcome them. Figure 5 illustrates the key identified barriers (i.e. high transformative potential barriers and/or high centrality barriers) and enablers discussed in the survey. In the national workshop, the participants discussed the following key barriers and how they can be overcome by more specific enablers: 1) Lack of sense of urgency, 2) Lack of political will and long-term Commitment, 3) social and cultural barriers to land acquisition from private owners, and 4) 'Untouched nature' aspect of NBS. Table 5 depicts how workshop participants have evaluated the importance of enablers and their descriptions.

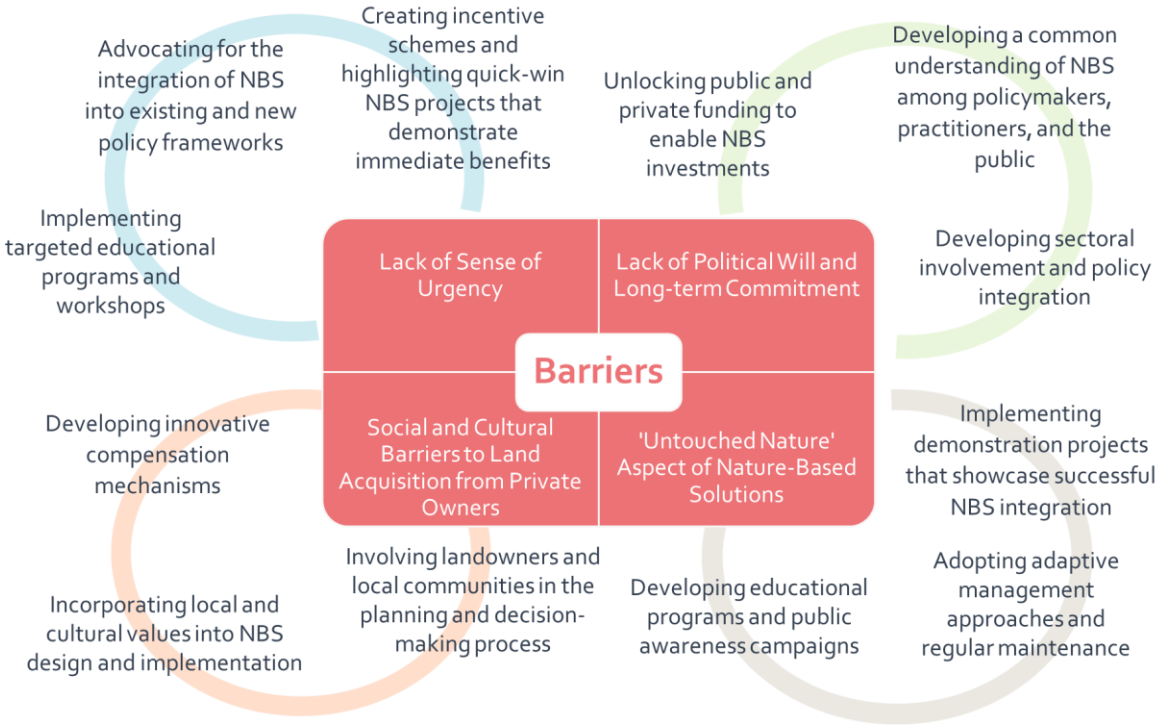

Figure 5 Barriers and their enablers in Croatia

Table 5 Key barriers and enablers in Croatia

Barrier 1. Lack of Sense of Urgency	Barrier 2. Lack of Political Will and Long-term Commitment	Barrier 3. Social and Cultural Barriers to Land Acquisition from Private Owners	Barrier 4. 'Untouched Nature' Aspect of Nature-Based Solutions
Enabler 1. **Creating incentive schemes and highlighting quick-win NBS projects that demonstrate immediate benefits** (mean score: 8.1/10-point scale) • Develop grants for financing NBS projects to boost acceptance and willingness to select NBS over traditional measures • Implement small-scale NBS pilot projects to demonstrate success and encourage spatial planners to incorporate NBS in future plans. • Involve the entire community, especially ministries, in obtaining additional funds for co-financing NBS.	Enabler 1. **Unlocking public and private funding to enable NBS investments** (mean score: 8.3/10-point scale) • Merge complementary funding streams into single programs that prioritize NBS. • Promote innovative financing mechanisms such as payment for ecosystem services. • Explore co-funding opportunities with the EU and local authorities to entice other potential funders.	Enabler 1. **Developing innovative compensation mechanisms** (mean score: 8.5/10-point scale) • Implement land-for-land exchanges, land pooling, or long-term benefit-sharing arrangements • Allow landowners to maintain a connection to their ancestral land. • The Ministry of Agriculture should maintain records of land areas of equal value and inform farmers about replacement land options and potential additional financial support.	Enabler 1. **Implementing demonstration projects that showcase successful NBS integration** (mean score: 8.5/10-point scale) • Develop projects that emphasize the aesthetic appeal and functionality of NBS in human-dominated landscapes. • Ensure these projects are well-documented and their benefits are clearly communicated to the public. • Involve local communities in the planning and implementation process to increase understanding and acceptance.
Enabler 2. **Advocating for the integration of NBS into existing and new policy frameworks** (mean score: 7.8/10-point scale) • Push for the inclusion of NBS in EU directives to facilitate easier acceptance across all stakeholder levels • Encourage revisions to existing planning documentation to incorporate new zones reserved for NBS.	Enabler 2. **Developing a common understanding of NBS among policymakers, practitioners, and the public** (mean score: 8.0/10-point scale) • Conduct awareness-raising campaigns targeted at politicians. • Organize educational programs to improve understanding of NBS benefits and implementation.	Enabler 2. **Incorporating local and cultural values into NBS design and implementation** (mean score: 8.3/10-point scale) • Demonstrate respect for landowners' ancestral ties to the land in NBS planning • Integrate cultural and historical elements into NBS design.	Enabler 2. **Adopting adaptive management approaches and regular maintenance** (mean score: 7.8/10-point scale) • Ensure NBS maintain a desirable appearance and functionality over time. • Develop clear maintenance protocols that balance ecological functions with aesthetic considerations.
Enabler 3. **Implementing targeted educational programs and workshops** (mean score: 7.1/10-point scale) • Develop educational initiatives to improve understanding of NBS among all stakeholders	Enabler 3. **Developing sectoral involvement and policy integration** (mean score: 7.7/10-point scale) • Encourage cross-sector collaboration in NBS planning and implementation. • Integrate NBS considerations into various policy domains.	Enabler 3. **Involving landowners and local communities in the planning and decision-making process** (mean score: 8.2/10-point scale) • Ensure concerns and values of local communities are heard and addressed • Implement public presentations, lectures, or workshops to gather opinions, suggestions, and concerns.	Enabler 3. **Developing educational programs and public awareness campaigns** (mean score: 7.5/10-point scale) • Highlight the benefits of NBS and their compatibility with human activities and cultural values. • Use various media channels, including official public broadcasting services, to disseminate information about successful NBS projects.
Enabler 4. **Developing comprehensive communication strategies** (mean score: 6.9/10-point scale) • Utilize media (digital, radio, TV) to raise awareness and increase the sense of urgency	Enabler 4. **Identifying champions and advocates for NBS** (mean score: 6.7/10-point scale) • Identify and support influential individuals who can advocate for NBS at various levels of government	Enabler 4. **Conducting awareness-raising campaigns and educational programs** (mean score: 7.8/10-point scale) • Help landowners understand the long-term benefits of NBS for their land, community, and future generations • Use media, especially official public broadcasting services, to disseminate information about NBS.	Enabler 4. **Involving local communities and stakeholders in NBS planning and design** (mean score: 7.3/10-point scale) • Ensure NBS align with cultural norms and aesthetic preferences
Enabler 5. **Identifying and supporting NBS champions** (mean score: 6.9/10-point scale) • Identify and support individuals and organizations that can advocate for urgent NBS action	Enabler 5. **Fostering policy synergies by linking NBS policies to well-being and preventative healthcare policies** (mean score: 6.3/10-point scale) • Highlight the co-benefits of NBS in areas such as public health and wellbeing. • Simplify NBS approval procedures to encourage their adoption.	Enabler 5. **Establishing collaborative management and stewardship arrangements** (mean score: 6.0/10-point scale) • Allow landowners to remain actively involved in the care and maintenance of their land after NBS implementation	Enabler 5. **Integrating cultural and historical elements into NBS design** (mean score: 6.4/10-point scale) • Create a sense of connection and ownership among local communities by incorporating local cultural elements into NBS designs

Table 5 illustrates how workshop participants rated (in the pre-workshop survey) and described barriers and their enablers.

The first major barrier is the lack of a sense of urgency. To combat this, stakeholders emphasized the importance of creating incentive schemes and showcasing quick-win NBS projects. This approach, rated 8.1 out of 10 in effectiveness, aims to demonstrate immediate benefits and encourage wider adoption. Supporting this, there's a push to integrate NBS into existing and new policy frameworks, coupled with targeted educational programs to improve understanding among all stakeholders.

Political will and long-term commitment present another significant hurdle. The top strategy to address this, scoring 8.3 out of 10, focuses on unlocking both public and private funding for NBS investments. This financial backing is crucial for sustaining long-term projects. Additionally, developing a common understanding of NBS among policymakers, practitioners, and the public is seen as vital, along with encouraging cross-sector collaboration and policy integration.

The third barrier relates to social and cultural aspects of land acquisition from private owners. Here, the highest-rated enabler (8.5 out of 10) is the development of innovative compensation mechanisms. These could include land exchanges or benefit-sharing arrangements that respect landowners' connections to their ancestral lands. Incorporating local and cultural values into NBS design and involving landowners in the planning process are also key strategies to overcome this barrier.

Lastly, the perception of NBS as an 'untouched nature' poses a challenge. To address this, stakeholders strongly support implementing demonstration projects that showcase successful NBS integration in human-dominated landscapes. This approach also rated 8.5 out of 10, aims to illustrate how NBS can be both functional and aesthetically pleasing. Adopting adaptive management approaches and developing educational programs to raise public awareness about NBS complement this strategy.

Notably, workshop participants suggested an overarching enabler applicable to all barriers: the allocation of state subsidies for NBS implementation. This proposal emphasizes the role of government support in facilitating faster and easier decision-making regarding NBS adoption. By providing financial incentives, the state could significantly accelerate the implementation of NBS across Croatia.

Table 6 Key stakeholders, bridging actors, challenges and resistance in Croatia

	Addressing barrier 1. Lack of Sense of Urgency	Addressing barrier 2. Lack of Political Will and Long-term Commitment	Addressing barrier 3. Social and Cultural Barriers to Land Acquisition from Private Owners	Addressing barrier 4. 'Untouched Nature' Aspect of Nature-Based Solutions
Key stakeholders in activating enablers & roles	• Ministries, Croatian Water, Croatian Forests, and local authorities should recognize the importance of NBS and implement them in future policies and spatial planning • Local communities are both potential beneficiaries and key players in NBS implementation • Industry and businesses may be affected by NBS implementation and should be engaged in the process • International Sava River Commission can play a role in coordinating NBS efforts across borders	• Ministries and government agencies should take the lead in developing and implementing NBS-friendly policies. • Croatian Waters and other relevant agencies need to collaborate more effectively. • Local communities can exert pressure on political leaders to prioritize NBS. • The private sector can be both a potential source of funding and resistance, depending on how NBS align with their interests. • EU institutions can play a crucial role by incorporating NBS into directives, potentially accelerating adoption in member states	• Cities, Counties, and Croatian Waters should work closely with local communities to find suitable financing methods, means of compensation, and ensure sustainability. • The Ministry of Agriculture plays a crucial role in facilitating land exchanges and providing support. • Small landowners and local residents are both potential beneficiaries and key players in NBS implementation • Private sector entities may be affected by land use changes and should be engaged in the process • Religious groups could play a role in promoting the social aspect of community support for NBS implementation	• Local authorities, Croatian Waters, Croatian Forests, and the Sava Commission should take the lead in implementing and promoting NBS projects • The academic community can contribute to teaching about the benefits of NBS to both the private sector and local communities • Local businesses may be affected by NBS implementation and should be engaged in the process • Local communities should be involved in the planning and design of NBS to boost trust and willingness for future acceptance
Bridging actors	• The media, local communities, and local authorities can play crucial roles in bridging the gap between different stakeholders and raising awareness about the urgency of NBS implementation.	• Interest groups, relevant agencies, and non-governmental professional organizations are often perceived as neutral and impartial, potentially facilitating dialogue between different stakeholders.	• The European Union, media, and religious groups can act as bridging factors. EU directives could boost cooperation between decision-making stakeholders and local communities. The media and religious institutions could help propagate the social aspects and community benefits of NBS implementation.	• The media, schools/universities, government ministries, and the European Union can act as bridging factors. The involvement of multiple different professions and academia with good media coverage was identified as a major bridging actor.
Challenges & Resistance	• Lack of funding and understanding about NBS among stakeholders • Low priority of NBS on policymakers' lists • Potential resistance from local communities if NBS implementation affects their access to certain areas	• Cumbersome bureaucracy slowing down NBS initiatives • Short-term political cycles misaligned with long-term nature of NBS benefits • Competing priorities for limited government resources • Lack of understanding about NBS among policymakers	• Traditional and conservative views of some landowners who are not interested in negotiations or compensation • Lack of understanding about the potential benefits of NBS implementation • Concerns about land expropriation or changes in land use	• Die-hard groups of nature conservationists who oppose any kind of human intervention in nature • Lack of financing for small-scale demonstration NBS projects • Perception that NBS may not be visually appealing or might alter familiar landscapes • Disinterest of government agencies in financing small-scale urban NBS demonstration projects

Along with the barriers and enablers discussed above, Table 6 describes a set of stakeholders, potential bridging actors, and unique challenges for each barrier. In addition to the workshop results, the following text elaborates on the results of the desktop research.

The first barrier is the lack of a sense of urgency. Key players for realizing enablers and addressing barriers need to recognize the importance of NBS and incorporate them into future policies and spatial planning. At the national level, floods are managed by the *"Ministry of Environmental Protection and Green Transition"* and implemented by *Croatian Waters. Croatian Waters* prepare and implement the national River Basin Management Plan, Programme of Measures, Flood Risk Management Plan and water supply plans. State authorities approve the national River Basin Management Plan and the Flood Risk Management Plan and propose relevant legislation and strategies to Parliament. The *Croatian Water* is responsible for the development of technical guidelines and standards related to water management and flood protection it provides technical expertise and support to government agencies and other stakeholders on issues related to flood management. *Croatian Waters* – implements the Water Management Act, which regulates water management activities in Croatia; collaborates with relevant institutions to develop and implement flood management standards and guidelines; conducts flood reporting at the national level. Also, other agencies (e.g. the Croatian Environment and Nature Agency, the Ministry of Physical Planning, Construction, and State Property) contribute to the regulatory guidelines.

Local communities play a dual role as both potential beneficiaries and crucial implementers of NBS. The involvement of industry and businesses is also vital, as they may be affected by NBS implementation. On an international level, the Sava River Commission can coordinate NBS efforts across borders. To bridge the gaps between these diverse stakeholders, the media, local communities, and local authorities can raise awareness and facilitate communication. However, this process faces challenges such as a lack of funding and understanding about NBS, low prioritization by policymakers, and potential resistance from local communities if NBS implementation affects their access to certain areas.

The second barrier is the lack of political will and long-term commitment. Here, again ministries and government agencies should take the lead in developing and implementing NBS-friendly policies, with Croatian Waters and other relevant agencies collaborating more effectively. Local communities can exert pressure on political leaders to prioritize NBS, while the private sector can be both a potential source of funding and resistance. EU institutions play a crucial role by incorporating NBS into directives. Interest groups, relevant agencies, and non-governmental professional organizations can act as bridging actors, perceived as neutral and impartial. The challenges in this area include cumbersome bureaucracy, short-term political cycles misaligned with the long-term nature of NBS benefits, competing priorities for limited government resources, and a lack of understanding about NBS among policymakers.

The third barrier involves social and cultural aspects of land acquisition from private owners. Cities, counties, and Croatian Waters need to work closely with local communities to find suitable financing methods, and means of compensation, and ensure sustainability. The Ministry of Agriculture plays a crucial role in facilitating land exchanges and providing support. Small landowners and local residents are both potential beneficiaries and key players in NBS implementation, while private sector entities may be affected by land use changes. Religious groups could promote the social aspects of community support for NBS. The European Union, media, and religious groups can act as bridging factors, with EU directives potentially boosting cooperation between decision-makers and local communities. Challenges include traditional and conservative views of some landowners, lack of understanding about NBS benefits, and concerns about land expropriation or changes in land use.

The fourth barrier relates to the 'untouched nature' aspect of NBS. Local authorities, Croatian Waters, Croatian Forests, and the Sava Commission should lead in implementing and promoting NBS projects. The academic community can contribute by educating both the private sector and local communities about NBS benefits. Local businesses and communities should be engaged in the planning and design process to boost trust and willingness for future acceptance. The media, schools/universities, government ministries, and the European Union can act as bridging factors, with the involvement of multiple professions and academia, coupled with good media coverage, identified as a major bridging actor. Challenges include opposition from die-hard nature conservationists, lack of financing for small-scale demonstration projects, perceptions that NBS may not be visually appealing or might alter familiar landscapes, and disinterest from government agencies in financing small-scale urban demo NBS projects.

By understanding these complex dynamics of stakeholders, bridging actors, and challenges for each barrier, Croatia can develop more effective strategies to implement NBS across the country.

5.5 Linking the barrier/enabler analysis to the existing policy framework

In this chapter, we provide a synopsis of the policy analysis. More details are provided in Annex A and B.

The governance and implementation of NBS (in particular, those related to flood risk mitigation) in Croatia are influenced by a complex network of stakeholders and policies at multiple levels. National authorities, particularly the Ministry of Interior and CNPRD, hold primary decision-making power in managing natural hazards, while regional and local governments, alongside entities like Croatian Waters, play crucial roles in flood protection and water management. The Water Act outlines the responsibilities of key institutions like the Ministry of Environment and Croatian Waters, which are central to flood management and the implementation of EU directives such as the Water Framework Directive and the Floods Directive.

Along with these Directives, there are 11 other EU Directives and mandatory regulations (e.g. on the quality of water, concerning the protection of waters and groundwater against pollution, on environmental quality standards, a framework for community action in the field of marine environmental policy, Natura 2000, Habitats Directive and Birds Directive, etc.) to which Croatia is obliged to adhere. They regulate national and regional policies and the legal framework supporting flood management and related NBS (e.g. Constitution, Water management strategy, Water Law, Water Management Financing Act, Flood risk management plans and related regulations, the UN Sustainable Development Agenda by 2030, National level guidelines on response to natural disasters as well as technical guidelines and standards for water management and flood protection).

However, several barriers still hinder the widespread adoption of NBS. These include outdated laws favoring traditional infrastructure, a lack of technical guidelines for NBS, siloed organizational thinking, limited financial capacity, poorly developed stakeholder network, path dependency, and lack of information on NBS benefits, etc. Moreover, the existing policies primarily support gray infrastructure, while NBS initiatives receive less focus due to these systemic issues. There is a need to reallocate funds from traditional infrastructure to NBS and integrate NBS more explicitly into policy frameworks. The ongoing consultation on the Law on Spatial Planning presents a potential avenue for strengthening the role of NBS.

Nevertheless, opportunities for NBS are growing, particularly through EU regulations mentioned earlier and several economic instruments such as EU funding mechanisms, and strategic reforms like the alignment with the EU Green Deal and the Future Climate Change Adaptation Strategy. Also, funding can be obtained from the World Bank, EIB, and

EBRD as well as EU funds (e.g. LIFE & LIFE+, HORIZON, Cohesion funds) and NGO initiatives.

Additionally, a variety of soft instruments (e.g. knowledge-sharing platforms, support to government agencies and other stakeholders, support in knowledge dissemination via reporting at the local, regional, and national levels, a collaboration between relevant institutions to develop and implement management standards and guidelines, campaigns and activities related to raising the awareness of communities about NBS, expanding knowledge and spreading information through different channels by civil society organizations) can raise awareness of NBS, improve knowledge and expertise, and build capacity for NBS development and implementation.

5.6 Key Takeaways for Croatia

Based on the analysis of the barriers and their corresponding enablers for the Bregana River Basin, several key takeaways and strategies emerge for mainstreaming NBS in Croatia:

1. There is a strong emphasis on *the need for robust scientific evidence* demonstrating the effectiveness of NBS in managing hydrometeorological risks. Implementing demonstration projects is crucial for building confidence.
2. Stakeholders strongly emphasize the importance of a *fair land acquisition process*. Developing clear procedures that ensure the rights of affected landowners is essential.
3. There is a preference for *visible solutions*, indicating that tangible and demonstrable measures are more likely to gain public confidence and support.
4. A significant knowledge gap exists about how NBS would work in the specific local context. This highlights the need for targeted *education and awareness-raising* efforts.
5. Developing *integrated planning frameworks that consider NBS* across multiple sectors and decision-making levels is seen as key to overcoming silo thinking.
6. *Enhancing technical expertise and institutional capacity* for designing, implementing, and maintaining NBS is critical. This involves training programs and strengthening relevant institutions.
7. *Improving public understanding of NBS* through participatory planning, demonstration projects, and strategic communication efforts is crucial for building support.
8. There is a need to develop *innovative financing mechanisms*, including creating new financial products and exploring options such as green bonds.
9. *Fostering political support* and ensuring long-term commitment to NBS is essential. This requires demonstrating multiple benefits and aligning NBS with political priorities.
10. *Leveraging EU-level policies and frameworks* to create incentives and remove barriers to NBS implementation is seen as an important strategy.

6 Vrbanja River Basin, Bosnia and Herzegovina: Options for Mainstreaming NBS

6.1 Introduction to the site

Belonging to the Vrbas River watershed, the Vrbanja River Basin is a crucial part of Bosnia and Herzegovina's integrated water management system. Situated in the Republic of Srpska, it spans an area of 804 sq. km. The Vrbanja River's upper course is characterized by mountainous terrain with steep slopes, transitioning to moderately hilly landscapes in the middle course, and finally, lowland areas in the lower course. Forests dominate the land cover, accounting for 61.46% of the basin, although widespread deforestation has led to extensive cultivation across all parts of the basin.

Recent hydrological analyses have revealed a notable increase in runoff from the basin over the past 25 years, leading to larger flood waves. Flash floods are particularly common in certain sections, such as the Josavka sub-basin. Current flood mitigation efforts primarily focus on urban areas and involve the implementation of gray infrastructure measures, including embankments, river channel regulation, and bridge replacements. Other hazards include riverine floods and landslides.

So, a list of NBS proposed within RECONECT consists of retention ponds, afforestation, and reforestation along with the quality improvement of existing forests, floodplain excavation/enlargement/restoration, removing obstacles, and widening of water bodies.

6.2 Co-creation activities

The analysis of barriers and enablers for NBS implementation in the Vrbanja River Basin, Bosnia and Herzegovina, is rooted in a series of co-creation activities (Figure 6). These activities were designed to engage a diverse range of stakeholders, ensuring that the insights gathered represent a comprehensive view of the local context. Figure 6 illustrates the timeline and components of these co-creation activities.

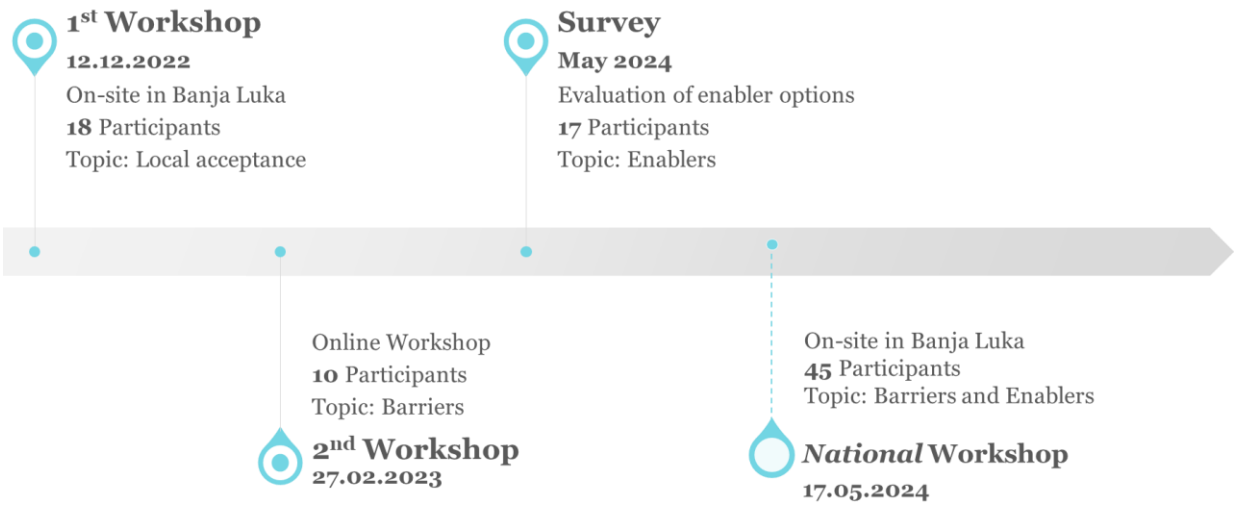

Figure 6 Co-creation activities in Bosnia and Herzegovina, Vrbanja River Basin

The co-creation process consisted of three following main components.

1. Workshops for Vrbanja River Basin

- First workshop: December 12, 2022, in Banja Luka (18 participants)
- Second workshop: February 17, 2023, online (10 participants)

These workshops brought together representatives from various sectors, including public authorities, civil society organizations, political entities, academia, and the private sector. The diverse participation ensured a multi-faceted approach to identifying barriers and potential solutions for NBS implementation.

2. Pre-workshop survey

- Online, May 2024 (17 participants)
- Focus: Evaluation of potential enablers for key identified barriers

This survey provided quantitative and qualitative data on the perceived relevance of various enablers, laying the groundwork for more targeted discussions during the subsequent national workshop.

3. National Workshop

- May 17, 2024, in Banja Luka (45 participants)
- Sectors represented: Academia, public authorities, private sector, and international organizations

A key activity during this workshop was to identify key stakeholders, including potential agents of change and sources/agents of resistance to NBS implementation in Bosnia and Herzegovina. Participants engaged in collaborative discussions to identify key stakeholders and their roles in overcoming the previously identified barriers to NBS adoption.

The insights, data, and stakeholder perspectives gathered through these co-creation activities form the foundation for the subsequent analysis presented in this chapter. By grounding our findings in these participatory processes, we ensure that the barriers identified, and the enablers proposed are deeply rooted in local realities and reflect the collective knowledge of those most intimately familiar with the challenges and opportunities in the Vrbanja River Basin.

The following sections will delve into the specific outcomes of these co-creation activities, exploring the identified barriers, potential enablers, and the roles of various stakeholders in driving or resisting change towards NBS implementation in Bosnia and Herzegovina and the respective social, cultural, institutional, and political context.

6.3 Local acceptance of NBS in Vrbanja River Basin

The acceptability study conducted during the first workshop in the Vrbanja River Basin provided crucial insights into local stakeholders' perspectives on NBS implementation (detailed in RECONECT Deliverable 4.5). The findings indicate a generally positive attitude towards NBS, contingent upon addressing key procedural aspects and effectively communicating benefits. Key findings are as follows:

1. **Stakeholder support:** There is broad support for NBS projects, provided that: a) Stakeholders are meaningfully involved in the planning and implementation processes. b) The benefits of NBS are clearly articulated and understood.
2. **Scientific evidence:** Stakeholders emphasized the need for robust scientific evidence demonstrating NBS effectiveness in managing hydrometeorological risks.

This underscores the importance of investing in research and monitoring to build a strong evidence base supporting NBS adoption in the region.

3. **Procedural fairness:** The study highlighted the significance of transparent and inclusive decision-making processes. Stakeholders value: a) Open communication channels b) Information sharing c) Community involvement in project design and implementation
4. **Compensation mechanisms:** Fair compensation for property and land potentially affected by NBS implementation was identified as a critical consideration. This emphasizes the need for equitable and transparent compensation processes.
5. **Perception of impacts:** Notably, stakeholders strongly disagreed with statements suggesting potential negative impacts of NBS on the landscape, river accessibility, or cultural aspects. This indicates a positive perception of NBS and recognition of their potential multi-benefits.
6. **Political acceptance:** Despite community support, the current political acceptance of NBS is perceived as limited. Political actors are viewed primarily as observers, with their support being more declarative than executive in nature.

In conclusion, the following points need to be considered for more local acceptance of NBS in the Vrbanja river basin site.

- Prioritizing community engagement
- Ensuring transparent communication
- Demonstrating NBS effectiveness through empirical evidence
- Developing fair compensation mechanisms

6.4 Overcoming key barriers

The co-creation activities revealed several key barriers to the implementation of NBS in the Vrbanja river basin (detailed in RECONECT Deliverable 4.6), as well as potential enablers to overcome these challenges. Figure 7 illustrates the key identified barriers (i.e. high transformative potential barriers and/or high centrality barriers) and enablers discussed in the survey. In the national workshop, the participants discussed the following key barriers:1) Lack of financial resources and 2) Lack of Awareness, Knowledge and Understanding of NBS, due to time limit, and how they can be overcome by more specific enablers (Table 7).

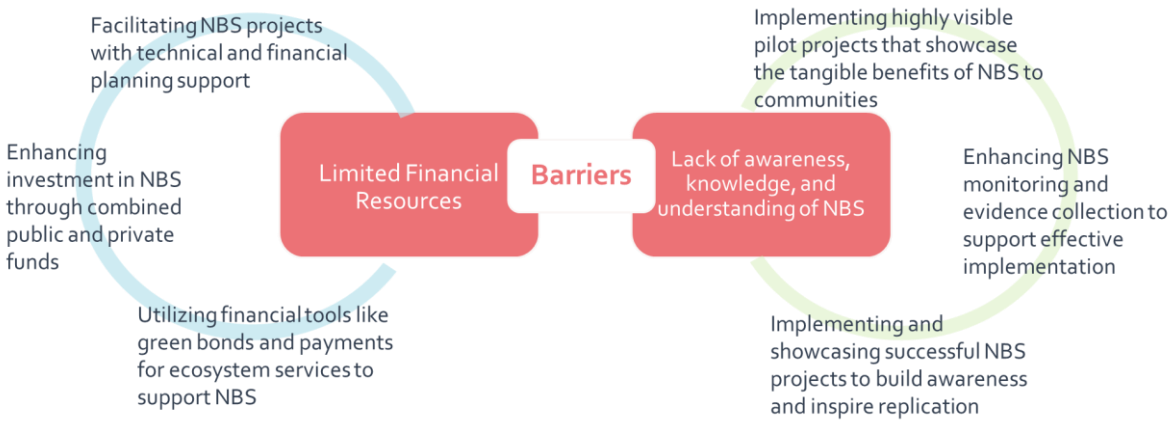

Figure 7 Barriers and enablers in Bosnia and Herzegovina

Table 7 Key barriers and enablers in Bosnia and Herzegovina

<table>
<tr><th colspan="2">Barrier 1. Limited financial resources</th><th colspan="2">Barrier 2 Lack of awareness, knowledge, and understanding of NBS</th></tr>
<tr>
<td>Enabler 1. Facilitating NBS projects with technical and financial planning support (mean score: 8.83/10-point scale)
Develop a national program providing grants for feasibility studies, project design, and cost-benefit analysis of NBS initiatives.
The Government and relevant ministries (e.g., Ministry of Finance, Ministry of Agriculture, Forestry and Water Management) should enhance the regulatory framework for NBS implementation.
The academic community should educate the public about NBS advantages and highlight the responsibility of decision-makers in achieving societal development goals through NBS.</td>
<td>Enabler 4. Developing insurance products that de-risk the project risks (mean score: 7.17/10-point scale)
Encourage insurance companies to develop products providing reduced premiums or pay-out coverage for property protected by NBS.
Government institutions should support these initiatives through appropriate policies and incentives.</td>
<td>Enabler 1. Implementing highly visible pilot projects that showcase the tangible benefits of NBS to communities (mean score: 9.35/10-point scale)
Develop pilot projects in areas with significant flood risk, especially in torrential streams.
Ensure these projects are well-documented and their benefits are clearly communicated to the public.
Involve local communities in the planning and implementation process to increase understanding and acceptance.</td>
<td>Enabler 4. Creating new knowledge and expertise on NBS through targeted educational initiatives (mean score: 8.59/10-point scale)
Incorporate NBS-related topics into school curricula from an early age.
Develop specialized courses on NBS at relevant universities and faculties.
Create continuing education programs for professionals in related fields.</td>
</tr>
<tr>
<td>Enabler 2. Enhancing investment in NBS through combined public and private funds (mean score: 7.50/10-point scale)
Establish a dedicated national “Natural Infrastructure Fund” consolidating funds from government budgets, EU funds, private investments, and various fees.
Involve the Environmental Protection Fund, Agricultural funds of local communities, the banking sector, and private companies in increasing NBS investments.
Address the lack of trust in fair distribution of financial resources through transparent processes and clear investment structures.</td>
<td rowspan="2">Enabler 5. Introducing financial products that back NBS projects, such as resilience bonds (mean score: 6.83/10-point scale)
The government could enable resilience bonds where the bond principal is reduced after a flood disaster if predefined NBS resilience measures are applied.
Provide more detailed explanations and education about resilience bonds to stakeholders.
Implement changes in the legislative framework to support these new financial products.
The national workshop results indicated that concepts like green bonds and resilience bonds were not fully understood by all participants, suggesting a need for education and capacity building in these areas.
The workshop also highlighted the need for better horizontal and vertical connections between actors, as current communication is at a low level. This systemic change is necessary for collective action and effective implementation of NBS financing strategies.</td>
<td>Enabler 2. Enhancing NBS monitoring and evidence collection to support effective implementation (mean score: 9.12/10-point scale)
Establish a comprehensive monitoring system for NBS projects.
Ensure that monitoring reports are not just “put in drawers” but are actively used in decision-making processes.
Develop formal regulations or guidelines for the inclusion of monitoring reports in decision-making and awareness-raising activities.</td>
<td>Enabler 5. Providing NBS training for professionals across sectors to build awareness and skills (mean score: 8.29/10-point scale)
Develop training programs for practicing engineers and other professionals.
Make NBS knowledge a requirement for obtaining or renewing professional licenses.
Engage professional associations and academia in developing and delivering these training programs.</td>
</tr>
<tr>
<td>Enabler 3. Utilizing financial tools like green bonds and payments for ecosystem services to support NBS (mean score: 7.39/10-point scale)
The government could issue green bonds to raise capital for NBS projects, with bonds repaid by beneficiaries who “pay” for flood protection and recreation services.
Conduct educational initiatives to improve understanding of these financial tools among stakeholders.
Study and apply experiences from EU countries and engage financial experts to develop these tools.</td>
<td>Enabler 3. Implementing and showcasing successful NBS projects to build awareness and inspire replication (mean score: 8.94/10-point scale)
Document and widely share success stories of NBS implementation.
Use various media channels, including official public broadcasting services, to disseminate information about successful projects.
Engage academia and experienced professionals to present these success stories, as they are seen as credible sources of information.</td>
<td>Enabler 6. Inclusion of NBS-related topics in school syllabus to enable education of children from an early age (added by workshop participants)
Develop age-appropriate educational materials about NBS for primary and secondary schools.
Train teachers to effectively communicate NBS concepts to students.
Organize field trips to NBS project sites to provide hands-on learning experiences.</td>
</tr>
</table>

Table 7 illustrates how workshop participants rated (in the pre-workshop survey) and described barriers and their enablers.

To address the barrier of limited financial resources, several key enablers were proposed. The most highly rated enabler, with a mean score of 8.83 out of 10, is facilitating NBS projects with technical and financial planning support. This involves developing a national program for grants, enhancing the regulatory framework, and educating the public about NBS advantages. Another significant enabler is enhancing investment in NBS through combined public and private funds, which scored 7.50 out of 10. This approach suggests establishing a dedicated "Natural Infrastructure Fund" and involving various sectors in increasing NBS investments. Besides that, the workshop participants have mentioned some general considerations for realizing these enablers.

- Improve coordination and communication among different authorities, especially ministries and government agencies.
- Engage the academic community to bridge the gap between agents of change and sources of resistance.
- Address potential conflicts between private landowners, companies, and local communities through systemic activities and appropriate legislation.
- Utilize the expertise of EU organizations experienced in NBS implementation and financing.

The workshop also highlighted the potential of utilizing financial tools like green bonds and payments for ecosystem services, which received a score of 7.39 out of 10. However, it was noted that these concepts were not fully understood by all participants, indicating a need for further education and capacity building in these areas. Additional financial enablers include developing insurance products to de-risk projects and introducing financial products like resilience bonds, though these scored lower at 7.17 and 6.83 out of 10, respectively.

Regarding the barrier of lack of awareness, knowledge, and understanding of NBS, the workshop participants identified several promising enablers. The highest-rated enabler, scoring 9.35 out of 10, is implementing highly visible pilot projects that showcase the tangible benefits of NBS to communities. This is closely followed by enhancing NBS monitoring and evidence collection to support effective implementation, which scored 9.12 out of 10. Implementing and showcasing successful NBS projects to build awareness and inspire replication also received a high score of 8.94 out of 10.

Other important enablers for addressing the knowledge gap include creating new expertise on NBS through targeted educational initiatives (8.59/10) and providing NBS training for professionals across sectors (8.29/10). Additionally, workshop participants suggested including NBS-related topics in school syllabi to educate children from an early age.

The workshop results also emphasized the need for better horizontal and vertical connections between actors, as current communication is at a low level. This systemic change is seen as necessary for collective action and effective implementation of NBS strategies.

Along with the barriers and enablers discussed above, Table 8 describes a set of stakeholders, potential bridging actors, and unique challenges for each barrier. In addition to the workshop results, the following text elaborates on the results of the desktop research.

Table 8 Key stakeholders, bridging actors, and challenges and resistance in Bosnia and Herzegovina

	Addressing barrier 1. Limited financial resources	Addressing barrier 2. Lack of awareness, knowledge and understanding of NBS and its enablers
Key stakeholders in activating enablers & roles	• At the forefront of potential change are government bodies such as the Ministry of Finance and the Ministry of Agriculture, Forestry and Water Management. These institutions have the power to reshape policies and redirect funds towards NBS. However, they often struggle with coordination and operational capacity. The Environmental Protection and Energy Efficiency Fund could play a pivotal role in channeling resources, but its effectiveness is currently limited. • Local communities and their agricultural funds are both potential beneficiaries and key players in NBS implementation. They understand the local context and needs but often lack the necessary resources to initiate projects. • The private sector presents a mixed picture. Some banks and insurance companies are be-ginning to explore NBS-friendly financial products, while others resist change due to perceived risks or lack of understanding. Private companies and individual landowners who have successfully implemented NBS serve as important advocates, demonstrating the tangible benefits of these solutions. • International funds and organizations, particularly those focused on climate change adaptation, represent a significant opportunity for financing NBS. However, accessing these funds often requires navigating complex application processes.	• Ministry of Education and Culture and Ministry of Scientific and Technological Development and Higher Education can initiate educational initiatives. • The Republic Hydrometeorological Institute can lead efforts in NBS monitoring and data collection. • Local authorities can implement pilot projects and facilitate community engagement. • Universities and research institutions can develop and deliver NBS-related courses and conduct research. • The Chamber of Engineers of the Republika Srpska can incorporate NBS knowledge into licensing requirements. • Professional associations can develop and deliver training programs. • Official public broadcasting services can play a crucial role in disseminating information about NBS. • NGOs like the Center for Environment can raise awareness and facilitate connections between stakeholders. • Local farmers, landowners, and residents are both potential beneficiaries and key players in NBS implementation.
Bridging actors	• The academic community, professional organizations, and NGOs play a crucial role in bridging the knowledge gap. They provide expertise, raise awareness, and can help translate complex NBS concepts into practical applications. • The media was identified as a key bridging actor and could be utilized to disseminate information about these financial tools and their benefits.	• The academic community, seen as a credible source of information, can play a crucial role in educating the public and decision-makers. • Advisory services of the Ministry of Agriculture, Forestry and Water Management can educate local farmers and landowners about NBS benefits. • Media, especially the official public broadcasting service, can help disseminate in-formation about NBS. • Hunting and Fishing Associations, working at the local level, can advocate for NBS implementation and monitoring.
Challenges & Resistance	• Traditional industries, particularly those involved in resource exploitation, view NBS as a potential threat to their operations. • Current legislation often doesn't recognize or prioritize NBS, making it difficult to allocate funds or create supportive policies. • There's a general lack of understanding about NBS among many stakeholders, leading to hesitation in investment. • The benefits of NBS are often long-term and distributed, making it challenging to justify immediate financial commitments.	• Traditional mindset and resistance to change, especially among older generations. • Concerns from local farmers and landowners about potential land use changes or expropriation. • Skepticism about the effectiveness of NBS compared to traditional "gray" infrastructure solutions. • Potential increase in educational costs for students and professionals. • Resistance from companies that deal exclusively with "gray solutions". •

For the barrier of limited financial resources, government bodies such as the Ministry of Finance and the Ministry of Agriculture, Forestry, and Water Management are at the forefront of potential change. These institutions have the power to reshape policies and redirect funds towards NBS, although they often struggle with coordination and operational capacity. The Environmental Protection and Energy Efficiency Fund could play a pivotal role in channeling resources, but its effectiveness is currently limited.

Local communities and their agricultural funds are both potential beneficiaries and key players in NBS implementation. They understand the local context and needs but often lack the necessary resources to initiate projects. The private sector presents a mixed picture, with some banks and insurance companies beginning to explore NBS-friendly financial products, while others resist change due to perceived risks or lack of understanding. Private companies and individual landowners who have successfully implemented NBS serve as important advocates, demonstrating the tangible benefits of these solutions.

International funds and organizations, particularly those focused on climate change adaptation, represent a significant opportunity for financing NBS. However, accessing these funds often requires navigating complex application processes.

In bridging the gap for this barrier, the academic community, professional organizations, and NGOs play a crucial role. They provide expertise, raise awareness, and can help translate complex NBS concepts into practical applications. The media was also identified as a key bridging actor that could be utilized to disseminate information about financial tools and their benefits.

Challenges in addressing the financial barrier include resistance from traditional industries that view NBS as a potential threat to their operations, legislation that doesn't recognize or prioritize NBS, a general lack of understanding about NBS among stakeholders, and the difficulty in justifying immediate financial commitments for long-term, distributed benefits.

Regarding the barrier of lack of awareness, knowledge, and understanding of NBS, key stakeholders include various government ministries such as the Ministry of Education and Culture and the Ministry of Scientific and Technological Development and Higher Education. These can initiate educational initiatives. The Republic Hydrometeorological Institute can lead efforts in NBS monitoring and data collection, while local authorities can implement pilot projects and facilitate community engagement.

Universities, research institutions, and professional bodies like the Chamber of Engineers of the Republika Srpska have roles in developing and delivering NBS-related courses, conducting research, and incorporating NBS knowledge into licensing requirements. Official public broadcasting services and NGOs like the Center for Environment can play crucial roles in disseminating information and facilitating connections between stakeholders. Local farmers, landowners, and residents are both potential beneficiaries and key players in NBS implementation.

Bridging actors for this barrier include the academic community, seen as a credible source of information, advisory services of the Ministry of Agriculture, Forestry and Water Management, media, and local associations such as Hunting and Fishing Associations.

Challenges in addressing the awareness and knowledge barrier include a traditional mindset and resistance to change, especially among older generations, concerns from local farmers and landowners about potential land use changes, skepticism about the effectiveness of NBS compared to traditional "gray" infrastructure solutions, a potential

increase in educational costs, and resistance from companies that deal exclusively with “gray solutions”.

6.5 Linking the barrier/enabler analysis to the existing policy framework

In this chapter, we provide a synopsis of the policy analysis. More details are provided in Annex A and B.

Bosnia and Herzegovina is divided into two Entities–the Federation of Bosnia and Herzegovina and the Republika Srpska, which are politically autonomous to an extent, as well as the Brčko District, which is self-governing administrative unit. The Entities have their own constitutions. This complexity hampers the integration of NBS into existing climate and natural disaster policy frameworks. In Bosnia and Herzegovina, disaster response and environmental management responsibilities are divided across various entities and levels of government, including the Republika Srpska and the Federation of Bosnia and Herzegovina. Among the key institutions are ministries that oversee forestry, water management, environmental protection, and civil protection. The Ministry of Security coordinates these efforts at the state level.

However, the legal and organizational frameworks in Republika Srpska and Bosnia and Herzegovina lack clear indications for NBS solutions for hydro-meteorological risk reduction. Other significant challenges in implementing NBS relate to the country’s complex administrative structure, decentralized decision-making, and fragmented responsibilities across sectors. The existing policy framework does not adequately recognize or support NBS, and there is a lack of coordination, information exchange, and institutional capacity. Additionally, the approach to disaster risk reduction (DRR) is reactive rather than proactive, with limited early warning systems and insufficient integration of climate change adaptation into policies. Overcoming these barriers requires stronger policy frameworks, better coordination among institutions, and increased awareness and promotion of NBS among decision-makers.

Legal recognition for NBS solutions is forthcoming, with plans to integrate them into strategic documents and by-laws as mandatory measures in catchment areas. Initiatives like the RECONECT project, along with the similar projects and efforts by IUCN, will bolster these endeavors. NBS-related measures have so far been presented in the strategic documentation of the water sector of the Republika Srpska (Integral Water Management Strategy, Flood Risk Management Plan, Management Plans for the Regional River Basins (Districts), and in the Law of Forests, Act of Environmental protection, and Strategies of Agriculture and Forestry. However, these measures are not explicitly mentioned as NBS but rather shown as non-structural solutions that are planned to be implemented for protection from the related risks (anti-erosion works, afforestation, sustainable management of agricultural land). NBS that are emphasized in strategic planning documents (Strategies) to be adopted by the National Assembly of the Republika Srpska, in addition to the technical part, should contain measures for the adoption of by-laws that will regulate the application and obligation of NBS.

National funding (mostly through tax revenues), public funds from budgets of local government units, budgets of local authorities along with the funds provided by the European Banks, International cooperation funds, civil society funding, and the various soft instruments (e.g. improve knowledge and expertise, raise awareness, promote stakeholder networking, etc.) provide opportunities to develop NBS. Further enhancement of collaboration between ministries, local self-government units, and departments for agriculture, forestry, and water management is essential for the successful and broader implementation of NBS.

6.5 Key Takeaways for Bosnia and Herzegovina

Based on the analysis of the barriers and their corresponding enablers for the Vrbanja River Basin, several key takeaways and strategies emerge for mainstreaming NBS in Bosnia and Herzegovina:

1. There is a critical need to focus on *public education and actively engage decision-makers* in understanding the importance of NBS. This includes incorporating NBS into educational curricula at various levels.
2. *Institutions should incorporate NBS into their strategic documents and laws*, making them mandatory components of policy and practice.
3. There is a strong need for both *horizontal and vertical cooperation among various sectors*, including water management, forestry, agriculture, construction, and spatial planning.
4. Implementing pilot *projects that visibly demonstrate the benefits of NBS* is crucial. These projects should have robust monitoring and maintenance systems.
5. Professionals and the academic community must *present NBS* to decision-makers effectively, *using* strong *Cost-Benefit Analyses (CBA) and practical examples*.
6. Investing in scientific research projects, particularly those focused on NBS, is essential to advance this field and *provide evidence of effectiveness*.
7. *Programs for the education and training of professionals on NBS* should be developed, potentially making NBS knowledge a requirement for obtaining or renewing professional licenses.
8. *Securing adequate financial resources* is necessary to support NBS initiatives. This includes exploring innovative financing mechanisms and combining public and private funds.
9. Ensuring *transparency in the use of financial resources* is vital to maintaining public trust and accountability.
10. *Leveraging international experiences and good practices*, particularly from EU countries, can accelerate NBS adoption in Bosnia and Herzegovina.

7 Pilica River Basin, Poland: Options for Mainstreaming NBS

7.1 Introduction to the site

The Pilica River Basin is situated in central Poland. It is the longest left tributary of the Vistula River. Spanning 319 km in length, the Pilica River basin covers an expansive area of 9252.48 sq. km. Within this basin, the Luciaza River emerges as the longest left tributary of the Pilica River, with a catchment area of 766 sq. km. The mean annual temperature is 7.5°C and the mean January and July temperature is equal to -4°C and 18°C accordingly. Elevation in the river basin varies from 285 m a.s.l. in the South in the spring section of the river to 165 m a.s.l. in the lowland area in the North of the valley. Geology is mainly represented by chalk marls covered with glacial formations. Sandy soils predominate the soil cover in the basin. Land use within the Luciaza River catchment area is predominantly comprised of agricultural arable lands (39.6%) and forests (38.6%).

The Luciaza River basin is characterized by extensive drained areas, leading to rapid water runoff and contributing to flood formation at the river's mouth into the reservoir. Additionally, the upper parts of the basin face the risk of agricultural drought. Thus, agricultural, hydrological, and hydrogeological droughts, along with the flood pose the main hydro-meteorological hazards.

Through analyzes of the Luciaza River basin, the Bogdanowka River Basin has been identified as a potential site for the implementation of NBS measures, which include wetland restoration/enhancement, restoration/reconnection of oxbow lakes, re-meandering, retention ponds, afforestation, hybrid solution (NBS combined with the adaptation of the existing hydro-technical infrastructure such as drainage and damming facilities).

7.2 Co-creation activities

The analysis of barriers and enablers for NBS implementation in the Pilica River Basin, Poland, is grounded in a series of co-creation activities. These activities were designed to engage a diverse range of stakeholders, ensuring that the insights gathered represent a comprehensive view of the local context. Figure 8 illustrates the timeline and components of these co-creation activities.

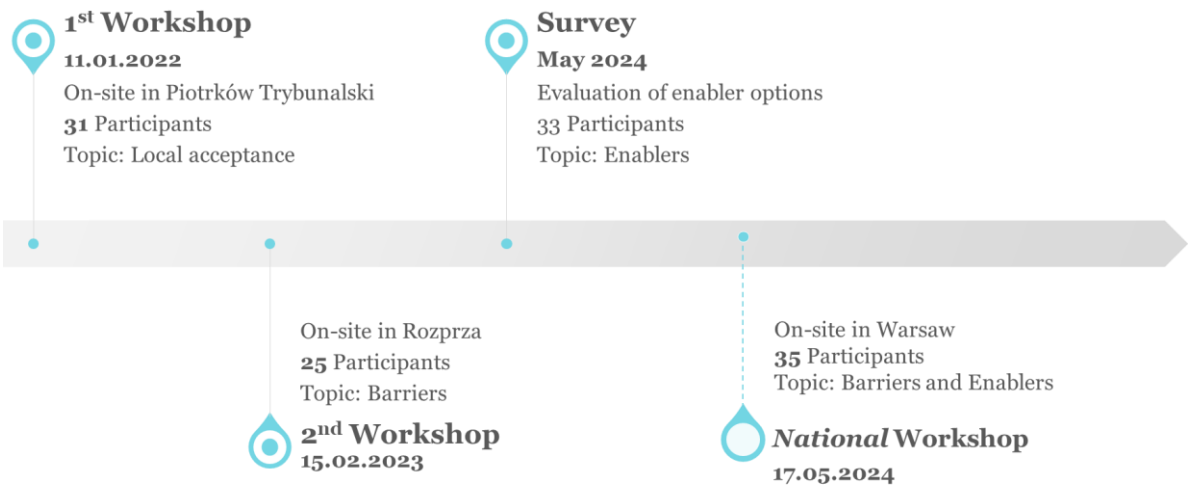

Figure 8 Co-creation activities in Poland

The co-creation process consisted of three main components:

1. Workshops for Pilica River Basin
   - First workshop (Data Collection): January 11, 2023, in Piotrków Trybunalski (31 participants)
   - Second workshop (Validation): February 15, 2023, in Rozprza (25 participants)

These workshops brought together representatives from various sectors, including public authorities, academia, and the private sector. The diverse participation ensured a multi-faceted approach to identifying barriers and potential solutions for NBS implementation.

2. Pre-survey
   - Conducted before the national workshop
   - Focus: Evaluation of potential enablers for key identified barriers

This survey provided quantitative and qualitative data on the perceived effectiveness of various enablers, laying the groundwork for more targeted discussions in the subsequent national workshop.

3. National Workshop
   - May 17, 2024, in Warsaw (35 participants)
   - Sectors represented: Authority (29), Academia (5), Private sector (1)
   - Key activities: Presentations on NBS and the RECONECT project, stakeholder mapping, collaborative discussion on barriers and enablers

The national workshop focused on four key barriers: 1) Lack of financial resources for the NBS, 2) Lack of political will, 3) Lack of public understanding of the NBS, and 4) Lack of Awareness about NBS among decision-makers, professionals, and the general public. Participants were engaged in stakeholder mapping and collaborative discussions to identify key actors and potential strategies for overcoming these barriers.

The insights, data, and stakeholder perspectives gathered through these co-creation activities form the foundation for the subsequent analysis presented in this chapter. By grounding our findings in these participatory processes, we ensure that the barriers identified and the enablers proposed are deeply rooted in local realities and reflect the collective wisdom of those most intimately familiar with the challenges and opportunities in the Pilica River Basin.

The following sections will delve into the specific outcomes of these co-creation activities, exploring the identified barriers, potential enablers, and the roles of various stakeholders

in driving of or resisting to change toward NBS implementation in the Pilica River Basin, Poland.

7.3 Local acceptance of NBS in Pilica River Basin

The acceptability study conducted as part of the co-creation activities in the Pilica River Basin provided crucial insights into local stakeholders' perspectives on NBS implementation. The Q-methodology findings (detailed in RECONECT Deliverable 4.5) suggest that stakeholders are generally supportive in development of NBS projects and have a positive outlook towards their realization, provided that certain key procedural aspects are properly addressed and the benefits of NBS are clearly communicated. Key findings are as follows:

1. **Stakeholder support:** There is broad support for NBS projects, contingent upon:
   - Clear communication of NBS benefits
   - Proper addressing of key procedural aspects
   - Compensation and Fair Land Acquisition: Stakeholders strongly emphasize the importance of:
   - Adequate compensation for any losses or inconveniences incurred due to NBS implementation
   - An equitable and transparent land acquisition process

   This highlights the need for clear and inclusive procedures that ensure the rights and interests of affected stakeholders are respected and properly addressed.
2. **Environmental values:** Stakeholders recognize the high value that people place on the natural environment in the NBS area. This appreciation and attachment to natural surroundings can lead to increased support for NBS projects, suggesting that leveraging existing environmental values and stewardship can be a powerful catalyst for garnering public backing.
3. **Preference for visible solutions:** Stakeholders express a preference for visible and physical flood risk reduction measures. This indicates that tangible and demonstrable solutions are more likely to gain public confidence and support, underscoring the importance of effectively communicating the risk reduction capabilities of NBS.
4. **Knowledge gap:** The study reveals that many stakeholders do not yet fully understand how NBS would work in their specific locality. This highlights the need for targeted education and awareness-raising efforts to enhance stakeholders' knowledge about NBS and their potential benefits.
5. **Evidence-based approach:** There is a need to provide evidence of successful NBS implementation in similar contexts to build confidence in these solutions.

In conclusion, the following points need to be considered for increasing local acceptance of NBS in the Pilica River Basin:

- Ensuring fair compensation and transparent land acquisition processes
- Leveraging existing environmental values and local stewardship
- Demonstrating NBS effectiveness through visible and tangible outcomes
- Enhancing education and awareness about NBS functioning and benefits
- Providing clear and accessible information on NBS performance and co-benefits
- Implementing evidence-based approaches, showcasing successful NBS examples in similar contexts

By focusing on these aspects, stakeholders can work towards creating a more conducive environment for the successful adoption and implementation of NBS in the Pilica River

Basin, building on the generally positive outlook that already exists among local stakeholders.

7.4 Overcoming key barriers

The co-creation activities revealed several key barriers to the implementation of NBS in the Pilica river basin (detailed in RECONECT Deliverable 4.6), as well as potential enablers to overcome these challenges. Figure 9 illustrates the key identified barriers (i.e. high transformative potential barriers and/or high centrality barriers) and enablers discussed in the survey. In the national workshop, the participants discussed the following key barriers, 1) Lack of financial resources for the NBS, 2) Lack of political will, 3) Lack of public understanding of the NBS, and 4) Lack of Awareness of NBS among decision-makers, professionals and the general public, and how they can be overcome by more specific enablers.

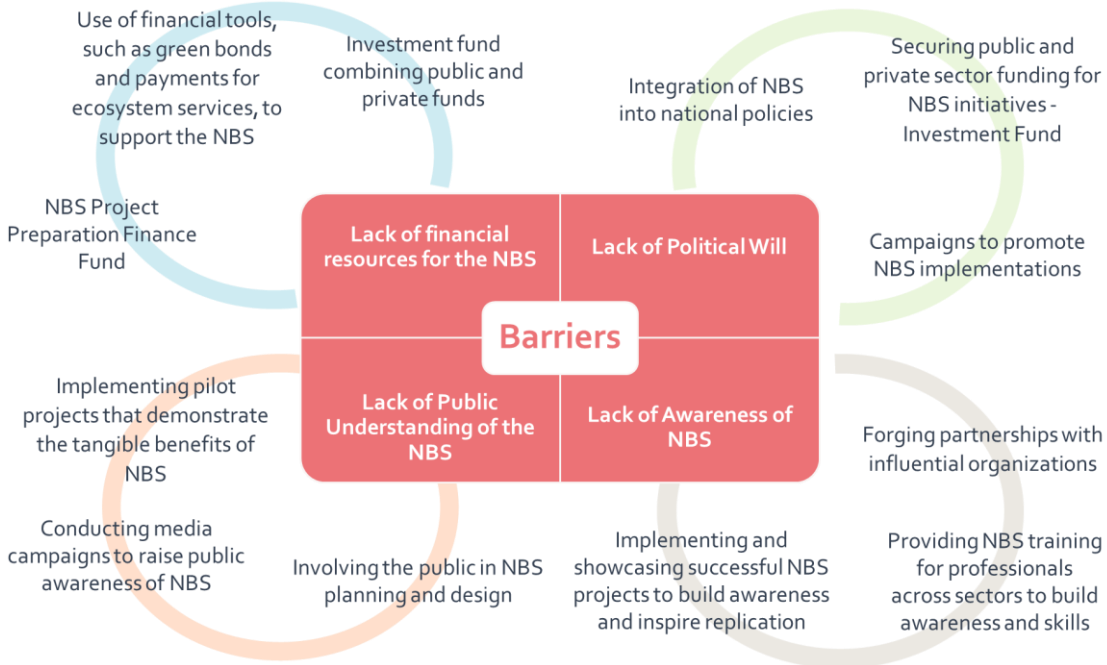

Figure 9 Barriers and their enablers in Poland

Table 9 Key barriers and enablers in Poland

Barrier 1. Lack of Financial Resources for the NBS	Barrier 2. Lack of Political Will	Barrier 3. Lack of Public Understanding of the NBS	Barrier 4. Lack of Awareness of NBS - among decision-makers, professionals and the general public
Enabler 1. **NBS Project Preparation Finance Fund** (mean score: 7.55/10-point scale) • Utilize existing programs like those supporting the preparation of urban climate change adaptation plans • Leverage funds from the Polish Recovery and Resilience Plan for green-blue infrastructure in rural areas	Enabler 1. **Campaigns to promote NBS implementations to create a critical mass of competence and determination for further implementations** (mean score: 8.42/10-point scale) • Utilize NGOs and local activists to promote NBS, starting from villages • Leverage existing programs like "My Water" from the National Fund for Environmental Protection and Water Management • Include clear political obligations, such as "100 concretes for the first 100 days of Coalition government"	Enabler 1. **Implementing pilot projects that demonstrate the tangible benefits of NBS to the public** (mean score: 8.30/10-point scale) • Organize study visits to pilot projects for farmers, pupils, and students • Involve local groups like village housewives' circles • Secure funding for pilot project start-ups from relevant ministries and EU funds	Enabler 1. **Implementing and showcasing successful NBS projects to build awareness and inspire replication** (mean score: 8.09/10-point scale) • Highlight successful NBS implementations by government agencies and local authorities • Create a database of case studies accessible to professionals and the public
Enabler 2. **Investment fund combining public and private funds** (mean score: 6.42/10-point scale) • Develop partnerships between large companies and local authorities in urban areas • Encourage collaboration between small local companies and local authorities in rural areas • Utilize EU financing opportunities and set deadlines to minimize other barriers	Enabler 2. **Integration of NBS into national policies: adaptation, biodiversity strategy, development, and others to achieve sectoral objectives** (mean score: 7.67/10-point scale) • Encourage the European Commission to consider NBS in sectoral policies • Prioritize NBS over public benefit investments in relevant policies	Enabler 2. **Conducting media campaigns to raise public awareness of NBS** (mean score: 8.15/10-point scale) • Engage celebrities, influencers, and youtubers to promote NBS • Utilize various media channels including internet, TV, and radio • Create "NBS premieres" featuring high-profile figures discussing their NBS projects • Use PR and marketing agencies to develop engaging content	Enabler 2. **Providing NBS training for professionals across sectors to build awareness and skills** (mean score: 7.88/10-point scale) • Organize training courses led by scientific entities and NGOs • Utilize the European Commission's Technical Support Facility • Engage leaders from big cities to share best practices
Enabler 3. **Use of financial tools, such as green bonds and payments for ecosystem services, to support the NBS** (mean score: 6.21/10-point scale) • Explore existing financing mechanisms like European Commission funds for wetland strategy and RDP funds for afforestation • Develop tax relief systems for residents, companies, and farmers implementing NBS • Introduce property tax relief for having NBS	Enabler 3. **Securing public and private sector funding for NBS initiatives - Investment Fund** (mean score: 7.64/10-point scale) • Encourage cooperation between farmers, business associations, and local authorities • Engage the private sector in investigating ways to benefit from NBS implementation.	Enabler 3. **Involving the public in NBS planning and design to build ownership and responsibility** (mean score: 7.94/10-point scale) • Implement participatory budgeting with additional points for citizen-implemented projects • Organize campaigns with giveaways to attract initial interest • Conduct surveys to gather public opinion	Enabler 3. **Forging partnerships with influential organizations to amplify NBS awareness efforts** (mean score: 7.61/10-point scale) • Establish collaborations between NGOs, government bodies, and the European Commission • Engage the general public through participatory initiatives
Enabler 4. **Introduce financial products to support NBS projects, such as resilience bonds** (mean score: 6.12/10-point scale) • Create relief opportunities for inhabitants through the Ministry of Finance and local self-government units • Developing insurance products that reward the use of NBS • Include the insurance sector in the national adaptation strategy • Engage the Polish Insurance Association to prepare reports on catastrophe costs	Enabler 4. **Introduce provisions prioritising NBS implementation in water and climate change adaptation policies, streamlining NBS project approval processes** (mean score: 7.50/10-point scale) • Develop clear definitions and guidelines for NBS in legislation • Establish longer commitment periods for bodies managing natural resources • Implement control measures for the long-term efficiency of NBS solutions	Enabler 4. **Developing core curricula and courses to bring NBS issues closer to the public** (mean score: 7.73/10-point scale) • Incorporate NBS topics into school curricula from an early age • Develop specialized courses on NBS at universities • Engage the University of the Third Age to reach older demographics • Utilize the Agricultural Advisory Centre to educate farmers	Enabler 4. **Development of Comprehensive Legislation and Regulations Targeted Outreach and Communication** (mean score: 7.27/10-point scale) • Collaborate between ministries, scientific entities, and NGOs to develop clear NBS legislation • Incorporate NBS into existing environmental and urban planning regulations

	Enabler 5. **Identify and link NBS experts and activists with ministries and political leaders to facilitate the integration of NBS into sectoral policies and national programs** (mean score: 6.94/10-point scale) (1) Launch partnerships and working groups between ministries and NGOs (2) Create coalitions of NGOs to amplify bottom-up pressures on politicians	Enabler 5. **Creating platforms accessible to the public to share information and experiences on NBS best practices** (mean score: 7.18/10-point scale) (3) Develop visually appealing and interactive platforms (4) Create gamification elements, such as "catching NBS like Pokemon" (5) Implement interactive boards and QR codes in the field to explain NBS	Enabler 5. **Organizing events, workshops, and media campaigns to bring NBS into the mainstream** (mean score: 6.4/10-point scale) (6) Utilize public administration and NGOs to organize awareness events (7) Engage local initiatives like rural housewives' clubs and voluntary fire brigades (8) Leverage celebrities and influencers for a broader reach

Table 9 illustrates how workshop participants rated (in the pre-workshop survey) and described barriers and their enablers.

To address the barrier of limited financial resources, several key enablers were proposed. The highest-rated enabler, with a mean score of 7.55 out of 10, is the creation of an NBS Project Preparation Finance Fund. This would involve utilizing existing programs supporting urban climate change adaptation plans and leveraging funds from the Polish Recovery and Resilience Plan for green-blue infrastructure in rural areas. Other financial enablers include developing an investment fund combining public and private resources (6.42/10), using financial tools like green bonds and payments for ecosystem services (6.21/10), and introducing financial products such as resilience bonds (6.12/10).

For the lack of political will, the workshop identified several promising enablers. The highest-rated enabler is campaigns to promote NBS implementations, scoring 8.42 out of 10. This involves utilizing NGOs and local activists to promote NBS, leveraging existing programs, and including clear political obligations. Other important enablers include integrating NBS into national policies (7.67/10), securing public and private sector funding for NBS initiatives (7.64/10), and introducing provisions prioritizing NBS implementation in water and climate change adaptation policies (7.50/10). Additionally, the workshop emphasized the importance of identifying and linking NBS experts and activists with ministries and political leaders to facilitate the integration of NBS into sectoral policies and national programs (6.94/10). This enabler focuses on launching partnerships and working groups between ministries and NGOs, as well as creating coalitions of NGOs to amplify bottom-up pressures on politicians.

Addressing the lack of public understanding of NBS, the workshop highlighted implementing pilot projects to demonstrate tangible benefits as the most effective enabler, scoring 8.30 out of 10. This involves organizing study visits for various groups and securing funding for pilot project start-ups. Other enablers include conducting media campaigns (8.15/10), involving the public in NBS planning and design (7.94/10), and developing core curricula and courses (7.73/10). The workshop also stressed the importance of creating platforms accessible to the public to share information and experiences on NBS best practices (7.18/10). This enabler suggests developing visually appealing and interactive platforms, creating gamification elements, and implementing interactive boards and QR codes in the field to explain NBS.

For the barrier of lack of awareness among decision-makers, professionals, and the general public, the highest-rated enabler is implementing and showcasing successful NBS projects, scoring 8.09 out of 10. This involves highlighting successful implementations by government agencies and local authorities and creating a database of case studies. Other key enablers include providing NBS training for professionals across sectors (7.88/10), forging partnerships with influential organizations (7.61/10), and developing comprehensive legislation and regulations (7.27/10). The workshop also highlighted the importance of organizing events, workshops, and media campaigns to bring NBS into the mainstream (6.4/10). This enabler focuses on utilizing public administration and NGOs to organize awareness events, engaging local initiatives like rural housewives' clubs and voluntary fire brigades, and leveraging celebrities and influencers for broader reach.

An additional enabler suggested by participants, which was not initially represented in the table, involves giving high priority to NBS in legislation by incorporating it into managerial competencies across relevant sectors. This approach aims to provide concrete benefits (not only financial) to encourage NBS adoption.

Table 10 Key stakeholders, bridging actors, and challenges and resistance in Poland

	Addressing barrier 1. Lack of financial resources	Addressing barrier 2. Lack of Political Will	Addressing barrier 3. Lack of Public Understanding of the NBS	Addressing barrier 4. Lack of awareness of NBS
Key stakeholders in activating enablers & roles	• Ministries (Finance, Agriculture, Climate and Environment): Develop and implement NBS-friendly policies and financial mechanisms • Local authorities: Implement NBS at community level • Large companies, entrepreneurs, banks, insurance companies: Contribute to funding and implementing NBS • Private sector: Investigate ways to earn from NBS implementation • European Commission: Provide funding and set policy directions for NBS • Various sectors: Provide expertise, raise awareness, translate complex NBS concepts	• Ministries (Infrastructure, Climate and Environment, Agriculture): Develop and implement NBS-friendly policies • Local authorities: Implement NBS at community level • Academic/Research Institutions: Provide scientific evidence, identify legal gaps and inconsistencies • Farmers/business associations: Secure resources for NBS • Private companies: Investigate benefits from NBS implementation • NGOs: Promote NBS, create bottom-up pressure for change	• Ministries (Education, Climate and Environment, Agriculture): Develop educational programs and policies • Local authorities: Implement NBS projects, facilitate community engagement · Schools/universities: Educate future generations about NBS • Agricultural Advisory Centre: Reach farmers and rural communities • Media/Influencers: Disseminate information, raise awareness • Farmers, residents, local groups: Potential beneficiaries and key players in NBS implementation	• Ministries (Climate and Environment, Infrastructure, Agriculture, Education): Develop policies and regulations • Local authorities: Implement NBS at community level • Academic/research institutions: Provide expertise, collaborate with government, develop courses and research • Private sector: Engage in NBS implementation, form public-private partnerships
Bridging actors	• Experts, teachers, researchers, and media promote implemented practices, increase education about nature, and highlight non-material NBS benefits.	• European Commission, decision-makers, cross-sectoral policies, and national/international groups act as bridging factors. Media, universities, and NGOs create awareness through memes and slogans. Visualizations promote good practices and hold politicians accountable.	• Media, educational institutions, and community leaders act as crucial bridging factors. Social media reaches younger generations. Professional organizations and academia provide credible information and expertise for public education.	• Scientific entities, NGOs, and European Commission provide neutral expertise and facilitate dialogue. • Educational institutions raise early awareness, while media disseminates information broadly.
Challenges & Resistance	• Lack of public-private cooperation culture in Poland • Limited understanding of long-term NBS benefits • Legislation not recognizing or prioritizing NBS • Insurance companies' reluctance to offer NBS-related products	• Conflicts between regulations and undefined NBS terms • Short-term nature of politicians' commitments • Lack of clear monetary arguments for NBS • Silo thinking and unawareness of interconnected issues • Perception of NBS as restriction to investments/business	• Lack of widespread willingness among educators • Underestimation of NBS role compared to other priorities • Knowledge gaps among teachers and public • Resistance to change, especially in older generations • Concerns about negative aspects of NBS (e.g., fallen leaves, ticks) · Economic considerations in agricultural production	• Diluted responsibility and lack of cross-sector cooperation • Lack of understanding NBS benefits • NBS seen as interfering with traditional investments • Bureaucratic hurdles, lack of training resources • Conflicting political/private interests • Short political cycles limiting long-term vision

Table 10 addresses key stakeholders in activating enablers and their roles, bridging actors and challenges, and resistance around four critical barriers in Poland for implementing NBS. In addition to the workshop results, the following text elaborates on the results of the desktop research.

To address the barrier of limited financial resources, key stakeholders include Ministries (for Finance, Agriculture, Climate, and Environment) that should develop and implement NBS-supportive policies and financial mechanisms. *The Minister of Infrastructure* is responsible for water management, e.g. for shaping, protecting, and rational use of water resources; maintenance of inland surface waters, owned by the State Treasury together with the technical infrastructure related to these waters; maintenance of inland waterways, in agreement with the minister in charge of the navigation of inland waterways; flood protection, including the construction, modernization, and maintenance of water facilities protecting against flooding; operation of the state hydrological and meteorological service; international cooperation on border waters within the scope of tasks belonging to the department. The Minister should define the requirements for the development of the maps of flood hazard (MZP) and maps of flood risk (MRP). He also supervises the activities of the President of the President of the State Water Management Authority Wody Polskie PGW Wody Polskieand the Institute of Meteorology and Water Management – National Research Institute (IMGW-PIB) as stated in the Water Law Act (e.g. approval of programs for the implementation of tasks related to the maintenance of water or water devices and investments in water management; approval of the annual report and the water management control plan performed by the President of the National Water Management Authority; recommending controls not included in the control plan). Another important stakeholder is the *President of PGW Wody Polskie.* It is the central body of government administration responsible for water management issues, supervised by the minister responsible for water management. He exercises ownership rights in relation to public waters owned by the State Treasury as well as to waters important for the shaping of water resources and flood protection. Following the Water Law Act, he prepares preliminary flood risk assessments, flood hazard maps, and flood risk maps for river basin districts. He also should ensure the active participation of all interested parties in achieving the objectives of flood risk management, in particular in the preparation, review, and update of the FMPs and making them public. Finally, he supervises the functioning of the national hydrological and meteorological service. The *Director of Regional Water Management Authorities (RZGW)* – it is a governmental administration body non-subordinate government administration body, responsible for water management in the water region, within the scope of the Act, reporting to the President of the PGW Wody Polskie (Polish Waters). He performs his tasks with the assistance of the Regional Water Management Authority, which acts on the basis of the Water Law and the Regulation of the Council of Ministers on the delimitation of river basin districts and water regions. In particular, the tasks include coordination of flood protection measures in the water region, operation of flood protection; coordination and information centers; preparation of the drafts of PZRP for the water regions; cooperation in the preparation of the preliminary flood risk assessment and the PZRP for the river basin districts. Importantly, he gives permissions (agreements) for the study of conditions and directions for the spatial development of a commune and a strategy for the development of a voivodeship also including the creation of maps of flood hazards and risks; local spatial development plans and spatial development plans referring to water intake protection zones, protection areas of inland water reservoirs and areas at risk of flooding; establishing the location of public purpose investments and approval for projects requiring water permits. Also, the *Voivodes and Voivodship Marshals* are relevant. It is the provincial governor's competent authority for water management that gives an opinion on the drafts of the preliminary flood risk assessment prepared by the President of the PGW Wody Polskie. He has to recognize decisions issued by the director of the RZGW on ordering the water damming to lower the water level or to empty the reservoir, without compensation. He is responsible for ensuring the cooperation of all governmental and self-

governmental administration bodies operating in the voivodship and directing their activities in preventing threats to life, health, or property and threats to the environment, state security, and the maintenance of public order, the protection of citizens' rights, as well as the prevention of natural disasters and other extraordinary threats and the combating and removing their effects; assessing the state of flood protection of the Voivodship, development of an operational plan for flood protection, as well as the promulgation and withdrawal of flood control measures in the Voivodship.

Local authorities also play a crucial role in implementing NBS at the community level, while large companies, entrepreneurs, banks, and insurance companies can contribute to funding and implementing NBS. The European Commission provides funding and sets policy directions. Experts, teachers, researchers, and media act as bridging actors by promoting implemented practices and highlighting non-material NBS benefits. Challenges include a lack of public-private cooperation culture, limited understanding of long-term NBS benefits, and legislation not recognizing or prioritizing NBS.

For the lack of political will, ministries (Infrastructure, Climate and Environment, Agriculture) should take the lead in developing and implementing NBS-friendly policies. Academic and research institutions provide scientific evidence and identify legal gaps, while NGOs promote NBS and create bottom-up pressure for change. The European Commission, decision-makers, and cross-sectoral policies act as bridging factors. Media, universities, and NGOs create awareness through various means. Challenges include conflicts between regulations, short-term political commitments, and the perception of NBS as a restriction of investments.

Addressing the lack of public understanding of NBS involves ministries (Education, Climate and Environment, Agriculture) developing educational programs and policies. Schools, universities, and the Agricultural Advisory Centre play crucial roles in education. Media, educational institutions, and community leaders act as bridging factors, with social media reaching younger generations. Challenges include a lack of willingness among educators, knowledge gaps, and resistance to change, especially among older generations.

For the barrier of lack of awareness among decision-makers, professionals, and the general public, ministries should lead in developing policies and regulations. Academic institutions provide expertise and develop courses, while the private sector engages in NBS implementation. Scientific entities, NGOs, and the European Commission act as bridging factors by providing neutral expertise. Challenges include diluted responsibility, lack of cross-sector cooperation, and short political cycles limiting long-term vision.

7.5 Linking the barrier/enabler analysis to the existing policy framework

In this chapter, we provide a synopsis of the policy analysis. More details are provided in Annex A and B.

The Regulation of the Council of Ministers outlines a comprehensive framework for flood risk management in Poland and assigns responsibilities to various stakeholders across different administrative levels, from the Minister of the Infrastructure, who oversees national water management and flood protection, to regional and local authorities responsible for implementing specific measures. Among the entities that are currently deciding on the need for specific NBS for the management of natural hazard-related risks in the wider region are Polish Waters (e.g. operates some polders for reducing flood risk), self-governments and marshal offices (e.g. operate small reservoirs/ponds, infiltration basins, infiltration ditches), and property owners (e.g. operate rainwater gardens, infiltration basins, and small reservoirs).

The EU directives (e.g. Flood Directive), EU guidelines (e.g. EU Strategy on Adaptation to Climate Change, EU Green Infrastructure Strategy), and UN SDGs encourage the use of European and international financial instruments to support flood protection projects. The

key national regulation is the Flood Risk Management Plan (PZRP) which is aligned with these Directives and act for preventing an increase in flood risk, reducing existing risks, and improving the flood management system. The national regulations emphasize traditional infrastructure but also recognize the potential of NBS. However, NBS integration is hindered by outdated spatial plans, limited public awareness, legal challenges, and a lack of institutional reforms. Still, there are no legal documents tackling the issue of applying NBS to water risk management, thus NBS remains a facultative approach. The object-specific standards are developed locally by the owner(s) of the area and water.

The use of NBS is conditioned by the necessity of prior implementation of instruments, including legal ones that enable their realization. Moreover, several challenges hamper NBS realization. Among them is a lack of general discussion about the role of NBS in water risk management, and outdated spatial plans that exhibit path dependency. Thus, conventional gray infrastructure remains the most frequently preferred measure, neglecting the requirements for integrating NBS. Additionally, land acquisition poses a frequent topic of discussion, especially concerning the legal aspects of operationalization and compensation issues related to the proposed measures' locations. Finally, there are no foreseeable institutional reforms in the short term for the modernization of legislation in the field of natural hazard management using the NBS concept, indicating a lack of possibilities for legislative modernization.

A number of existing financial sources at different levels (incl. international ones) can provide support and additional resources for NBS development. Setting direct incentives/disincentives by the regulatory system for the use of NBS for managing natural hazard-related risks can improve the situation. National funding, primarily sourced from tax revenues, along with public funds from local government and authority budgets, funding from European Banks, international cooperation funds, civil society contributions, and various supportive measures (such as enhancing knowledge, raising awareness, and promoting stakeholder collaboration) create additional opportunities for the implementation of NBS in Poland.

7.6 Key Takeaways for Poland

Based on the analysis of the barriers and their corresponding enablers for the Pilica River Basin, several key takeaways and strategies emerge for mainstreaming NBS in Poland:

1. Developing *innovative financing mechanisms* is crucial, including creating a dedicated national "Natural Infrastructure Fund" that consolidates funds from various sources.
2. There is a strong emphasis on the need to *integrate NBS into various policy sectors*, requiring coordinated efforts across different ministries and levels of government.
3. Addressing the knowledge gap about NBS among stakeholders is fundamental. This includes *integrating NBS concepts into formal educational curricula and professional training programs*.
4. Implementing and showcasing successful NBS projects is consistently ranked as one of the most important enablers. *Tangible, visible NBS examples* are crucial for building awareness and acceptance.
5. *Engaging local communities and stakeholders* in the planning, design, and implementation of NBS is seen as critical for ensuring relevance and long-term success.
6. *Enhancing NBS monitoring and evidence collection* is vital for demonstrating effectiveness and building confidence in these solutions.
7. *Improving horizontal and vertical coordination among different sectors and levels* of government is crucial for effective NBS implementation.
8. There is a need for *legislative changes to support NBS implementation*, including addressing conflicts between different laws and regulations.

9. *Leveraging existing environmental values and local stewardship* can be a powerful catalyst for garnering public backing for NBS.
10. Exploring the *role of the private sector, including insurance companies and large corporations*, in supporting and implementing NBS is seen as an important strategy.

8 Jadar and Tamnava River Basin, Serbia: Options for Mainstreaming NBS

8.1 Introduction to the sites

Both the Jadar as well as the Tamnava River Basins are located in Serbia.

The Jadar River, a right tributary of the Drina River, spans a length of 81.7 km and encompasses a catchment area of approximately 990 sq. km. Its primary left tributary, the Likodra River, originates in the town of Krupanj, where it is fed by four torrential tributaries.

The winter can be severe with abundant snowfalls, while summer is hot and long. The topography of the area is formed by mountains (less than 1000 m a.sl. in elevation) at the watershed and flat at the valley of the main river course. Soils and geology in lowlands are represented by gravel, sand, and clay sediments deposited by the Drina and its tributaries. Agriculture is the main land use type in this area.

Both urban and rural areas of the Krupanj municipality experienced devastating flash floods, resulting in loss of life and extensive material damage. Other hydro-meteorological hazards encompass erosion processes and landslides.

Recent assessments indicate that existing flood mitigation measures are inadequate, attributable to a combination of natural and human-induced factors. NBS measures proposed within RECONECT include checking dams, afforestation and reforestation, forest conservation, retention ponds, removing obstacles, bank stabilization, and buffer strips.

The Tamnava River Basin is part of the larger Kolubara watershed and spans an area of 726 sq. km. The mean annual temperature is 11.4 ºC, whereas the mean temperatures in the winter/summer seasons reached 1.5 ºC and 21.9 ºC respectively. The relief in the upstream is formed by mountainous and is moderately hilly (prone to flash floods). However, the downstream (middle and lower sections) is represented by the lowland (flat river valleys). Elevation ranges between 76 m.a.s.l. at and 1346 m.a.s.l. Sands, sandy clays, sandy limestones, and conglomerates, along with gravels and alluvium are typical geological and soil features. It predominantly comprises arable cultivated land (79.3%), with minimal urbanized and industrial areas (1.2%).

Flooding (fluvial and flash floods) and erosion processes occur due to insufficient protective measures. Current flood mitigation efforts include levees constructed along various segments of the Tamnava and Ub rivers, engineered to withstand floods ranging from 25 to 100 years in recurrence.

NBS measures to be realized are composed of retention ponds, afforestation and reforestation, floodplain restoration, buffer strips, and removal of obstacles from river channels.

8.2 Co-creation activities

The analysis of barriers and enablers for NBS implementation in the Jadar and Tamnava River Basins, Serbia, is grounded in a series of co-creation activities. These activities were designed to engage a diverse range of stakeholders, ensuring that the insights gathered represent a comprehensive view of the local context. Figure 10 illustrates the timeline and components of these co-creation activities.

Figure 10 Co-creation activities in Serbia, Jadar and Tamnava River Basins

The co-creation process consisted of three main components:

1. Workshops for Jadar and Tamnava River Basins
   - Jadar River Basin workshop (Data Collection): December 9, 2022, in Krupanj (25 participants)
   - Tamnava River Basin workshop (Data Collection): December 2, 2022, in Ub (23 participants)
   - Validation workshop: February 23, 2023, in Krupanj (16 participants)

These workshops brought together representatives from various sectors, including public authorities, academia, and the private sector. The diverse participation ensured a multi-faceted approach to identifying barriers and potential solutions for NBS implementation.

2. Pre-survey
   - Conducted before the national workshop
   - Focus: Evaluation of potential enablers for key identified barriers

This survey provided quantitative and qualitative data on the perceived effectiveness of various enablers, laying the groundwork for more targeted discussions in the subsequent national workshop.

3. National Workshop
   - April 3, 2024, in Belgrade (61 participants)
   - Sectors represented: Authority (18), Academia (30), NGO (2), Commercial (consultants) (9), Local authority (2)
   - Key activities: Presentations on NBS and the RECONECT project, stakeholder mapping, collaborative discussion on barriers and enablers

The national workshop focused on four key barriers: 1) Lack of Financial Resources for NBS, 2) Lack of political will and long-term commitment, 3) Lack of knowledge of NBS, and 4) Lack of Legal Basis for Land Acquisition, Compensation, and Incentives. Participants were engaged in stakeholder mapping and collaborative discussions to identify key actors and potential strategies for overcoming these barriers.

The insights, data, and stakeholder perspectives gathered through these co-creation activities form the foundation for the subsequent analysis presented in this chapter. By grounding our findings in these participatory processes, we ensure that the barriers identified and the enablers proposed are deeply rooted in local realities and reflect the collective wisdom of those most intimately familiar with the challenges and opportunities in the Jadar and Tamnava River Basins.

The following sections will delve into the specific outcomes of these co-creation activities, exploring the identified barriers, potential enablers, and the roles of various stakeholders in driving of or resisting to change toward NBS implementation in the Jadar and Tamnava River Basins, Serbia.

8.3 Local acceptance of NBS in Jadar and Tamnava River Basins

The acceptability study conducted as part of the co-creation activities in the Jadar and Tamnava River Basins provided crucial insights into local stakeholders' perspectives on NBS implementation. The Q-methodology findings suggest that stakeholders in both basins are generally supportive of NBS projects and have a positive outlook towards their realization, provided that certain key procedural aspects are properly addressed and the benefits of NBS are clearly communicated. Key findings are as follows:

1. **Transparent and Participatory Process**
   - In both basins, stakeholders strongly emphasize the importance of an open and transparent process throughout the planning and implementation stages of NBS projects.
   - Clear communication, information sharing, and involvement of the local community in decision-making processes are seen as crucial for building trust and fostering a sense of ownership among stakeholders.
2. **Fair Land Acquisition Process**
   - Stakeholders in both basins place significant emphasis on the importance of a fair land acquisition process as a key factor in increasing the acceptance of NBS projects.
   - An equitable, transparent, and participatory land acquisition process is seen as essential for enhancing the likelihood of stakeholders embracing NBS initiatives.
3. **Proper Compensation**
   - The importance of fair and equitable compensation for any potential losses or inconveniences incurred due to NBS implementation is highlighted in both basins.
   - Stakeholders stress the need for transparent and inclusive compensation processes that take into account the specific needs and concerns of the local community.
4. **Positive Perception of NBS Impacts**
   - In both basins, stakeholders strongly disagree with statements suggesting potential negative impacts of NBS.
   - They do not believe that NBS would result in inconveniences, reduce quality of life, limit accessibility to rivers, or have negative aesthetic impacts on the area.
5. **Knowledge Gap**
   - In the Tamnava River Basin, many stakeholders do not yet fully understand how NBS would work in their specific locality, highlighting the need for targeted education and awareness-raising efforts.
   - Stakeholders in both basins recognize the need for more scientific evidence to demonstrate the effectiveness of NBS in managing hydrometeorological risks.
6. **Perception of NBS Maintenance**
   - Stakeholders in the Tamnava River Basin disagree with the idea that NBS maintenance is complicated, indicating a positive perception of the feasibility and manageability of these solutions.

In conclusion, to enhance local acceptance of NBS in the Jadar and Tamnava River Basins, the following aspects should be considered:

- Ensuring transparent and participatory processes throughout NBS planning and implementation
- Developing fair and equitable land acquisition procedures
- Establishing clear and inclusive compensation mechanisms
- Conducting targeted education and awareness-raising efforts to address knowledge gaps
- Investing in research and monitoring to provide scientific evidence of NBS effectiveness
- Demonstrating the feasibility and manageability of NBS maintenance

By focusing on these aspects, stakeholders can work towards creating a more conducive environment for the successful adoption and implementation of NBS in the Jadar and Tamnava River Basins, building on the generally positive outlook that already exists among local stakeholders.

8.4 Overcoming key barriers

The co-creation activities revealed several key barriers to the implementation of NBS in the Jadar and Tamnava River Basins, (detailed in RECONECT Deliverable 4.6), as well as potential enablers to overcome these challenges. Figure 11 illustrates the key identified barriers (i.e. high transformative potential barriers and/or high centrality barriers) and enablers discussed in the survey. In the national workshop, the participants discussed the following key barriers,1) Lack of Financial Resources for NBS, 2) Lack of political will and long-term commitment, 3) Lack of knowledge of NBS, and 4) Lack of Legal Basis for Land Acquisition, Compensation, and Incentives, among decision-makers, professionals and the general public, and how they can be overcome by more specific enablers.

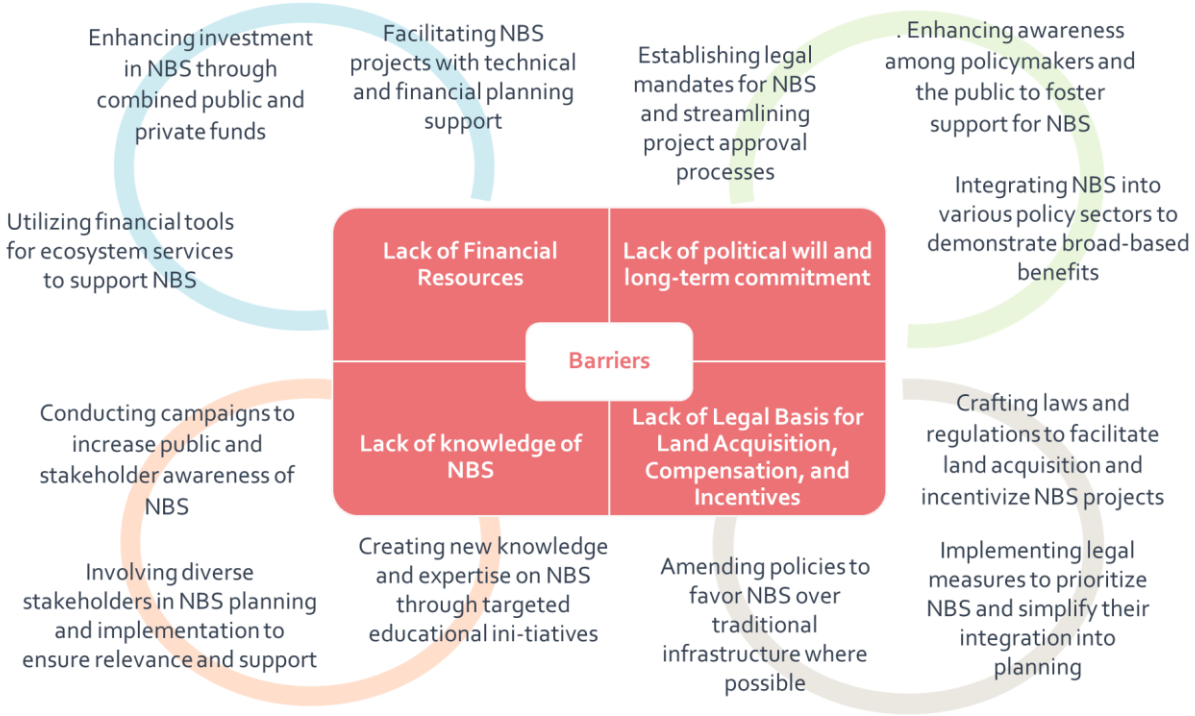

Figure 11 Barriers and their enablers in Serbia

Table 11 Key barriers and enablers in Serbia

Barrier 1. Lack of Financial Resources for the NBS	Barrier 2. Lack of Political Will and Long-term Commitment	Barrier 3. Lack of knowledge of NBS	Barrier 4. Lack of Legal Basis for Land Acquisition, Compensation, and Incentives
Enabler 1. **Facilitating NBS projects with technical and financial planning support** (mean score: 6.36/9-point scale) • Develop systemic activities of competent ministries to enhance the regulatory framework for NBS implementation • Propose appropriate measures for the implementation of public policies supporting NBS • Enable the existence of financial products that support NBS	Enabler 1. **Establishing legal mandates for NBS and streamlining project approval processes** (mean score: 7.82/9-point scale) • Transpose and impose EU legislation and regulations to establish legal support for NBS • Make obtaining location permits conditional on "respecting nature," similar to waste management plan requirements • Improve inter-sectoral cooperation to represent different interests across sectors	Enabler 1. **Conducting campaigns to increase public and stakeholder awareness of NBS** (mean score: 7.73/9-point scale) • Develop targeted awareness campaigns for different stakeholder groups • Utilize various media channels to disseminate information about NBS benefits and success stories • Organize public events and workshops to showcase NBS projects	Enabler 1. **Crafting laws and regulations to facilitate land acquisition and incentivize NBS projects** (mean score: 7.36/9-point scale) • Analyze existing laws and regulations in detail • Make changes and additions to relevant laws, such as the Law on Planning and Construction • Enable horizontal linking between different laws
Enabler 2. **Introducing financial products that support NBS projects, such as resilience bonds** (mean score: 5.36/9-point scale) • Explore and develop new financial instruments specifically designed to support NBS projects • Engage financial institutions in creating products that incentivize NBS implementation	Enabler 2. **Enhancing awareness among policymakers and the public to foster support for NBS (mean score: 7.45/9-point scale)** • Engage environmental influencers and environmentally oriented politicians • Utilize educational institutions and public media services to raise awareness • Organize international promotional conferences	Enabler 2. **Involving diverse stakeholders in NBS planning and implementation to ensure relevance and support** (mean score: 7.55/9-point scale) • Create platforms for multi-stakeholder engagement in NBS planning processes • Establish participatory decision-making mechanisms for NBS projects • Encourage co-creation of NBS solutions with local communities	Enabler 2**. Implementing legal measures to prioritize NBS and simplify their integration into planning** (mean score: 6.82/9-point scale) • Define clear legally binding targets for NBS implementation • Consider digitalization as a way of implementing NBSs in a broader sense • Simplify lower-rank regulations while maintaining standard procedures for higher-rank ones
Enabler 3. **Enhancing investment in NBS through combined public and private funds** (mean score: 4.82/9-point scale) • Develop mechanisms to blend public and private funding for NBS projects • Create incentives for private sector involvement in NBS financing	Enabler 3. **Leveraging the advocacy of NBS proponents to motivate engagement and implementation policies,** streamlining NBS project approval processes (mean score: 7.50/10-point scale) • Develop clear definitions and guidelines for NBS in legislation • Establish longer commitment periods for bodies managing natural resources • Implement control measures for long-term efficiency of NBS solutions	Enabler 3. **Enhancing NBS monitoring and evidence collection to support effective implementation** (mean score: 7.55/9-point scale) • Establish comprehensive monitoring systems for NBS projects • Develop standardized methodologies for assessing NBS effectiveness • Create platforms for sharing data and best practices among practitioners	Enabler 3. **Amending policies to favor NBS over traditional infrastructure where possible** (mean score: 6.18/9-point scale) • Better define the relation between NBS and traditional measures • Consider hybrid solutions that include both NBS and gray infrastructure
Enabler 4. **Developing insurance products that de-risk the project risks** (mean score: 4.72/9-point scale) • Work with insurance companies to create products that mitigate risks associated with NBS projects • Explore ways to make NBS projects more attractive to investors by reducing perceived risks	Enabler 4. **Integrating NBS into various policy sectors to demonstrate broad-based benefits** (mean score: 6.82/9-point scale) • Revise the current Law on Water, particularly in terms of shifting from administrative jurisdictions to watershed-based management • Incorporate NBS considerations into various sectoral policies	Enabler 4. **Creating new knowledge and expertise on NBS through targeted educational initiatives** (mean score: 6.91/9-point scale) • Develop specialized courses and curricula on NBS at various educational levels • Organize training programs for professionals in relevant fields • Support research initiatives focused on NBS effectiveness and implementation	Enabler 4. **Establishing dedicated bodies to oversee and promote NBS initiatives** (mean score: 8/10-point scale) • Introduce NBS definition and list into supreme law • Implement NBS concepts into other laws through vertical linking • Promote NBS in different strategies and policies (water management, agriculture, forestry, climate changes, rural development)

Table 11 illustrates how workshop participants rated (in the pre-workshop survey) and described barriers and their enablers.

To address the barrier of limited financial resources, the highest-rated enabler is facilitating NBS projects with technical and financial planning support, scoring 6.36 out of 9. This involves developing systemic activities to enhance the regulatory framework, proposing appropriate measures for public policies supporting NBS, and enabling financial products that support NBS. Other financial enablers include introducing financial products such as resilience bonds (5.36/9), enhancing investment through combined public and private funds (4.82/9), and developing insurance products to de-risk projects (4.72/9).

For the lack of political will and long-term commitment, the top-rated enabler is establishing legal mandates for NBS and streamlining project approval processes, scoring 7.82 out of 9. This includes transposing EU legislation, making location permits conditional on "respecting nature," and improving inter-sectoral cooperation. Other important enablers include enhancing awareness among policymakers and the public (7.45/9), integrating NBS into various policy sectors (6.82/9), and leveraging the advocacy of NBS proponents (7.50/10).

Addressing the lack of knowledge of NBS, the highest-rated enabler is conducting campaigns to increase public and stakeholder awareness, scoring 7.73 out of 9. This involves developing targeted awareness campaigns, utilizing various media channels, and organizing public events. Other key enablers include involving diverse stakeholders in NBS planning and implementation (7.55/9), creating new knowledge through educational initiatives (6.91/9), and enhancing NBS monitoring and evidence collection (7.55/9). Importantly, participants suggested an additional enabler: adopting and following good practices regarding NBS from foreign countries. This involves studying successful NBS implemented abroad and participating in international knowledge exchange programs, which could significantly accelerate the adoption of effective NBS strategies in Serbia.

For the barrier of lack of awareness among decision-makers, professionals, and the general public, the top-rated enabler is establishing dedicated bodies to oversee and promote NBS initiatives, scoring 8 out of 10. Other important enablers include crafting laws and regulations to facilitate land acquisition and incentivize NBS projects (7.36/9), implementing legal measures to prioritize NBS (6.82/9), and amending policies to favor NBS over traditional infrastructure where possible (6.18/9). Notably, participants proposed a high-priority additional enabler: defining NBS and introducing their definitions into regulations and laws with lists of NBS. This crucial enabler involves incorporating NBS definitions and lists into supreme law, implementing NBS concepts across various laws through vertical linking, and promoting NBS in different strategies and policies such as water management, agriculture, forestry, climate change, and rural development.

Table 12 Key stakeholders, bridging actors, and challenges and resistance in Serbia

	Addressing barrier 1. Lack of Financial Resources for NBS	Addressing barrier 2. Lack of Political Will and Long-term Commitment	Addressing barrier 3. Lack of knowledge of NBS	Addressing barrier 4. Lack of Legal Basis for Land Acquisition, Compensation, and Incentives
Key stakeholders in activating enablers & roles	• Ministries: Policy-making, introducing NBS-friendly financial products • Republic Water Directorate: Water management policies, NBS implementation • Investors, banks: Funding, financial products • Communities affected by floods: Beneficiaries, advocates • Universities: Research, education, awareness	• Government, ministries, and parliament: Preparing and adopting regulations • EU institutions: Source of legislation for transposition • Environmental influencers and green parties: NBS champions and advocates • Educational institutions: Awareness raising and training • Public media: Information dissemination • Well-paid professionals: Expertise and independent advocacy • Environmentalist associations: NBS implementation advocacy	• Public Water Management Companies: Advocate for NBS implementation • Local communities and influential members: Initiate learning, and support NBS projects • Academia and Educational Institutions: Promote NBS, incorporate into curricula • NGOs: Launch awareness programs • Media: Disseminate information about NBS	• Government of the Republic of Serbia: Main decision-maker for a legal basis • Relevant Ministries (Environmental Protection, Agriculture, Forestry and Water Management, Construction, Transport and Infrastructure, Finance): Responsible for implementation • Universities and research institutions: Provide expertise and clarify facts about NBS • Entire community: Affected by and can influence new legal frameworks
Bridging actors	• Academic community: • Research and education on NBS implementation and financing • Raising awareness about institutional responsibilities • Presenting NBS benefits (economic, ecological, sociological) • Bridging the gap between agents of change and resistance factors	• NGOs: Advocacy and stakeholder bridging • EU legislation: Implementation framework • Extreme climate events: Highlighting the need for hazard protection • Academia: Knowledge provision and awareness-raising • International organizations: Expertise and support • Protected areas: Examples of successful nature-based management	• Media: Promote NBS and raise awareness • Volunteers: Raise awareness at community level • Academia: Educate the general population, perceived as highly credible • Advisors to key decision-makers: Convey NBS importance to formal decision-makers	• Academic community: Clarify NBS facts, and enable communication between change agents and resistance sources • Public opinion: Raise awareness to foster understanding among different actors
Challenges & Resistance	• Ministerial conflicts in project evaluation and budget programming • Conflicting interests between affected and unaffected communities • Insufficient ministerial capacity for NBS planning • Lack of trust in fair resource distribution • Perception of NBS diverting resources from other goals	• Institutional segmentation: Scattered decision-making across ministries • Non-compliance with existing regulations • Outdated legislation, especially Water Law • Political opposition to NBS implementation • Media censorship influenced by power groups • Lack of awareness about NBS benefits among decision-makers	• Investors: May resist due to perceived threats to traditional projects • Local authorities: May favor lucrative "investor-centered" developments over NBS • Ministry of Education: Might be reluctant to incorporate NBS into curricula • Uninformed citizens: May oppose NBS due to misconceptions • Politicians: May not support NBS if perceived as unlucrative	• Lack of implementation of existing laws and regulations • Unsettled property relations on real estate • Lack of knowledge and understanding about NBS • Insufficient human resources to implement new legal frameworks • Potential conflicts between different sectors and stakeholders

Table 12 addresses key stakeholders in activating enablers and their roles, bridging actors and challenges, and resistance around four critical barriers in Serbia for implementing NBS. In addition to the workshop results, the following text elaborates on the results of the desktop research.

Addressing the lack of financial resources involves a range of key stakeholders. Ministries, including Environmental Protection, Agriculture, Forestry, and Water Management are obliged to formulate water management policies, regulate water usage, ensure water supply, protect water sources, implement water protection measures, and monitor water regimes. Additionally, stakeholders, such as public water management companies (JVP "Srbijavode", JVP "Vode Vojvodine", and JVP "Beogradvode",) local governments, and public companies, also play essential roles in responding to flood and other hydro-meteorological hazards. However, also the Ministries for Construction, Transport and Infrastructure, Health, Economy, and Finance, are responsible for policy-making and introducing new financial products that support NBS.

The Republic Water Directorate plays a crucial role in water management policies and NBS implementation. Domestic and foreign investors, along with banks and financial institutions, are potential sources of funding and can develop NBS-friendly financial products. Communities affected by floods are primary beneficiaries and potential advocates for NBS projects. Universities and research institutions provide research, and education, and raise public awareness about NBS financing. The academic community serves as a crucial bridging actor, conducting research, raising awareness, presenting NBS benefits, and bridging gaps between change agents and resistance factors. Challenges include conflicts between ministries, conflicting community interests, insufficient ministerial capacity, lack of trust in resource distribution, and the perception of NBS diverting resources from other goals.

The lack of political will and long-term commitment is addressed by various stakeholders. The government, relevant ministries, and parliament are responsible for preparing and adopting regulations. EU institutions provide a source of legislation and regulations that can be transposed. Environmental influencers, green political parties, and environmentalist associations champion and advocate for NBS. Educational institutions raise awareness and provide training, while public media disseminates information. Well-paid professionals offer expertise and act as independent advocates. NGOs, EU legislation, extreme climate events, international organizations, and protected areas serve as bridging actors, advocating for NBS, providing implementation frameworks, and offering expertise and support. Challenges include institutional segmentation, non-compliance with existing regulations, outdated legislation, political opposition, media censorship, and lack of awareness among decision-makers.

Addressing the lack of knowledge of NBS involves Public Water Management Companies advocating for implementation, local communities initiating and promoting learning about NBS benefits, and academia incorporating NBS into curricula. NGOs launch awareness programs, while the media disseminates information. Volunteers, academia, and advisors to key decision-makers act as bridging actors, raising awareness and conveying the importance of NBS. Challenges include resistance from investors due to perceived threats to traditional projects, local authorities favoring lucrative developments over NBS, reluctance from the Ministry of Education to incorporate NBS into curricula, opposition from uninformed citizens, and lack of political support if NBS is perceived as unlucrative (unprofitable).

Finally, crafting laws and regulations to facilitate land acquisition and incentivize NBS projects involves the Government of Serbia as the main decision-maker for providing a

legal basis. Relevant ministries are responsible for implementation, while universities and research institutions provide expertise. The entire community can influence the implementation of new legal frameworks. The academic community and public opinion serve as bridging actors, clarifying facts about NBS and fostering understanding among different actors. Challenges include a lack of implementation of existing laws, unsettled property relations, lack of knowledge about NBS, insufficient human resources, and potential conflicts between sectors and stakeholders.

8.5 Linking the barrier/enabler analysis to the existing policy framework

In this chapter, we provide a synopsis of the policy. More details are provided in Annex A and B.

Water management in Serbia is a multi-faceted responsibility involving numerous ministries (e.g., construction, transportation, health, environmental protection), agencies, public water management entities, utility companies, and local government bodies. The primary national authorities include the Republic Directorate for Water and the Ministry of Agriculture, Forestry, and Water Management, which oversee water management policy, multipurpose water use, water protection, and flood regulation. Key stakeholders also include public water management companies such as JVP “Srbijavode”, JVP “Vode Vojvodine”, and JVP “Beogradvode”, alongside local governments responsible for managing hydro-meteorological risks. Local municipalities play a crucial role in approving locations for NBS implementation, often influenced by political agendas.

Serbia’s water management and flood risk policies are framed by several EU directives (e.g. Climate Change Framework Law, the Paris Agreement, Flood Directive) and national regulations (e.g. Constitution, Water Management Strategy, Water Law) that cover various aspects of water use and protection, including flood risk management and mapping. Additionally, several guidelines (e.g. EU Strategy on Adaptation to Climate Change, EU Action Plan for a Sendai Framework), and UN SDGs by 2030 are used for establishing national and regional policy instruments (Water management plan, Framework Law on the Protection and Rescue of People & Material Assets from Natural & Other Disasters, National Disaster Risk Reduction Strategy, Municipalities and District programs and plans for flood protection and management). However, the current legislation does not explicitly recognize NBS, and existing laws mostly tend to favor traditional gray infrastructure solutions.

Despite the comprehensive legal framework, lack of political will (politicians often prioritize projects with immediate visible benefits, leading to a lack of support for NBS) and inadequate institutional capacity at all administrative levels hinder effective water management and impede the NBS implementation in Serbia. Other challenges include path dependency (since outdated spatial plans do not align with the needs for NBS, perpetuating reliance on traditional infrastructure) that often leads to land acquisition issues which appear from the problems with securing land for NBS projects, particularly from private owners or in cases of illegal construction. Moreover, there is a scarcity of both human and financial resources to manage crucial flood areas effectively.

Nevertheless, there are several opportunities to enhance NBS adoption in Serbia. The alignment with EU Directives and the ongoing development of strategic planning documents like the Water Management Strategy offer pathways to integrate NBS. The EU and European Banks’ funds as well as civil society funding initiatives (crowdfunding, voluntary work, NGO) provide economic support for NBS development. Various existing soft instruments, such as knowledge-sharing platforms, support for government agencies, and awareness campaigns, can enhance understanding, build capacity, and promote the development and implementation of NBS across local, regional, and national levels.

To sum up, the legislative framework in Serbia does not currently prioritize NBS over conventional/gray solutions. NBS are largely invisible in existing regulations, and there is a lack of stimulating instruments or incentives to promote their adoption. However, the legislation has a good potential to foster NBS implementation. To broadly promote NBS, there is a need for clearer responsibilities among stakeholders, improved strategic planning, and increased political and financial commitment. Enhancing public and political awareness of the long-term benefits of NBS could also drive more robust support and implementation efforts.

8.6 Key Takeaways for Serbia

Based on the analysis of the four key barriers and their corresponding enablers, several overarching themes and strategies emerge for mainstreaming NBS in the Jadar and Tamnava River Basins:

1. There is a critical need to *integrate NBS into various policy sectors*, including water management, agriculture, forestry, and climate change adaptation. This requires a coordinated effort across different ministries and levels of government to create a coherent policy framework that supports NBS implementation.
2. Developing *innovative financing mechanisms* is crucial for overcoming the lack of financial resources. This includes creating new financial products, combining public and private funds, and exploring options such as green bonds and payments for ecosystem services.
3. Establishing a *robust legal basis for NBS* implementation, including clear definitions, land acquisition procedures, and incentive structures, is essential. This involves revising existing laws and crafting new regulations that prioritize NBS where appropriate.
4. Addressing the lack of knowledge about NBS among stakeholders, professionals, and the public is fundamental. This requires *comprehensive education and awareness campaigns*, as well as the integration of NBS concepts into formal educational curricula.
5. *Involving diverse stakeholders in NBS* planning and implementation is crucial for ensuring relevance, support, and long-term success. This includes engaging local communities, NGOs, academic institutions, and the private sector.
6. *Enhancing NBS monitoring and evidence collection* is vital for demonstrating effectiveness and building confidence in these solutions. This involves developing standardized methodologies for assessing NBS and creating platforms for sharing best practices.
7. *Fostering political support and ensuring long-term commitment to NBS* is essential. This requires demonstrating the multiple benefits of NBS, aligning them with political priorities, and creating legal mandates for their implementation.
8. *Improving horizontal and vertical coordination* among different sectors and levels of government is crucial for effective NBS implementation. This includes breaking down silos between water management, environmental protection, and urban planning departments.
9. Developing the *technical expertise and institutional capacity* necessary for designing, implementing, and maintaining NBS is critical. This involves training programs for professionals and strengthening relevant institutions.
10. *Learning from and adopting good practices from other countries* can accelerate NBS adoption. This includes participating in international knowledge exchange programs and adapting successful NBS implementations to the local context.

9 Kamchia River Basin, Bulgaria: Options for Mainstreaming NBS

9.1 Introduction to the site

The Kamchia River Basin is situated in Eastern Bulgaria, spanning an area of 5358 sq. km (approx. 5% of Bulgaria). Being the longest river on the Balkan Peninsula, Kamchia directly flows into the Black Sea. Climate conditions are influenced by two climate zones: Continental and Mediterranean. The mean annual temperature is around 12°C. In January, the mean temperature is -2°C, and in July +25°C. In the sense of topography, the area is predominantly characterized as low mountainous, but plains are also presented. The highest point is peak Bulgarka (1181 m a.s.l.) in Slivenska mountain and the lowest is Kamchia River mouth. In the mountainous areas, the geology is mostly of karst origin, while in the plain it is more siliceous based.

The major part of the river basin is represented by forest and agricultural land but is also covered by Natura 2000 protected areas (39% of the territory). There are mostly rural landscapes characterized by well-developed agriculture, particularly crop cultivation. Notably, the river serves as a crucial water source for the cities of Varna (420,000 inhabitants) and Burgas (280,000 inhabitants), with reservoirs like Ticha and Tsonevo facilitating drinking water supply.

Among the main hydrometeorological hazards are three types of floods: fluvial, pluvial, and flash floods. Currently, flood mitigation efforts in the region rely on levees constructed along various sections of the river basin, engineered to withstand 100-year flood events.

The proposed NBS interventions include: (1) within the main focus area (Dalgopol): removing obstacles, dike restoration, strengthening and relocation, bioswales, wetland channels (wet swales), urban trees/parks, and gates with the control system in the main focus area; (2) within the extended focus area: detention basins (in river flood-plain), afforestation/reforestation (in hilly areas), soil infiltration improvement (agricultural measures, permeable areas), deepening water bodies; widening of water bodies, floodplain rehabilitation (excavation/enlargement/restoration).

9.2 Co-Creation Activities

The analysis of barriers and enablers for NBS implementation in the Kamchia River Basin, Bulgaria, is grounded in a series of co-creation activities. These activities were designed to engage a diverse range of stakeholders, ensuring that the insights gathered represent a comprehensive view of the local context. Figure 12 illustrates the timeline and components of these co-creation activities.

Figure 12 Co-creation activities in Bulgaria, Kamchia River Basin

The co-creation process consisted of three main components:

1. Workshops for Kamchia River Basin

    - First workshop (Data Collection): December 7, 2022, in Varna (28 participants)
    - Second workshop (Validation): February 24, 2023, in Varna (12 participants)

These workshops brought together representatives from various sectors, including public authorities, academia, and the private sector. The diverse participation ensured a multi-faceted approach to identifying barriers and potential solutions for NBS implementation.

The workshops were conducted prior to the national workshop, and diverse activities have identified the barriers to the implementation of NBS.

2. National Workshop

    - June 21, 2024, in Varna (19 participants)
    - Sectors represented: Regional Administration, Black Sea Basin Directorate, Black Sea-Danube Association for Research and Development, Institute of Fish Resources, Bulgarian Academy of Sciences, and private sector
    - Key activities: Presentations on the RECONECT project, real-time monitoring system, and mathematical modeling for hydrometeorological scenarios, identification of enablers, and barriers

The national workshop included presentations on the project's significance, the selected NBS for the Focus Area, and their implementation status. It also featured discussions on the nature, efficiency, specifics, and barriers to implementing NBS. A real-time monitoring system and mathematical model for hydrometeorological scenarios were presented, along with a cost-benefit analysis for NBS.

Following the workshop, participants completed a survey to assess enablers for overcoming barriers to NBS implementation in Bulgaria. This survey provided quantitative and qualitative data on the perceived effectiveness of various enablers, offering insights into stakeholder perspectives on mainstreaming NBS.

The insights, data, and stakeholder perspectives gathered through these co-creation activities form the foundation for the subsequent analysis presented in this chapter. By grounding our findings in these participatory processes, we ensure that the barriers identified, and the enablers proposed are deeply rooted in local realities and reflect the collective wisdom of those most intimately familiar with the challenges and opportunities in the Kamchia River Basin.

The following sections will delve into the specific outcomes of these co-creation activities, exploring the identified barriers, potential enablers, and the roles of various stakeholders in driving or resisting to change toward NBS implementation in the Kamchia River Basin, Bulgaria.

9.3 Local acceptance of NBS in Kamchia River Basin

The acceptability study conducted in the Kamchia River Basin, as detailed in Deliverable 4.5, provides valuable insights into local stakeholders' perspectives on NBS implementation. The findings suggest that stakeholders generally hold a positive outlook towards NBS projects and are supportive of their implementation, provided that certain key procedural aspects are properly addressed. Key findings are as follows:

1. **Stakeholder support:** There is general support for NBS projects among stakeholders, particularly when key procedural aspects are properly addressed.
2. **Transparency and communication**: Stakeholders strongly emphasize the need for an open and transparent process throughout the planning and implementation stages. Clear communication, information sharing, and involvement of the local community in decision-making processes are seen as crucial, especially given the current unstable political environment in Bulgaria and the general lack of public trust in government and local authorities.
3. **Compensation for land use:** Proper compensation for any private land utilized for NBS implementation is identified as a critical factor. Fair compensation schemes are considered essential to ensure the support and buy-in of affected landowners, making this a key determinant of public acceptance of NBS projects in the Kamchia River Basin.
4. **Comparative effectiveness:** While there is general support for NBS, stakeholders acknowledge that not everyone may be fully convinced of their superiority compared to traditional infrastructure. This highlights the need for ongoing education and awareness-raising efforts to communicate the multiple benefits of NBS.
5. **Perception of NBS effectiveness:** Stakeholders disagree with statements suggesting potential negative outcomes of NBS implementation. They do not believe that the town's high exposure to risks would render NBS ineffective, nor do they agree that hard infrastructure measures would necessarily offer better protection than NBS.
6. **Land Use Perception:** Stakeholders reject the notion that there might be more beneficial ways of utilizing the area than implementing NBS, indicating a recognition of the value and potential of these solutions.
7. **Political Acceptance:** Despite positive attitudes among stakeholders, the current political acceptance of NBS in the Kamchia River Basin is not perceived as favorable. Political actors are seen primarily as observers, with their activities being more declarative than executive in nature.

8. **Policy vs. Implementation Gap:** While political actors may advocate for the inclusion of NBS in relevant policy documents, their actual commitment to supporting the implementation of these solutions is viewed as limited.

In conclusion, to enhance local acceptance of NBS in the Kamchia River Basin, the following aspects should be considered:

- Ensuring transparent and participatory processes throughout NBS planning and implementation
- Developing fair and equitable compensation mechanisms for affected landowners
- Conducting targeted education and awareness-raising campaigns to demonstrate the effectiveness and multiple benefits of NBS
- Bridging the gap between policy inclusion and actual implementation of NBS
- Addressing the lack of trust in public authorities through improved communication and community involvement
- Showcasing the comparative advantages of NBS over traditional infrastructure where applicable

9.4 Overcoming Key Barriers

The co-creation activities revealed several key barriers to the implementation of NBS in the Kamchia River Basin (detailed in RECONECT Deliverable 4.6), as well as potential enablers to overcome them. Figure 13 illustrates the key identified barriers (i.e. high transformative potential barriers and/or high centrality barriers) and enablers discussed in the survey. In the national workshop, the participants discussed the following key barriers and how they can be overcome by more specific enablers: 1) Silo thinking, 2) Lack of awareness of NBS, 3) Lack of public participation, and 4) Lack of public understanding of NBS.

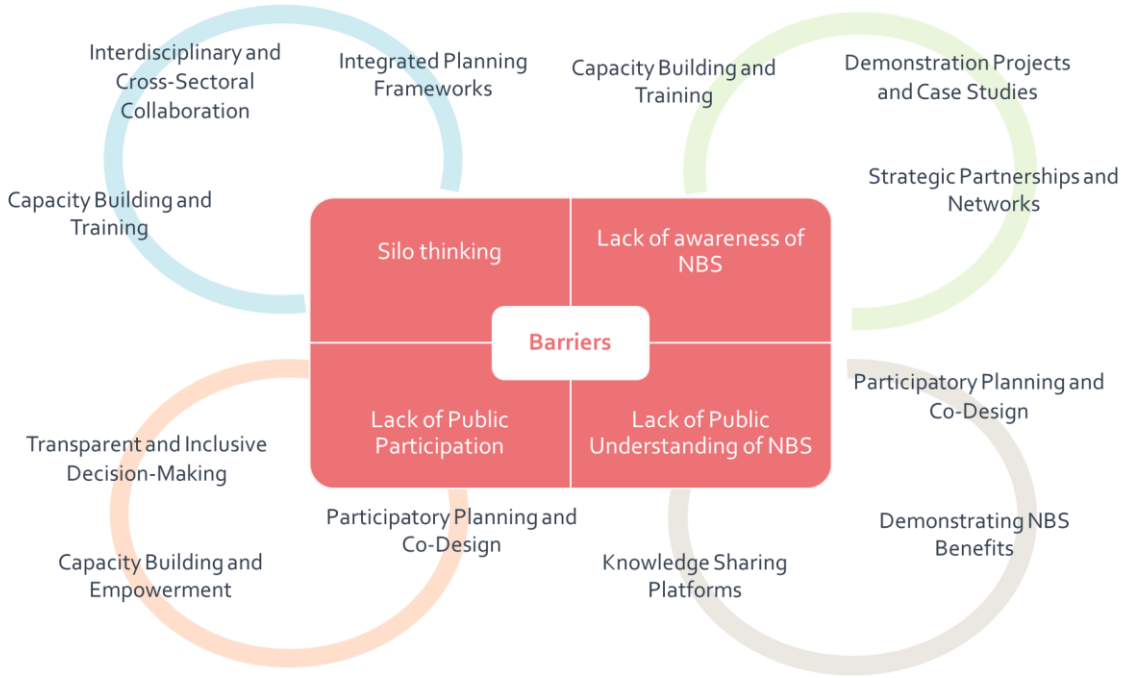

Figure 13 Barriers and their enablers in Bulgaria

Details of these barriers and enablers are discussed in the next section. The structure of the chapter for Bulgaria differs from other chapters because the national workshop was organized differently.

Barrier 1. Silo Thinking

Silo thinking is characterized by fragmented decision-making and a lack of cross-sectoral collaboration, which hinders the integrated planning and implementation of NBS. The survey results provide valuable insights into how stakeholders perceive this barrier and potential ways to overcome it Figure 14.

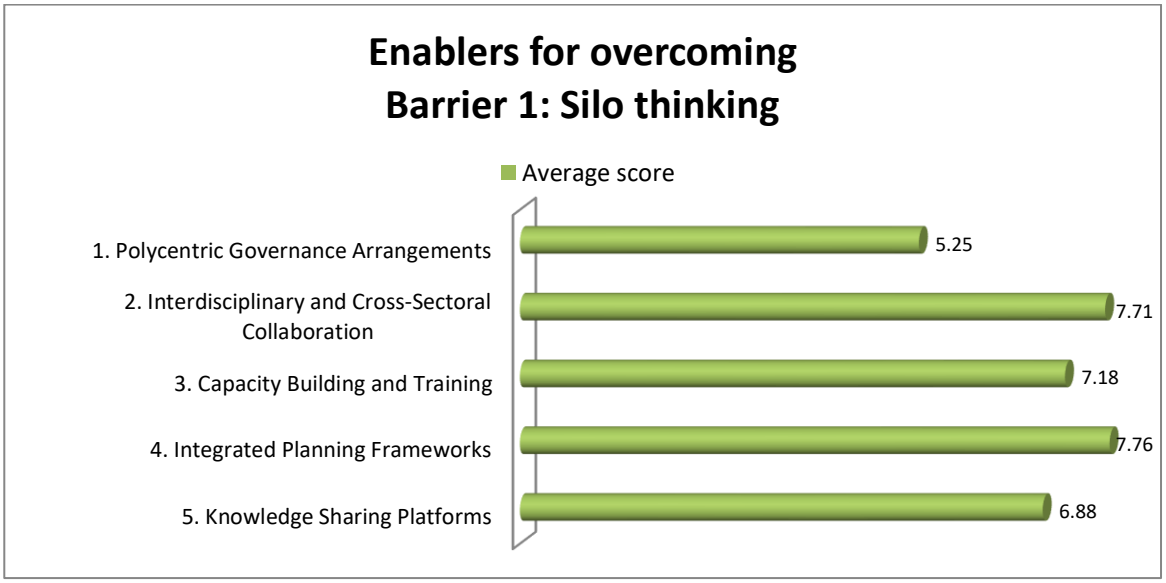

Figure 14 Scoring result for Barrier "Silo Thinking"

The survey presented five potential enablers for overcoming silo thinking, which respondents scored on a scale of 1 to 9, with 9 being the most important. The results were as follows:

1. Integrated Planning Frameworks (Highest average score)
2. Interdisciplinary and Cross-Sectoral Collaboration
3. Capacity Building and Training
4. Knowledge Sharing Platforms
5. Polycentric Governance Arrangements (Lowest average score)

Integrated Planning Frameworks received the highest average score, indicating that stakeholders see this as the most critical enabler for overcoming silo thinking. This result suggests that there's a strong desire for a comprehensive, cross-sectoral approach to NBS implementation. Such frameworks would ensure that efforts to implement NBS are not isolated cases but part of a more thorough and long-term strategy.

Interestingly, Polycentric Governance Arrangements received the lowest score. While these arrangements could potentially allow for more rapid and flexible decision-making, especially in regions with increased flood risk, respondents seemed to view them as less practical. This could be due to the political situation in Bulgaria and the complexity of implementing such arrangements.

Respondents also provided additional qualitative insights by suggesting two more enablers:

1. Bottom-up methods and solutions based on the needs of the population: This suggestion highlights the importance of public participation in overcoming silo thinking. It indicates that stakeholders believe NBS should be grounded in local needs and perspectives, rather than imposed from the top down.
2. Initiation of legislative changes: This proposal was justified by the presence of conflicts between different laws and regulations. It suggests that current legislative frameworks may be contributing to silo thinking by creating conflicting mandates or responsibilities across different sectors.

Further qualitative feedback from the open-ended questions provides additional context:

- A government sector respondent emphasized the need for "Commitment of the municipal and regional authorities regulated by the law through the implementation of shared initiatives, monitoring, and goal setting." This underscores the importance of coordinated action across different levels of government.
- Another government sector respondent highlighted the need for "Cooperation between the institutions in charge," further emphasizing the importance of breaking down silos between different governmental bodies.
- A private sector respondent suggests "Persuading local authorities about the effectiveness of NBS," indicating that lack of understanding or buy-in at the local government level might be contributing to silo thinking.

Based on these findings, the following strategies could be effective in addressing silo thinking:

1. Develop and implement integrated planning frameworks that mandate cross-sectoral consideration of NBS. These frameworks should be designed to bridge gaps between different departments and levels of government.
2. Foster interdisciplinary and cross-sectoral collaboration through regular joint workshops, projects, and knowledge-sharing events.
3. Implement capacity building and training programs that emphasize systems thinking and the interconnected nature of NBS benefits across different sectors.
4. Establish knowledge-sharing platforms to facilitate the exchange of ideas, best practices, and lessons learned across different sectors and stakeholder groups.
5. Consider legislative changes to resolve conflicts between different laws and regulations that may be reinforcing silo thinking.
6. Encourage bottom-up approaches that incorporate local needs and perspectives into NBS planning and implementation.
7. Develop targeted communication strategies to persuade local authorities about the effectiveness and multi-faceted benefits of NBS.

Barrier 2. Lack of Awareness of NBS

Lack of awareness of NBS is characterized by insufficient awareness of NBS as a viable solution among decision-makers, professionals, and the general public. The survey results provide valuable insights into how stakeholders perceive this barrier and potential ways to overcome it Figure 15.

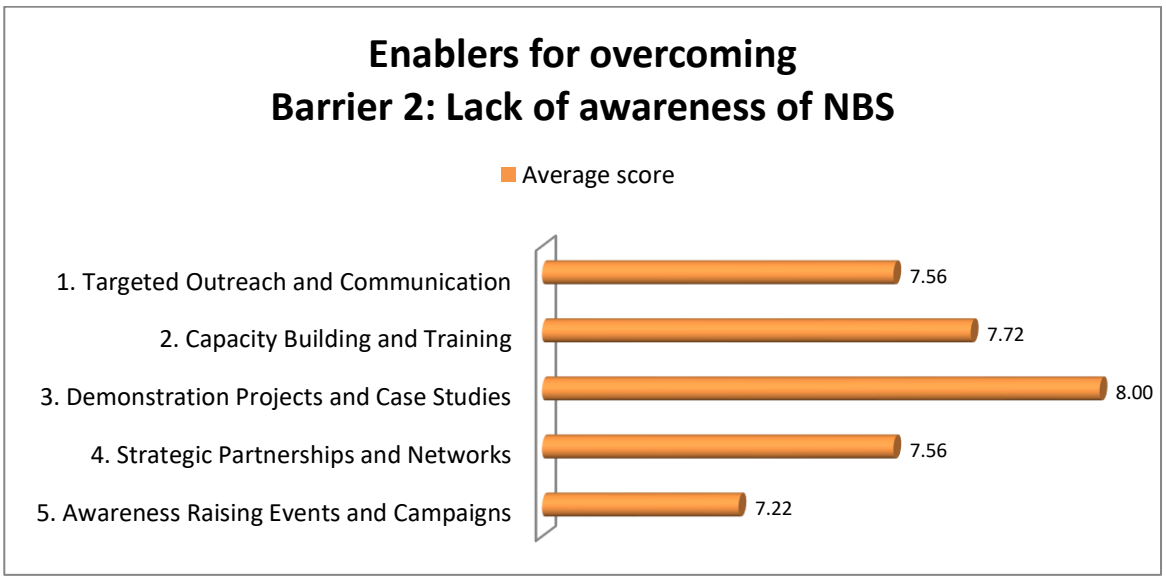

Figure 15 Scoring result for Barrier "Lack of awareness of NBS"

The survey presented five potential enablers for overcoming the lack of awareness of NBS, which respondents scored on a scale of 1 to 9, with 9 being the most important. The results were as follows:

1. Demonstration Projects and Case Studies (Highest average score)
2. Capacity Building and Training
3. Strategic Partnerships and Networks
4. Targeted Outreach and Communication
5. Awareness Raising Events and Campaigns (Lowest average score)

Demonstration Projects and Case Studies received the highest average score, indicating that stakeholders see this as the most critical enabler for increasing awareness of NBS. This result suggests that concrete, visible examples of successful NBS implementations are viewed as the most effective way to raise awareness and understanding.

All proposed enablers received high scores (above 7), indicating that respondents see value in a multi-faceted approach to raising awareness. Interestingly, Awareness Raising Events and Campaigns received the lowest score, though still above 7. This might suggest that while such events are seen as important, they are perceived as less effective on their own compared to more hands-on or practical approaches.

Respondents provided additional qualitative insights by suggesting one more enabler, the *engagement of all stakeholders, including the most vulnerable ones*: This suggestion adds depth to the "Targeted Outreach and Communication" enabler, emphasizing the importance of inclusive engagement strategies that consider all affected parties, particularly those who might be most impacted by flood risks or NBS implementations.

Further qualitative feedback from the open-ended questions provides additional context:

- A government sector respondent emphasized the need for "Active fieldwork with the public" and "Presenting the successful projects implemented." This aligns with the high ranking of demonstration projects and highlights the importance of practical, on-the-ground engagement.

- Another government respondent suggests “Organising a national campaign for raising the awareness on NBS and their application,” indicating support for large-scale awareness efforts despite the lower ranking of awareness campaigns in the quantitative results.
- A civil sector respondent advocated for the “Development of large-scale awareness-raising campaigns for all stakeholders,” further supporting the idea of comprehensive awareness initiatives.
- An academic sector respondent stressed the importance of “Improving the overall level of education and nurturing culture of public engagement from early childhood. Attracting children and students in the implementation of NBS.” This suggests a long-term approach to building awareness and understanding of NBS.
- Several respondents mentioned the importance of media involvement, with one government sector respondent specifically suggesting “publicity about the (NBS) solutions in electronic media.”

Based on these findings, the following strategies could be effective in addressing the lack of awareness of NBS:

1. Implement and showcase demonstration projects and case studies that clearly illustrate the benefits and effectiveness of NBS in local contexts.
2. Develop comprehensive capacity-building and training programs for professionals across various sectors, focusing on practical applications of NBS.
3. Establish strategic partnerships and networks with influential organizations to amplify NBS awareness efforts and reach broader audiences.
4. Design targeted outreach and communication strategies, ensuring the inclusion of all stakeholder groups, particularly the most vulnerable populations.
5. Organize awareness-raising events and campaigns, but ensure these are part of a broader, more hands-on strategy rather than standalone efforts.
6. Engage with media outlets, particularly electronic media, to increase public exposure to NBS concepts and successful implementations.
7. Develop educational programs targeting children and students to foster long-term understanding and support for NBS.
8. Conduct active fieldwork and community engagement to provide firsthand experiences with NBS planning and implementation.

Barrier 3. Lack of Public Participation

Lack of public participation is associated with limited public involvement in the planning, design, and implementation of NBS, which can lead to a lack of community support and ownership of implemented solutions. The survey results provide valuable insights into how stakeholders perceive this barrier and potential ways to overcome it (Figure 16).

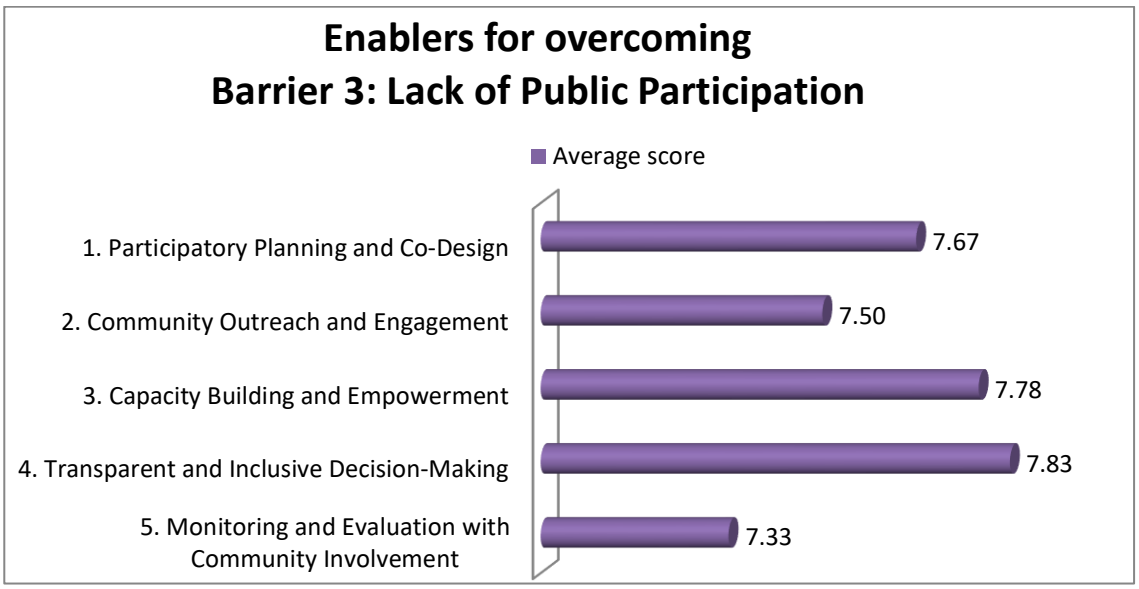

Figure 16 Scoring result for Barrier "Lack of Public Participation"

The survey presented five potential enablers for overcoming the lack of public participation, which respondents scored on a scale of 1 to 9, with 9 being the most important. The results were as follows:

1. Transparent and Inclusive Decision-Making (Highest average score)
2. Capacity Building and Empowerment
3. Participatory Planning and Co-Design
4. Community Outreach and Engagement
5. Monitoring and Evaluation with Community Involvement (Lowest average score).

All enablers for overcoming this barrier were ranked high by respondents, with scores of more than 7, indicating that stakeholders see value in a multi-faceted approach to enhancing public participation.

Transparent and Inclusive Decision-Making received the highest average score, suggesting that stakeholders view transparency and inclusivity in the decision-making process as crucial for fostering public participation. This highlights a concern among stakeholders about the current level of transparency and inclusivity in NBS-related decision-making processes.

Capacity Building and Empowerment ranked second, with a score very close to the top-ranked enabler. This aligns with previous findings in the project that identified a lack of capacity as a significant hindrance to implementing NBS.

Interestingly, Monitoring and Evaluation with Community Involvement received the lowest score, though still above 7. This might be due to the perception that monitoring and evaluation require specific expertise that may not be widely present in the community.

While no additional enablers were proposed specifically for this barrier, the open-ended questions provided valuable qualitative insights:

- A government sector respondent emphasized the need for "Targeted engagement for each specific NBS in order to ensure sustainability and continuity of solutions."

This suggests a need for tailored approaches to public participation based on the specific NBS being implemented.

- A private sector respondent highlighted the importance of "Enhancing public participation in the planning, design, and implementation of NBS not just via projects funded by programs, but also in the form of local initiatives – at both municipal and regional levels in the plans of municipalities." This indicates a desire for more grassroots, community-driven participation beyond formal project structures.
- An academic sector respondent stressed the importance of "Linking European funding with the application of NBS, mandatory research for an NBS option." This suggests using funding mechanisms to incentivize public participation and research on NBS options.
- Another academic sector respondent emphasized: "Awareness-raising among all stakeholders, understanding of the measures under the project by the population, and finding a way to ensure mutual benefit for all parties involved." This highlights the interconnection between awareness, understanding, and meaningful participation.
- A civil sector respondent suggests: "Stimulating civil participation through increased transparency in the decision-making process and engaging the public in the monitoring processes." This aligns with the high ranking of transparent and inclusive decision-making in the quantitative results.

Based on these findings, the following strategies could be effective in addressing the lack of public participation:

1. Implement transparent and inclusive decision-making processes for NBS projects, ensuring that community input is actively sought and incorporated throughout the planning, design, and implementation phases.
2. Develop comprehensive capacity-building and empowerment programs to equip community members with the knowledge and skills needed to participate effectively in NBS initiatives.
3. Adopt participatory planning and co-design approaches that actively involve local communities in shaping NBS projects to meet their needs and preferences.
4. Conduct targeted community outreach and engagement activities, tailored to each specific NBS project and local context.
5. Incorporate community involvement in monitoring and evaluation processes, while providing necessary training and support to build relevant skills within the community.
6. Encourage and support local initiatives for NBS implementation, beyond formally funded projects, to foster grassroots participation and ownership.
7. Explore ways to link funding mechanisms (including European funding) with requirements for public participation and research into NBS options.
8. Develop strategies to ensure mutual benefits for all stakeholders involved in NBS projects, thereby incentivizing broader participation.
9. Create mechanisms for continuous engagement throughout the lifecycle of NBS projects, from initial planning to long-term maintenance, monitoring, and evaluation.

By addressing the lack of public participation through these multifaceted approaches, Bulgaria can foster a more engaged and supportive community environment for the implementation of NBS. Enhanced public participation is crucial for ensuring that NBS projects are well-aligned with local needs, have strong community support, and are sustainable in the long term.

Barrier 4. Lack of Public Understanding of NBS

Lack of public understanding of NBS is associated with a widespread lack of awareness of the urgency of NBS measures among stakeholders and decision-makers, which hampers the swift adoption and implementation of NBS. The survey results provide valuable insights into how stakeholders perceive this barrier and potential ways to overcome it (Figure 17).

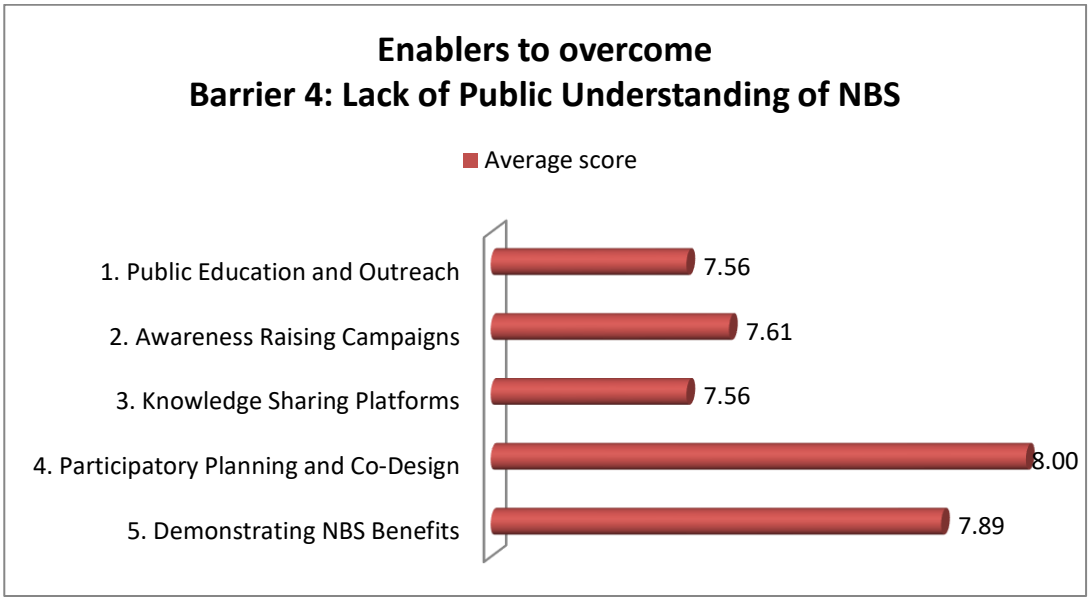

Figure 17 Scoring result for Barrier "Lack of Public Understanding of NBS"

The survey presented five potential enablers for overcoming the lack of public understanding of NBS, which respondents scored on a scale of 1 to 9, with 9 being the most important. The results were as follows:

1. Participatory Planning and Co-Design (Highest average score)
2. Demonstrating NBS Benefits
3. Knowledge Sharing Platforms
4. Awareness Raising Campaigns
5. Public Education and Outreach (Lowest average score)

All five enablers received high average scores – above 7.5, indicating that respondents view all these approaches as important for improving public understanding of NBS.

Participatory Planning and Co-Design received the highest ranking. This suggests that stakeholders believe active involvement of the public in both the planning and design of NBS is key to increasing their understanding and creating a sense of "ownership", which will ensure the sustainability and long-term effect of the implemented solutions.

Demonstrating NBS Benefits ranked second, with a score just slightly lower than the top-ranked enabler. This enabler is associated with the implementation of demonstration projects that show the actual benefits of NBS for the community. Like Participatory Planning and Co-Design, this enabler involves more practical involvement of the public, rather than "soft" measures.

Interestingly, Public Education and Outreach received the lowest ranking, albeit still important with a score above 7.5. This might suggest that while educational efforts are seen as valuable, stakeholders believe that more hands-on, participatory approaches might be more effective in improving public understanding.

While no additional enablers were proposed specifically for this barrier, the open-ended questions provided valuable qualitative insights:

- A government sector respondent emphasized the need for "More efforts are necessary to educate the public about NBS and to engage it." This aligns with the overall high scores given to all enablers for this barrier.
- Another government respondent suggests: "More specific pilot projects to demonstrate the effectiveness of these solutions and to raise awareness about them." This supports the high ranking of the "Demonstrating NBS Benefits" enabler.
- A civil sector respondent advocated for the "Development of large-scale awareness-raising campaigns for all stakeholders." This indicates support for comprehensive awareness efforts, despite the relatively lower ranking of awareness campaigns in the quantitative results.
- An academic sector respondent stressed the importance of "Improving the overall level of education and nurturing culture of public engagement from early childhood. Attracting children and students in the implementation of NBS." This suggests a long-term approach to building an understanding of NBS.
- Several respondents mentioned the importance of media involvement, with one government sector respondent specifically suggesting "publicity about the (NBS) solutions in electronic media."

Based on these findings, the following strategies could be effective in addressing the lack of public understanding of NBS:

1. Implement participatory planning and co-design processes that actively involve the public in NBS projects from the early stages. This hands-on involvement can significantly enhance understanding and create a sense of ownership.
2. Develop and implement demonstration projects that clearly showcase the tangible benefits of NBS to communities. These projects should be highly visible and accessible to the public.
3. Create knowledge-sharing platforms that make information about NBS easily accessible to the public. These platforms should include success stories, case studies, and practical information about NBS implementation and benefits.
4. Conduct awareness-raising campaigns through various channels, ensuring that the information is presented in an engaging and easily understandable manner.
5. Develop public education and outreach programs that clearly explain NBS concepts and their importance. While this ranked lowest among the enablers, it's still an important component of a comprehensive strategy.
6. Engage with media outlets, particularly electronic media, to increase public exposure to NBS concepts and successful implementations.
7. Develop educational programs targeting children and students to foster long-term understanding and support for NBS.
8. Organize community events and workshops that allow for hands-on learning experiences related to NBS.
9. Create opportunities for the public to visit and learn from existing NBS projects, both successful and challenging ones, to build a realistic understanding of their implementation and impacts.

9.5 Linking the barrier/enabler analysis to the existing policy framework

In this chapter, we provide a synopsis of the policy analysis. More details are provided in Annex A and B.

Key stakeholders in flood response, operation, and hydro-meteorological risk management in Bulgaria include members of the Regional Risk Reduction Councils, local authorities such as mayors and municipal architects, fire safety and civil protection services, forest and agricultural offices, water management companies, academic and technical institutions, NGOs, and private sector representatives.

Legislative and policy support of flood risk reduction measures is based on the utilization of EU and global policy instruments (e.g. EU Flood Directive, UN Sendai Framework for Disaster Risk Reduction) as well as national laws (e.g. Bulgarian Water Act, Disaster Protection Act, Water Management Strategy, Water Management Financing Act). These frameworks provide regulatory support for flood risk management and emphasize stakeholder involvement in planning and implementation. However, there is no specific legislation that mandates the use of NBS for flood risk management at the municipal level. Municipalities often lack documents that stipulate the implementation of NBS, indicating a gap that needs to be addressed.

In conclusion, to effectively implement NBS for flood risk reduction in Bulgaria, it is essential to improve coordination among stakeholders, leverage legislative and policy support as well as engage and educate the local population through innovative social methods, demonstrating the limitations of state and municipal authorities without their cooperation. National strategies and programs provide a framework for these efforts, but specific measures to promote NBS at the municipal level are needed to ensure sustainable and effective flood risk management.

Enhanced coordination among various stakeholders is crucial for reducing flood risk. This requires resource allocation and continuous efforts to shift focus towards sustainable NBS. Municipalities play a vital role in providing plans and regulations to ensure the long-term viability of NBS. Training and awareness-raising initiatives are necessary to maintain continuity, especially with changes in local authority.

9.6 Key Takeaways for Bulgaria

Based on the analysis of the four key barriers and their corresponding enablers, several overarching themes and strategies emerge for mainstreaming NBS in the Kamchia River Basin:

1. There is strong support for NBS among *stakeholders*, but this is contingent on *meaningful involvement* in planning and implementation processes. Ensuring transparent and participatory approaches is crucial.
2. *Fair and equitable land acquisition and compensation processes* are critical factors for increasing NBS acceptance. Clear procedures that protect landowners' rights need to be developed.
3. Stakeholders express a preference for *visible and tangible flood risk reduction measures*. This highlights the need to effectively communicate and demonstrate the risk reduction capabilities of NBS.
4. There is a significant knowledge gap about how NBS would function in the local context. *Targeted education and awareness campaigns* are needed to enhance understanding of NBS benefits and operations.
5. The current political acceptance of NBS is perceived as limited, with support being more declarative than executive. Efforts are needed *to secure a long-term commitment from municipal and regional authorities*.

6. *Integrating NBS into various policy sectors*, including water management, agriculture, and urban planning, is seen as crucial. This requires improved coordination between different ministries and levels of government.
7. Developing *innovative financing mechanisms,* including combining public and private funds, is essential for overcoming the lack of financial resources for NBS implementation.
8. There is a need for *legislative changes to support NBS*, including addressing conflicts between different laws and creating a more supportive legal framework.
9. *Highlighting the multiple benefits of NBS*, including intangible ones such as biodiversity enhancement and recreation opportunities, is important for building broader support.
10. The *role of the academic community* in providing expertise and bridging communication gaps between different stakeholders is seen as crucial for advancing NBS implementation.

10 Summary of Key Findings

The analysis of policies and policy instruments at the global and EU level has revealed that they actively promote and encourage the use of NBS. The EU advocates for transitioning from traditional grey infrastructure to green solutions (NBS) and aims to integrate both types of solutions into planning processes to maximize the benefits and co-benefits of NBS. The policy instruments established therefore is quite broad, including including legislative/regulatory, economic/financing, and soft instruments.

However, the analysis also reveals that existing policies lack effectiveness. (1) Very few EU regulations are binding/mandatory: this lack of regulatory authority may impede the effective integration of NBS, particularly when ecosystems fall outside the scope of existing policies (Ryfisch et al., 2023). (2) Many EU-level NBS policies rely on soft measures: which means that they are not mandatory for implementation at the local level and remain entirely voluntary (Scolobig et al., 2020). (3) Implementation of NBS depends on the ambition, capacities, and capabilities of lower-level authorities.

The analysis of case studies across different Collaborators' sites furthermore reveals **several persistent barriers** to the widespread implementation and mainstreaming of NBS. These barriers, while manifesting in context-specific ways, show remarkable consistency across diverse geographical and socio-political landscapes. Based on our national policy analysis, there are a number of recurring obstacles. The existing NBS supporting policy provided in the EU Directives and regulations (both binding and informal) is to a certain extent reflected in the national and regional legislation of the studied countries/NBS sites. Moreover, several such Directives/regulations, to which countries are obliged to adhere, frame their legislative basis in the field of protection and management of hazards and risk reduction. However, in most cases, the current legislation does not explicitly recognize NBS, and existing (often outdated) laws mostly tend to favor traditional grey infrastructure solutions. This is strongly linked to path dependency (since outdated spatial plans do not align with the needs for NBS, perpetuating reliance on traditional infrastructure) that often leads to land acquisition issues which appear from the problems with securing land for NBS projects, particularly from private owners or in cases of illegal construction. In cases where NBS-related measures have been presented in the strategic documentation, they are not explicitly mentioned as NBS but rather shown as non-structural solutions that are planned to be implemented for protection from the related risks (anti-erosion works, afforestation, sustainable management of agricultural land). The governance and implementation of measures (incl. NBS) related to flood risk management are furthermore hindered by a complex network of stakeholders and policies at multiple levels. National authorities hold primary decision-making power in managing natural hazards, while regional and local governments play crucial roles in the realization of flood protection and water management measures.

The results of the barrier/enabler analysis reflect the findings of our policy analysis. The most common barriers and enablers identified by stakeholder refer to **Institutional and Governance barriers**, encompassing the structural and political challenges inherent in decision-making processes and policy implementation. These barriers often stem from fragmented governance structures and short-term political cycles that struggle to align with the long-term benefits of NBS.

1. Institutional and Governance

- Barrier 1: Silo Thinking
- Barrier 2: Limited Political Will
- Barrier 3: Inadequate Legal Frameworks
- Enabler 1: Integrated Planning Frameworks
- Enabler 2: Cross-sectoral Collaboration Mechanisms
- Enabler 3: Policy Integration of NBS

The institutional and governance barriers to NBS implementation are evident across various sites. In Poland's Pilica River Basin, *silo thinking* manifests as fragmented decision-making across different ministries, significantly hindering NBS implementation. The challenge of *limited political will* is particularly apparent in Serbia's Jadar and Tamnava River Basins, where political actors are viewed primarily as observers, their support being more declarative than executive in nature. In Bosnia and Herzegovina's Vrbanja River Basin, the complex administrative structure of the country presents a significant obstacle, hampering the integration of NBS into existing climate and natural disaster policy frameworks.

To address these barriers, several enabling strategies have emerged across the study sites. The development of **integrated planning frameworks** has been identified as a crucial enabler for overcoming silo thinking and fragmented decision-making. In Poland's Pilica River Basin, stakeholders emphasized the importance of creating comprehensive, cross-sectoral approaches to NBS implementation. Similarly, in Bulgaria's Kamchia River Basin, participants highlighted the need for frameworks that mandate cross-sectoral consideration of NBS, designed to bridge gaps between different departments and levels of government.

To tackle the challenges of limited political will and fragmented governance, **cross-sectoral collaboration mechanisms** have been proposed. In Serbia's Jadar and Tamnava River Basins, stakeholders suggested creating coalitions of NGOs to amplify bottom-up pressures on politicians and launching partnerships between ministries and civil society organizations. In Bosnia and Herzegovina, the emphasis was on improving both horizontal and vertical connections between actors to facilitate collective action.

Integrating NBS into various policy sectors was identified as a key enabler across sites. In Croatia, stakeholders advocated for the inclusion of NBS in EU directives to facilitate easier acceptance across all stakeholder levels. Polish participants suggested integrating NBS into national policies on adaptation, biodiversity, and development to achieve sectoral objectives. This approach aims to create a more supportive policy environment for NBS implementation.

2. Economic and Financial

- Barrier 1: Lack of Financial Resources
- Barrier 2: Perception of High Costs
- Barrier 3: Limited Long-term Financing
- Enabler 1: Innovative Financing Mechanisms
- Enabler 2: Demonstrating Cost-effectiveness
- Enabler 3: Long-term Funding Strategies

Also, economic and financial barriers were identified as crucial in both our policy analysis and our barrier analysis. There is a variety of existing financial sources at different levels including funds by EIB, EBRD, World Bank, EU funds, national funding (mostly through tax revenues), public funds from budgets of local government units, budgets of local authorities along with civil society funding (crowdsourcing, voluntary work, NGO funds) that can provide support and additional resources for NBS development. However, not all of them are well known or used in full, which can explain the reported limited financial capacity at the Collaborator sites. Moreover, since the existing policies primarily support gray infrastructure and NBS initiatives still receive less focus, there is a need to reallocate funds from traditional infrastructure to NBS and integrate NBS more explicitly into policy frameworks.

In Croatia's Bregana River Basin, *the lack of financial resources* was prominently highlighted, with stakeholders emphasizing the need to develop new financial products and mechanisms to support NBS projects. *The perception of high costs* associated with NBS emerged as a barrier in Bulgaria's Kamchia River Basin, where stakeholders noted that not everyone may be fully convinced of the superiority of NBS compared to traditional infrastructure. In Serbia, the challenge of *limited long-term financing* was evident, with current funding models often focusing on short-term project implementation, making it difficult to ensure sustained financial support for maintenance and monitoring of NBS.

To address these economic and financial barriers, several enabling strategies have been proposed. **Innovative financing mechanisms** were suggested across the study area to tackle the lack of financial resources. In Croatia's Bregana River Basin, stakeholders proposed creating a dedicated national "Natural Infrastructure Fund" that consolidates funds from various sources, including government budgets, EU funds, and private investments. In Poland, participants explored the potential of green bonds and payments for ecosystem services to support NBS implementation.

To counter perceptions of high costs associated with NBS, several sites emphasized the importance of **demonstrating their cost-effectiveness and multiple benefits**. In Bulgaria's Kamchia River Basin, stakeholders proposed implementing and showcasing successful NBS projects to build awareness and inspire replication. This approach aims to provide tangible evidence of the economic viability and multi-faceted benefits of NBS compared to traditional infrastructure solutions. This also highlights the relevance of **soft policy instruments** (e.g. knowledge-sharing platforms, support to government agencies, support in knowledge dissemination, a collaboration between relevant institutions, campaigns, and activities for promoting NBS in the whole community). They can help to raise awareness of NBS, enhance understanding of its mechanisms and benefits, improve knowledge and expertise, and build capacity for NBS development and implementation across local, regional, and national levels.

Addressing the challenge of limited long-term financing, sites proposed strategies for ensuring **sustained financial support**. In Serbia, stakeholders suggested developing partnerships between public and private sectors to secure long-term funding for NBS

maintenance and monitoring. In Bosnia and Herzegovina, participants emphasized the need to align NBS with existing funding mechanisms and explore opportunities for blending different funding sources to ensure project sustainability.

11 Conclusion

In this chapter, we present the conclusion based on the work performed in WP 4, with a focus on key recommendations for mainstreaming NBS. Some of our findings are in line with the analysis performed in other European project, particularly the work conducted in PHUSICOS.

Conclusion 1: European and national policies need to more effectively promote the uptake of NBS.

While the significance of Nature-Based Solutions (NBS) is acknowledged in various EU policies, these policies are only encouraging the uptake of NBS but are not enforcing such an uptake with legally binding requirements and measurable targets. This results in fragmented NBS adoption and limited implementation. The relevance of the European policy frameworks is highlighted repeatedly in our national policy and barriers analysis, as it provides a relevant reference for any mainstreaming activity. At the national level, the relevance of integrated planning frameworks that encourage cross-sectorial collaboration and hence enforce the cooperation between different sectorial and hierarchical entities has been highlighted. Furthermore, NBS need to be integrated into various relevant sectoral policies, including water, biodiversity, climate change adaptation and others. This step is considered as being vital for the effective mainstreaming of NBS.

Conclusion 2: Mobilize Public and Private Finance.

A key barrier to NBS implementation is insufficient and unevenly distributed funding, compounded by the high priority given to gray infrastructure investment. Our analysis therefore recommends to more systematically unlocking public and private funding for NBS. Innovative financing mechanisms were therefore suggested as a key step forward, including natural infrastructure funds, unleashing public government budgets, EU funds, and private investments but also payments for ecosystem services. However, it is not just the availability of funds, they also need to be available for secured and made available for long time periods.

Conclusion 3: Further demonstrating the cost-effectiveness of NBS as well as their multiple benefits.

To counter perceptions of high costs associated with NBS, several sites emphasized the importance of demonstrating their cost-effectiveness and multiple benefits. Stakeholders repeatedly proposed implementing and showcasing successful NBS projects to build awareness and inspire replication. This approach aims to provide tangible evidence of the economic viability and multi-faceted benefits of NBS compared to traditional infrastructure solutions. This also highlights the relevance of soft policy instruments, which are in most of the sites well developed in order to help to raise awareness of NBS, enhance understanding of its mechanisms and benefits, improve knowledge and expertise, and build capacity for NBS development and implementation across local, regional, and national levels.

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Annex A. Overview on relevant European and national policies

DRR and NBS related policy instruments identified at the Collaborators sites based on the reports of Subcontractors and other EU related publications and data bases. A + means that we found information that the policy instruments encourages the adoption of NBS.

The table is based on the following sources: Reports from Subcontractors, RECONECT's Engagement Strategy Task 6.5, additional sources/EU reports: Popovicki 2019, 2022, Kiss et al., 2019; EIB 2023, Căţuţi and Kustova, 2020; UNICE 2017; de los Casares and Ringe, 2023; EEA 2021; Bisaro and Meyer, 2022; Kapović Solomun 2022; https://geoikp.operandum-project.eu/policy/catalogue

Regulation policy instrument	Bregana	Jadar	Kamchia	Tamnava	Pilica	Vrbanja
Type 1: Legislative/ regulatory tools						
Formal (mandatory/binding)						
1a. EU regulations						
The EU Restoration Law						
Climate Change Framework Law		+		+		
EU Soil Monitoring Law for 2030						
Habitats Directive and Birds Directive						
EU Taxonomy						
Natura 2000						
The Paris Agreement		+	+	+		
Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy	+					
Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (Flood Directive)	+	+	+	+	+	+
Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment	+					
Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption	+					
Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources	+					
Directive 2006/118/EC on the protection of groundwater against pollution and deterioration (Groundwater Directive)	+					
Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC	+					
Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community	+					
Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for	+					

Regulation policy instrument	Bregana	Jadar	Kamchia	Tamnava	Pilica	Vrbanja
community action in the field of marine environmental policy (Marine Strategy Framework Directive)						
Directive 2006/44 – Quality of fresh waters needing protection or improvement in order to support fish life	+					
Directive 2006/113/EC of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters	+					
Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council	+					
Commission Directive 2009/90/EC of 31 July 2009 laying down, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, technical specifications for chemical analysis and monitoring of water status	+					
National and regional policy regulations (legislative/mandatory)						
The Constitutions (National)	+	+	+	+	+	+
The Water management strategy	+	+		+		
The Water Law (The Law on Waters/The Water Act)	+	+	+	+	+	+
The Water Management Financing Act	+					
The Framework Law on the Protection and Rescue of People and Material Assets from Natural and Other Disasters						+
Regulation on special conditions for performing activities of water exploration works and other hydrogeological services, preventive flood defense activities, activities and measures of regular and extraordinary flood protection and maintenance of detailed buildings for drainage and irrigation	+				+	
The Flood Risk Management Plan(s) and The Regulation of the Council of Ministers on the adoption of the Flood Risk Management Plan for the river basin districts	+	+		+	+	+
Multiannual program for the construction of regulatory and protective water and reclamation facilities (incl. National flood defense plan)	+					
The Law on Disaster Risk Reduction and Emergency Management / Disaster Protection Act		+	+	+		+
The Law on Nature Protection		+		+		+
The Act (Law) for Protection of the Biological Diversity			+			
The Law on Planning and Construction / Spatial Planning Act		+	+	+		
The Law on Forests		+		+		+
The Law on Agricultural Land/Act of Agricultural Property and Land Use/Act of Protection of Agricultural Land		+	+	+		
The Law on Environmental Protection/Act of Environmental Protection		+	+	+	+	+
The Act of Protected Territories			+			
The Law on Environmental Impact Assessment		+		+		
The Law on Integrated Prevention and Control of Environmental Pollution		+		+		

Regulation policy instrument	Bregana	Jadar	Kamchia	Tamnava	Pilica	Vrbanja
The Law on Strategic Environmental Assessment		+		+		
The Law on Emergency Situations		+		+		
The Act/Law of Cultural Heritage			+			
The Act/Law of Underground Natural Resources			+			
The Regulation by the Minister of Infrastructure on the Adoption of the Plan for Counteracting the Effects of Drought					+	
National Climate Policy – Strategy for greenhouse gas emission reduction					+	
National Biodiversity Strategy and Action Plan		+		+	+	
Low Carbon Development Program		+		+		
The Sustainable Urban Development Strategy		+		+		
Program on Nature Conservation		+		+		
1b. Informal						
European						
The EU Strategy on Adaptation to Climate Change (guidelines)		+		+		
The EU Biodiversity Strategy for 2030 (guidelines)						
The EU Forest Strategy for 2030 (guidelines)						
The EU Blue Economy for a Sustainable Future (guidelines)						
The EU Action Plan for a Sendai Framework (guidelines)		+	+	+		
The EU Green Infrastructure Strategy (guidelines)						
The EU Nation Plan for Nature, People, and Economy (guidelines)						
The Sustainable Development Agenda of the United Nations by 2030 (SDGs)	+	+	+	+	+	+
National and Regional						
National-level guidelines on response to natural disasters	+					
Technical guidelines and standards related to water management and flood protection	+		+			
The Water management plan		+		+		
The Framework Law on the Protection and Rescue of People & Material Assets from Natural & Other Disasters		+		+		+
National Disaster Risk Reduction Strategy		+	+	+		
National Program for Mitigating the Risk of Disasters			+			
Annual plans (and reports) for implementing the National Program for Mitigating the Risk of Disasters			+			
National Disaster Protection Plan			+			
National Recovery and Resilience Plan			+			
National Operative Program "Environment"			+			
National Development Program/Concept and related Action Plan			+		+	
National Water and Environment Program					+	
Municipalities and District programs and plans for flood protection and management		+	+	+		+

Regulation policy instrument	Bregana	Jadar	Kamchia	Tamnava	Pilica	Vrbanja
Regional River Basin Management Plans						+
The Catalogue of Good Practice for Hydraulic Engineering Works and Maintenance Works (legal document)					+	
The Strategy of Integral Water Management		+		+		+
Type 2: Economic instruments/funding						
2a. New fiscal policies, investment, and financing policies						
National funding (state and tax revenues)/state funding and taxes to maintain and implement solutions for managing risks of natural hazards caused by flooding	+		+		+	+
Pre-funding instruments (e.g. sovereign, parametric insurance, reinsurance), financial reserves, contingency loans, catastrophe bonds, etc., to complement the commonly used instruments			+			
Public funds from budgets of local government units, Provincial Funds for Environmental Protection and Water Management		+	+	+	+	+
Budgets of local authorities		+	+	+	+	+
2b. Domestic private funding						
European Investment Bank (EIB)	+				+	+
World Bank	+					
European Bank of Reconstruction and Development (EBRD)	+					
The Council of Europe Development Bank					+	
The World Credit Bank						+
2c. International cooperation funding						
EU funds (mentioned in general)	+	+	+	+	+	+
LIFE & LIFE+	+					
HORIZON	+	+	+	+	+	+
The EU Cohesion funds (e.g. Infrastructure and Environment Operational Program for funding of environmental and trans-European network projects)	+		+		+	
The EU Solidarity Fund (financial support by natural hazard events)			+			
European Development Fund (Regional Operational programs)					+	
UNDP "EU for green agenda" initiatives		+		+		
2d. Civil society funding initiatives						
Crowdfunding (collecting donations, loans, or investments from a large number of people online, usually through a dedicated digital/web platform)		+		+		+
Civil sector's volunteers work		+		+	+	+
NGO initiatives providing funding	+	+	+	+	+	+
Type 3: Soft instruments						
3a. Information system & research						
Knowledge-sharing platforms & networks	+	+	+	+	+	+
Disseminating information through databases						
3b. Knowledge and expertise						

Regulation policy instrument	Bregana	Jadar	Kamchia	Tamnava	Pilica	Vrbanja
Technical expertise and support to government agencies and other stakeholders	+	+	+	+	+	+
Support in knowledge dissemination via reporting at the local, regional, and national levels	+	+	+	+	+	+
Flood risk assessments, hazard maps and spatial planning	+	+	+	+	+	+
3c. Tools related to organizational forms and actor networks						
Collaboration between relevant institutions to develop and implement management standards and guidelines	+	+	+	+	+	+
Network of connected actors for management of natural hazard-related risks	+	+	+	+	+	+
3d. Capacity building						
Campaigns and activities related to raising the awareness of communities about NBS	+	+	+	+	+	+
Workshops, and webinars to strengthen the related capacity-building for NBS realization			+		+	+
Expanding knowledge and spreading information through different channels by civil society organizations	+	+	+	+	+	+

Annex B – Policy analysis for the collaborator sites

Bregana River Basin, Croatia: Options for Mainstreaming NBS

The EU legislative framework serves as the primary driver for implementing NBS in Croatia, requiring government and local authorities to adhere to its principles. Initial steps for NBS integration began with strategic planning, followed by spatial planning, creation documentation, and implementation. While Croatian waters primarily manage natural hazard-related risks through traditional infrastructure projects, some initiatives focus on NBS. Funding for these projects primarily comes from state and tax revenues, with additional opportunities available from entities such as the EIB, World Bank, EBRD, EU funds, LIFE, HORIZON, and Cohesion funds (often funded by the EU). However, there's a debate about financing NBS from existing fees (taxes) received by Croatian waters. Croatian Waters should be considered as one of the key stakeholders in the mainstreaming process, including the relevant ministries. This is all the more significant, as limited entities in Croatia possess the capacity to initiate and operate NBS projects, highlighting the importance of collaboration among various stakeholders. Croatian waters, alongside local governments, are primarily responsible for managing NBS, with Croatian Forests and local authorities also involved, albeit to a lesser extent.

The legal framework controls the allocation of funding, particularly in water management. Entities responsible for addressing natural hazard risks and implementing NBS can develop suitable capacities through strategic planning. There's a need to redistribute funding, redirecting it to the revitalization-related projects. While Croatian waters possess financial resources, primarily from state taxes, the challenge lies in reallocating these funds from maintaining existing hard infrastructure to supporting NBS initiatives. By providing financial incentives, the state could significantly accelerate the implementation of NBS across Croatia.

As part of ongoing reforms, Croatian waters are mandated to align with the EU's Green Deal and Future Climate Change Adaptation Strategy from 2040 to 2070, indicating a commitment to NBS and environmental sustainability in the long term.

Notably, the Flood Risk Management Plan highlights the importance of combining construction measures with green infrastructure measures but does not explicitly mention NBS. There is hence already a basis for increasing the relevance of NBS by positioning them more prominently in already existing policy plans.

Vrbanja River Basin, Bosnia and Herzegovina: Options for Mainstreaming NBS

Boznia and Herzegoniva lacks robust policy and strategic frameworks further amplified by the country's complex administrative structure. Bosnia and Herzegovina is divided into two Entities – the Federation of Bosnia and Herzegovina and the Republika Srpska, which are politically autonomous to an extent, as well as the Brčko District, self-governing administrative unit. The Entities have their own constitutions. This complexity hampers the integration of NBS into existing climate and natural disaster policy frameworks.

Furthermore, silos in local administration and among different sectors also represent a considerable obstacle. Therefore, climate change and natural disaster issues in Bosnia and Herzegovina primarily intersect with sectors such as agriculture, forestry, and water management. However, responsibilities for environmental protection and biodiversity often lie within different institutions, leading to communication barriers both horizontally and vertically across state, entity, and cantonal. At the entity level, responsibilities for implementing NBS are dispersed across various departments within the same ministry and sometimes even among different ministries. This fragmentation presents a considerable obstacle and necessitates close collaboration among institutions within the same entity. For instance, in the Republika Srpska, the Ministry for Spatial Planning, Construction, and Ecology oversees environmental protection, biodiversity, climate change, nature protection, and protected areas, while the Ministry of Agriculture, Forestry, and Water Management focuses on NBS implementation in agriculture, forestry, and water management sectors.

There exist already a number of national policy instruments that are relevant for mainstreaming NBS, if they are adapted and the focus on NBS is made more explicit. They include the *Law on Forests of the Republika Srpska.* It governs forest-related policy, planning, management, and protection, as well as aspects such as financing, forest valuation, land registry, and information systems. It mandates that forest infrastructure planning, construction, and usage must uphold several principles, including maintaining watercourses, preventing erosion and obstruction of water flow, preserving unstable land balance, and safeguarding habitats crucial for the survival of wildlife species. The *Law on Nature Protection of the Republika Srpska* regulates the protection and preservation of nature, biological, geological, and landscape diversity as part of the environment. *The Nature Protection Strategy of the Republika Srpska* is a basic document that determines the long-term goals and guidelines for nature conservation as well as the manner of their implementation following the overall economic, social, and cultural development direction of the Republic. The strategy, in addition to general strategic goals, also contains guidelines for the preservation of biological, geological, and landscape diversity, protected natural assets, ecologically significant areas, etc. The *Law on Environmental Protection of the Republika Srpska* regulates the preservation, protection, restoration, and improvement of the ecological quality and capacity of the environment, as well as the quality of life and other relevant aspect. *The Law on Waters of the Republika Srpska* regulates the method of integral water management within the territory of the Republika Srpska. Water management includes an integral approach, namely: water protection, water use, protection against harmful effects of water, regulation of watercourses and other water bodies and public goods. Republika Srpska manages water in the manner established by this law and fulfills the obligations that Bosnia and Herzegovina has regarding its international legal responsibilities.

Regional and local policy instruments: There are 10 cantons in the Federation of Bosnia and Herzegovina, which, as smaller organizational and territorial units, enact their regulations in the area of natural hazards. When entities in Bosnia and Herzegovina adopt their Strategies or Plans for cases of natural hazards, then synthesized data are extracted

from those documents and presented as unified data in front of Bosnia and Herzegovina, externally to international entities. Adequate to the fact that one of the two Entities in Bosnia and Herzegovina, such as the Republika Srpska, has laws from different areas that determine policies and procedures in cases of natural hazards, so the other parts of Bosnia and Herzegovina enact laws from the same area. Often, as a rule, these regulations are coordinated and have very similar solutions. For water management, the National Assembly of the Republika Srpska adopts the Strategy of Integral Water Management in the Republika Srpska, as well as Regional River Basin Management Plans (districts) and Flood Risk Management Plans in Regional River Basins (districts), which are adopted by the Government of the Republika Srpska.

The legal and organizational frameworks in Republika Srpska and Bosnia and Herzegovina lack clear indications for NBS solutions, which aim to enhance protection against hydro-meteorological risks using nature-based methodologies. Drawing from EU experiences, these methodologies are deemed significant and adaptable to this region. The Ministry of Agriculture, Forestry, and Water Management of Republika Srpska should lead these efforts, supported by other sectors and ministries, along with relevant institutions. Collaboration between ministries, local self-government units, and departments for agriculture, forestry, and water management is essential for implementing solutions at the community level.

Legal recognition for NBS solutions is forthcoming, with plans to integrate them into strategic documents and by-laws as mandatory measures in catchment areas. Initiatives like the RECONECT project, along with similar projects and efforts by IUCN, will bolster these endeavors. NBS-related measures have so far been represented in the strategic documentation of the water sector of the Republika Srpska (Integral Water Management Strategy of the Republika Srpska, Flood Risk Management Plan of the Vrbas River Basin in the Republika Srpska, Management Plans for the Regional River Basins (Districts) of Sava and Trebišnjica in the Republika Srpska), and in the Strategies of Agriculture and Forestry. However, they are not explicitly indicated (mentioned as NBS) but rather shown as non-structural solutions that are planned to be implemented in order to protect against the related risks (anti-erosion works, afforestation, sustainable management of agricultural land).

NBS that are emphasized in strategic planning documents (Strategies) to be adopted by the National Assembly of the Republika Srpska, in addition to the technical part, should contain measures for the adoption of by-laws that will regulate the application and obligation of NBS.

Pilica River Basin, Poland: Options for Mainstreaming NBS

There are currently no legal documents tackling the issue of applying NBS to water risk management. However, the formal basis is provided by PZRP and the Water Law Act. The object-specific standards are developed locally by the owner(s) of the area and water.

The EC Flood Directive was reflected in the Polish legislation in the Water Law Act (Articles 163(6) and 173(19-21)). However, this and all the related policies became outdated in 2020, and the new phase is still under development. The *Regulation of the Council of Ministers from 18 October 2016, on the adoption of the Flood Risk Management Plan for the river basin district*, organized in three documents referring to Vistula, Oder, and Pregoła Rivers (PZRP) is the main document/basis for any water hazard-related action. It considers all elements of flood risk management, emphasizing flood prevention and protection measures and information on the state of preparedness in case of floods. Within the PZRP, three main objectives with the related sub-goals have been identified: (1) to halt the increase in flood risk, (2) to reduce the existing flood risk, and (3) to improve the flood risk management system. Among the measures mentioned in the PZRP, several were dedicated to NBS and referred to actions carried out by the Directorate General of State Forests, between 2007 and 2015.

The general responsibilities for any further risk management actions have been conveyed to regional and local autonomies, with emphasis on water retention, namely: *"The self-government administration at the provincial level is tasked with developing for the individual provinces small retention programs. These programs are not limited to flood protection alone, on the contrary, flood prevention is only one of the water management tasks attributed to planned facilities, alongside water supply, hydropower, agriculture, and recreation" (Krauze et al., 2023).* Nevertheless, most of the planned measures fulfill the goal of reducing the existing flood risk. Among them, the measures related to the construction of water retention facilities are prevailing while other objectives of flood risk management have less attention even though they are key to reducing the vulnerability of communities and facilities.

The *Regulation by the Minister of Infrastructure of 15 July 2021 on the adoption of the Plan for Counteracting the Effects of Drought (PPSS)* is another important document related to the management of water-related risks. The specific objectives of the PPSS are dictated by the regulation of the Water Act and relate to the following measures, among others, effective water resources management to increase available water resources water resources in river basin districts; increasing retention in river basin districts; education and drought risk management; formalization and planning of financing of measures to counter the effects.

The document recognized several NBS measures supporting the increase in water retention, especially in catchments, and through the conservation of relevant ecosystem services. Some investment opportunities include the Program of Planned Investments of PGW WP aimed at increasing retention and supporting the counteracting effects of flood and drought as well as increasing channel retention in rural catchments.

The Water Law Act prescribes that flood protection shall be carried out with consideration of the PZRPs, and the findings of these documents shall be considered in the concept of spatial management of the country, the Voivodeship development strategy, the Voivodeship spatial management plans, the study of conditions and directions of spatial management of the communes and in local spatial management plans. Moreover, it regulates the protection against flooding and ensures coordination with activities on achieving environmental objectives and protecting waters. Therefore, it obligates to conduct an environmental analysis of undertakings and activities for the purposes of PZRP, which directly refers to the planning and coordination process for the development of updated water management plans (aPGW). According to the Water Law, inland standing

water, water in a ditch, and water in a pond that are not filled as part of a water service but solely by rainwater or snowmelt, or groundwater, located within the boundaries of a landed property, shall be the property of the owner of that property. The responsible for risk management issues is the owner of water, so consequently this is either the responsibility of the state usually represented by Polish Waters, or local autonomies, or private land owners.

The only legal document that indirectly tackles the issue of NBS is the Catalogue of good practice for hydraulic engineering works and maintenance works with the establishment of rules for their implementation (MGGP, 2018) published under the umbrella of the Ministry of Environment as one of the tasks foreseen in the Update of the National Water and Environment Program.

The financing of projects from foreign sources mentioned above might be complemented by public funds, granted by the state budget, budgets of local government units, Provincial Funds for Environmental Protection and Water Management, and the National Fund for Environmental Protection and Water Management. In some cases, the measures could also be financed from the budgets of local authorities, when they are considered as part of their local priorities.

Funds from foreign financial institutions offer financial support programs, where non-reimbursable financial support programs are the most effective source of funding and should be considered a priority. Flood protection projects can be co-financed with EU funds. Within the 2016-2021 planning period, it was set that flood control projects would be subsidized primarily by the Cohesion Fund (Infrastructure and Environment Operational Program) and the European Development Fund (Regional Operational Programs). Additionally, other international financial institutions also offer loans and credits (e.g. the World Bank, the Council of Europe Development Bank; the European Investment Bank).

The use of NBS is conditioned by the necessity of prior implementation of instruments, including legal ones that enable their realization. The analysis of policy instruments at the national and regional levels concludes that NBS implementation is not anchored in any legal documents and remains a facultative approach.

There are no legal documents tackling the issue of applying NBS to water risk management. The use of NBS is conditioned by the necessity of prior implementation of instruments, including legal ones that enable their realization. According to the analysis of policy instruments at the national and regional levels, there is still no legal documents that mention NBS as an important or mandatory measure, thus NBS remains a facultative approach. Furthermore, spatial plans, whose related policies became outdated in 2020 and are still under development for the new phase, exhibit path dependency. Despite this, conventional grey infrastructure remains the most frequently preferred measure, neglecting the requirements for integrating NBS. Additionally, land acquisition poses a frequent topic of discussion, especially concerning the legal aspects of operationalization and compensation issues related to the proposed measures' locations. Finally, there are no foreseeable institutional reforms in the short term for the modernization of legislation in the field of natural hazard management using the NBS concept, indicating a lack of possibilities for legislative modernization.

Even though there is a number of financial sources at different levels (incl. international ones), there are no direct incentives/disincentives to be set by the regulatory system for the use of NBS for managing natural hazard-related risks.

Generally, decisions regarding the implementation of large-scale NBS can be made centrally by Polish Waters, which oversees major hydro-technical constructions. On a smaller scale, NBS projects can be executed locally within communes. Any land or water owner has the potential to implement NBS for mitigating natural hazard risks, however, they need to obtain the water permit and approval regarding the potential impact on the

environment. Moreover, local NBS implementations, often initiated by private property owners, typically have limited impact on water-related risks and fail to significantly reduce these risks. These initiatives are usually privately funded or co-funded by the EU or the Provincial Environment Protection Fund and are exceedingly uncommon in Poland. The majority of measures are initiated by provincial authorities upon approval by Polish Waters, or directly by Polish Waters themselves. However, these initiatives rarely involve NBS. In the instances where NBS are employed, they must demonstrate long-term viability and are obligated to engage the community. Additionally, they typically possess the technological capabilities to develop these solutions with reasonable effort. Despite having administrative, human resource, and financial capabilities, the selection of resources may not always be optimal due to time and procedural constraints. Provincial authorities are formally required to survey local concerns, and while they have access to finance, it may not always be sufficient to choose the best long-term solution. Furthermore, while they have the ability to achieve expected outcomes at reasonable costs, the administrative system, including public procurement, may not always enable this effectively.

Among the entities that are currently deciding on the need for specific NBS for the management of natural hazard-related risks in the wider region are Polish Waters (e.g. operates some polders for reducing flood risk), self-governments and marshal offices (e.g. operate small reservoirs/ponds, infiltration basins, infiltration ditches), and property owners (e.g. operate rainwater gardens, infiltration basins, and small reservoirs).

Jadar and Tamnava River Basin, Serbia: Options for Mainstreaming NBS

In the legislative framework of the Republic of Serbia, the value of nature is currently not adequately acknowledged, despite the presence of numerous laws and regulations addressing nature-related issues. Consequently, NBS, which rely on natural elements, functions, and services, do not receive formal or legal preference over conventional (grey) solutions.

However, the existing legislation does not prohibit the implementation of NBS. Although the term "NBS" may not be explicitly used in legal terminology, this does not restrict their application. The *Constitution of the Republic of Serbia* guarantees every citizen the right to a healthy environment, including access to clean water as its essential component. The *Law on Waters* serves as the primary legal framework governing water-related matters in Serbia, supplemented by other laws addressing various aspects of water and flood risk management. The Law on Waters covers a wide range of topics, including the legal status of water bodies, integrated water management, financing of water-related activities, and protection measures against pollution and harmful effects. It mandates the development of a Preliminary Flood Risk Assessment and outlines requirements for vulnerability and flood risk maps, which form the basis for *Flood Risk Management Plans*. While the Law on Waters does not explicitly mention NBS, it defines water facilities for flood protection, erosion control, and torrent management. Additionally, several other laws and by-laws (e.g. *Law on Environmental protection*, the *Law on environmental impact assessment*, the *Law on nature protection*, the *Law on integrated prevention and control of environmental pollution*, and the *Law on strategic environmental assessment*) and strategic planning documents regulate the environmental protection system and contribute to sustainable water management practices. Moreover, such laws as the *Law on Planning and Construction*, t*he Law on Forests, and the Law on* Agricultural Land can be relevant for NBS realization.

The *Law on Disaster Risk Reduction and Emergency Management* regulates disaster risk reduction measures, including emergency management, monitoring climate change, and community adaptation to the expected flood effects.

The Law on Waters specifies the planning documents necessary for water management within the Republic of Serbia. The most important one is *the Water Management Strategy*, drafted for a ten-year period and adopted by the Government at the proposal of the Ministry of Agriculture. Among the essential parts of the strategy are: a) assessment of the water management; b) goals and guidelines for water management; c) measures for achieving the established goals; d) water management development projection.

Furthermore, among the 99 identified flood-prone areas, eight are deemed high-risk zones with significant potential for damage. However, these areas fall under the jurisdiction of local self-government units rather than the JVP Srbijavode.

Despite these legal frameworks, some flood-prone areas fall under the jurisdiction of local self-government units rather than central water management authorities. Planning documents like the *Water Management Strategy* (adopted and monitored by the Government) and *Water Management Plans* (developed under the Danube River Basin Strategy and adopted by public water management enterprises) guide long-term water management efforts.

The Water management plan and plans for river basin districts, aligned with the Danube River Basin Strategy, and district-specific strategies, are adopted by the Government and public water management enterprises, respectively. However, there is inconsistency between short-term plans and long-term goals. It means that the strategic documents at the level of the Republic and those of the municipalities (Ub, Koceljeva, Obrenovac) do not adequately recognize the need for flood defense. The spatial plans can be characterized as outdated; thus they do not integrate the real needs for flood protection.

Summing up, in the legislative framework of the Republic of Serbia, the value of nature is currently not adequately acknowledged, despite the presence of numerous laws and regulations addressing nature-related issues. Consequently, NBS, which rely on natural elements, functions, and services, do not receive formal or legal preference over conventional (grey) solutions. Nevertheless, NBS are not prominently featured in current regulations, and the existing legislation does not actively promote their implementation. Furthermore, there is a lack of incentivizing mechanisms within the legal framework, with laws primarily focused on identifying violations rather than encouraging compliance. In some cases, existing regulations may even act as disincentives, such as through fines or penalties.

Overall, the regulatory landscape does not comprehensively address NBS. For mainstreaming NBS, attention should be given to clarifying and distributing responsibilities among relevant parties, as well as refining the section of the Law on Water that pertains to watercourses of the second order.

Kamchia River Basin, Bulgaria: Options for Mainstreaming NBS

It is important to consider key stakeholders in activating enablers and their roles, bridging actors, and challenges around four critical barriers in Bulgaria for implementing NBS.

The main stakeholders who are directly or indirectly involved in coordinating flood response efforts/management of hydro-meteorological risks at the local, regional, and national levels include first of all members of the Regional Risk Reduction Councils. Additionally, stakeholders with distinct roles in disaster risk management are also integrated. Among them are: 1) the Regional Governor, 2) the mayors, deputy mayors, and chief architects of the municipalities; 3) the chairs of the municipal councils and the chair of the board of directors of Local Initiative Groups; 4) the Regional Directorate and Regional Service of Fire Safety & Civil Protection, 5) the chief of Prevention and Control Sector, Ministry of Interior; 6) the Regional Forest Directorate; 7) the Agricultural Office and their Municipal branches; 8) the Black Sea River Basin Directorate; 9) North-East State Enterprise; 10) Sub-Section Water & Sewer; 11) Irrigation Systems Joint Stock, 12) other representatives of the private sector; 12) representatives of the academic society (Institute for Ecological Modernisation, Black Sea – Danube Association of Research and Development (BDCA), Bulgarian Ship Hydrodynamics Centre, Technical University – Varna, Museum of Natural History – Varna); 13) representatives of international organisations; 14) actors responsible for cleaning the rivers; 15) regional Inspectorates of Environment and Waters; 16) professional associations; 17) central administration – the President and the Prime Minister; 18) social network groups, which become increasingly influential; 19) NGOs; 20) Regional Directorate of the National Construction Control Directorate. However, the entities that are currently operating NBS for the management of hydrometeorological risks include:

- the National Institute of Meteorology and Hydrology (NIMH) is responsible for operating automated data collection systems for a section of Kamchia River, which can be part of the proposed NBS;
- the public water management company can implement, operate, own, and control NBS for mitigating hydrometeorological risks (e.g. the current water level of the Kamchia River depends primarily on the owners of the Ticha and Tsonevo dams – they fill them with water, then they harvest the fish and discharge the water to the river and their actions are merely guided by their interests; but also a hydropower plant near Ticha dam needs water; they could be controlled by the water management company);
- Irrigation Systems EAD which currently operates the facilities related to hydrometeorological risk management; it restores the dykes, cleans the river bed from debris, and maintains the dams;
- municipal and state authorities.

But the local population can be also defined as a key stakeholder who can be the most interested party. Their actions and behavior are very often completely inadequate to the existing flood risk and are often a cause of damage much greater than a torrential rain might imply. Addressing this requires focused efforts and innovative social methods to demonstrate the limitations of state and municipal authorities in managing flood risks without community cooperation.

Thus, the entities/stakeholders who have a certain important role in implementing, operating and/or owning NBS for mitigating hydrometeorological risks and thus should be involved in every NBS measure:

a) municipality since it provides the necessary plans and regulations to ensure the long-term viability of the implemented solutions; is interested in satisfying the needs of the population, but might be incapable of operating

NBS and this should be assigned to other actors; moreover, training and awareness raising are required to ensure the continuity of the NBS related process, especially in the case of change in authority;

b) public water management company – because it has the greatest impact and the necessary technological capabilities, administrative, and human resources to develop NBS;
c) Ministry of Agriculture and Forestry and the owners of the NBS facilities as they have greater interest and would exploit NBS effectively;
d) private sector since it could manage and operate NBS and be guided and controlled by the municipality and the government;
e) concessionaires and site tenants that are interested in implementing and operating their own NBS.

Improving coordination among stakeholders is crucial for flood risk reduction and necessitates resource allocation. It's a continuous process that requires a shift in focus towards NBS, which offer cost-effective flood risk reduction compared to conventional construction methods. Utilizing available projects and activities funded by other sources can also help optimize resources and expert assistance.

Among the EU policy instruments that support NBS realization the following mandatory and informal tools are used as leading legislative and regulatory framework for the national and regional policy: Directive 2007/60 of the EU (the Flood Directive), the Sendai Framework for Disaster Risk Reduction 2015-2030, the Paris Climate Agreement, the Sustainable Development Agenda of the United Nations by 2030 "Transforming our world", and the Hyogo Framework for Action (HFA) 2005 – 2015 – a global blueprint for disaster risk reduction efforts with a ten-year plan, adopted in January 2005 by 168 Member States of the United Nations at the World Conference on Disaster Reduction).

National policy instruments: The actions aimed at reducing the flood risk are currently regulated (both directly and indirectly) by the following ten national laws: Bulgarian Water Act (WA), Bulgarian Disaster Protection Act (DPA), Bulgarian Spatial Planning Act (SPA), Bulgarian Act of Environmental Protection (AEP), Bulgarian Act of Agricultural Property and Land Use (AAPLU), Bulgarian Act of Protection of Agricultural Land (APAL), Bulgarian Act of Underground Natural Resources (AUNR), Bulgarian Act of Cultural Heritage (ACH), Bulgarian Act of Protected Territories (APT) and Bulgarian Act for Protection of the Biological Diversity (APBD).

These laws outline the duties of institutions involved in flood risk reduction and provide the structure for planning and disaster management. The Bulgarian Water Act and Bulgarian Disaster Protection Act directly address flood reduction processes and protective measures. The remaining eight Acts indirectly influence flood risk reduction by regulating spatial and land use planning, land management (particularly agricultural land), and biodiversity protection. None of these Acts explicitly incorporate provisions for employing NBS for flood risk reduction and mitigation.

The *Water Act* responds to the main principles of Directive 2007/60 of the EU (the Floods Directive) by regulating the issues of prevention and protection from other types of harmful effects of water, including flood protection; protection from ice phenomena; protection of river beds and banks from erosion; protection of shores from wave action; protection against dangerous rise or fall of the groundwater level; protection of catchment basins from water erosion; protection from artificial spontaneous outflow of groundwater; protection from sea-induced flooding of coastal areas.

The types of flood protection are defined jointly the Water Act as well as the *Civil Code, and the Disaster Protection Act* to be implemented by the National Unified Rescue System. They include: (a) operational protection (to be performed in line with the emergency plans for water management systems, facilities, and units, and with the disaster protection plans); (b) permanent protection (e.g. the activities assigned to the executor of the

obligation to be carried out by the public services for protection from the harmful effects of water, incl. construction and maintenance of dams, corrections of rivers and ravines and other hydro-technical and protective facilities; creation and maintenance of monitoring, forecast, and early warning systems; activities for the protection of catchment basins from water erosion, implementation of measures to prevent and limit damage caused by natural floods, etc.); it also obliges the owners (or users) of water management systems and facilities and units to prepare emergency plans or assign their preparation to operators, ensuring the implementation of the measures provided for in them.

National strategies, programs, action plans, instructions, and guidance documents for flood risk reduction include four basic state policy documents that are developed and adopted by the Council of Ministers: The first one is the *National Disaster Risk Reduction Strategy of Bulgaria* that considers the international approach (incl. policy documents at international and EU level) to ensuring policy coherence for disaster risk reduction, climate change adaptation and sustainable development and outlines a coherent framework until 2030 for adequately reducing existing risks and preventing the emergence of new ones, increasing preparedness and response capabilities, rapid recovery after disasters and ensuring a sustainable and safer living environment for the population of Bulgaria, also underlining the value of the public participation and engagement as well as strengthening institutional disaster risk management and investing in disaster risk reduction. Another document is the *National Program for Mitigating the Risk of Disasters* which outlines the guidelines for the creation of an effective, resource- and technically assured national system for prevention and response; assessing and mapping the risks of hazards, increasing the resilience of critical infrastructure sites in the event of disasters; for preparing the executive authorities and the disaster response forces. Other documents refer to A*nnual plans for implementing the National Program for Mitigating the Risk of Disasters* which are drawn up based on the Disaster Protection Act (DPA) and include the main preventive activities as well as *National Disaster Protection Plan* that is also based on the Disaster Protection Act (DPA) and has a very practically oriented goal – to carry out analyses and assessments of the risk of disasters occurring in Bulgaria and to identify preventive measures to reduce their consequences.

In regard to the flood risk reduction within the Kamchia River basin, there are two plans of the Basin Directorate for the Black Sea region that are most relevant: The *River Basin Management Plan for the Bulgarian Black Sea River Basin* and the *Flood Risk Management Plan for the Bulgarian Black Sea River Basin*.

In Bulgaria, there is no special legislation that regulates the duties and specifies the actions related to flood risk management of the Regional Governors. Their duties are regulated by the Water Act and the Disaster Protection Act and include organizing and coordinating the disaster protection actions in the Districts; training the regional administration, supervising the preparation for disasters carried out by the district administration, controlling the implementation of preventive measures; providing data for the preparation of the National Disaster Risk Reduction Program and the National Disaster Protection Plan; declaration of the state of emergency on the territory of the District.

At the local (municipalities) level, there is no special legislation that sets the obligations and regulates the actions related to flood risk management of mayors and municipalities. Their duties are regulated by the Water Act and in the Disaster Protection Act. Nevertheless, many municipalities have their own regulations, adopted by the municipal councils, for action and protection in case of specific risks, including in the event of different types of floods. All districts/municipalities have developed and adopted municipal programs and plans for flood protection. Municipal risk management and disaster protection strategies, however, are not required by the legislation, therefore, only a few municipalities have such. Not all municipal programs and plans for flood protection are prepared according to the legal requirements and not all plans uploaded on the websites

of municipal administrations are up-to-date. For this reason, there is a number of documents that have to be submitted to the Basin Directorate in electronic format (e.g. The Municipal Disaster Action Plan including floods, names of members that are engaged in disaster risk reduction activities, the annual reports to the District Council on disaster risk reduction, etc.).

It was revealed, that the municipalities in the region covered by the Black Sea Basin Directorate, including those, in the Kamchia River Basin have no documents stipulating the implementation of NBS for the purposes of flood risk reduction.